



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Tongass National Forest | R10-MB-840a | March 2022

Mendenhall Glacier Visitor Facility Improvements Project Draft Environmental Impact Statement



Cover photo: Mendenhall Glacier Visitor Center, Juneau, AK. (USDA Forest Service photo by A Sherwin)

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File Code: 1950
Date: March 2, 2022

Dear Reader,

The Tongass National Forest is seeking public comment on the Mendenhall Glacier Visitor Facility Improvements Project draft environmental impact statement (DEIS). The project proposes to implement a variety of infrastructure projects over several years, including parking and access expansion, a new Welcome Center complex, Visitor Center improvements, Glacier Spur Road trailheads, a Lakeshore trail along the south shore of Mendenhall Lake, public use cabins, restoration of Steep Creek, Steep Creek Trail expansion, docks and motorized commercial boat use on Mendenhall Lake, a remote glacier visitor area, and new and improved multi-use trails throughout the Mendenhall Glacier Recreation Area. The proposal also includes new management strategies including changes to visitor capacity and commercial use and adjustments to management unit boundaries.

The Responsible Official for this project is Earl Stewart, Forest Supervisor for the Tongass National Forest. A notice of availability for the DEIS is expected to be published in the Federal Register on March 4, 2022, starting a 45-day formal public comment period for this project.

The DEIS and supporting documents are available on the project web site at: <https://www.fs.usda.gov/project/?project=53780>. Paper copies of the draft EIS are available for review at the Douglas, Downtown, and Valley branches of Juneau Public Libraries and at the Mendenhall Glacier Visitor Center (open Friday through Sunday 10:00 am to 4:00 pm through March 27). Informational posters will also be on display at the Visitor Center.

During the public comment period, the Forest Service will host one public open house and one online public webinar to provide opportunities to learn more about the project and participate in the project planning process.

Public open house:

- **Date and Time:** March 15, 2022 from 11:45 am until 8:00 pm AKST
- **Location:** Mendenhall Glacier Visitor Center, 6000 Glacier Spur Road, Juneau AK
- **Format:** Project information will be on display and project staff will be available to discuss the project and answer questions. A welcome and overview video will be available for viewing in the Visitor Center theater. The open house is subject to change or cancellation due to Covid-19 mitigations. Please see the project website for details.

Public online webinar:

- **Date and Time:** March 31, 2022, from 5:30 pm until 7:30 pm AKST
- **How to Connect:** Please see the project website (<https://www.fs.usda.gov/project/?project=53780>) for webinar login information.
- **Format:** The presentation is expected to last approximately 20 minutes, and the remainder of the time will be for questions and answers to assist in understanding the project and to address questions about how to submit comments. The webinar will be recorded and posted to the project website for future viewing.



How to Comment:

Comments on this project, the alternatives, and the analysis are requested for a period of 45 days to help improve the analysis, finalize alternatives, and develop a final environmental impact statement and draft record of decision. The Mendenhall Glacier Visitor Facility Improvements Project will be subject to the objection process defined by 36 CFR 218, Subparts A and B. More information can be found at <http://www.gpo.gov/fdsys/pkg/FR-2013-03-27/pdf/2013-06857.pdf>. Only individuals or entities who submit timely and specific written comments about this proposed project during this comment period, the scoping comment periods held February 18–March 19, 2020 and December 16, 2020–January 15, 2021, or another public comment period established by the responsible official will be eligible to file an objection. Although courtesy notices will be published in the *Ketchikan Daily News* and the *Juneau Empire*, the publication date in the *Federal Register* is the exclusive means for calculating the 45-day comment period for this DEIS. Those wishing to comment should not rely upon dates or timeframe information provided by any other source. The Federal register notice will be posted to the project website.

Persons submitting comments must provide the following information: name and address; title of the proposed project; specific written comments; and signature or other verification of identity upon request. Other requirements to be eligible to submit an objection are listed at 36 CFR 218.25(a)(3). Individual members of an entity must submit their own comments to have eligibility to object as an individual. It is the responsibility of the sender to ensure timely receipt of any comments submitted. Names and contact information submitted with comments will become part of the public record and may be released under the Freedom of Information Act. Comments should be within the scope of the proposed action, have a direct relationship to the proposed action, and must include supporting reasons for the responsible official to consider.

Please submit comments via one of the following methods:

- Submit comments online through the project public participation portal (preferred): <https://cara.ecosystem-management.org/Public//CommentInput?Project=53780>
- Fax to 907-586-8808
- Mail or hand deliver to 8510 Mendenhall Loop Road, Juneau, Alaska, 99801. *Hand delivery is by appointment only and can only be accepted during weekday business hours, between 8 a.m. and 4:30 p.m., excluding holidays.*

For further information, please contact Monique Nelson, Tongass National Forest land management planner, at 907-209-4090 or monique.nelson@usda.gov. Individuals who use telecommunication devices for the deaf (TDD) may call the Federal Information Relay Service (FIRS) at 1-800-877-8339 between 8 a.m. and 8 p.m., Eastern Time, Monday through Friday. Thank you for your time and interest.

Sincerely,



M. EARL STEWART
Forest Supervisor, Tongass NF

Mendenhall Glacier Visitor Facility Improvements Project

Draft Environmental Impact Statement

Juneau, Alaska

Lead Agency: USDA Forest Service
Tongass National Forest

Cooperating Agency: National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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Abstract: The USDA Forest Service proposes to implement a variety of infrastructure projects, recreational opportunities, and management strategies at the Mendenhall Glacier Recreation Area to update aging infrastructure; accommodate demands for increased capacity; and support local tourism, fish and wildlife habitat, local and regional economies and scenery objectives. This draft environmental impact statement evaluates the Proposed Action, as modified (Alternative 2), along with the No Action Alternative and other Action Alternatives. Other Action Alternatives are based on issues identified during public and internal scoping and include variations in project infrastructure development, capacity, and commercial use management actions.

Summary

Introduction

The proposed improvements analyzed in this document constitute a federal action that has the potential to affect the quality of the human environment on public land administered by the USDA Forest Service (Forest Service). Therefore, this project must be analyzed pursuant to the National Environmental Policy Act of 1969 (NEPA). Under NEPA, federal agencies must carefully consider environmental concerns in their decision-making processes and provide relevant information to the public for review and comment.

With this document, the Forest Service analyzes a variety of actions at the Mendenhall Glacier Recreation Area (MGRA) within the scope of the Mendenhall Glacier Visitor Facility Improvements Project. The MGRA is located on the Tongass National Forest, Juneau Ranger District, in Juneau, Alaska. The Forest Service proposes to construct new facilities and trails; make improvements to existing facilities and trails; establish visitor capacity and determine how much commercial use (outfitter, guide, and transportation services) to permit at the MGRA; and make adjustments to MGRA's management unit boundaries and trail Recreational Opportunity Spectra.

The Council on Environmental Quality (CEQ) published new NEPA-implementing regulations on September 14, 2020; those regulations apply to projects begun on or after that date (40 CFR 1506.13). The Mendenhall Glacier Visitor Facility Improvements Project began in February 2020, and the Forest Service has determined it will continue this project under the old (1978) CEQ regulations.

Given the purpose and need for this project, the responsible official will review the alternatives and the environmental consequences of each alternative to make the following decisions:

- whether to implement visitor facility improvements as described in the proposed action;
- whether to implement visitor facility improvements as described in an alternative to the proposed action;
- whether to implement a combination of alternatives analyzed in detail;
- whether to adopt proposed changes to management unit boundaries and commercial use as part of the selected alternative;
- whether to adopt identified mitigation measures and monitoring requirements, including those associated with the adaptive management plan, as part of the selected alternative; or
- whether to take no action.

What actions are proposed?

The Forest Service proposes to implement a variety of infrastructure projects and management strategies over several years to meet the purpose and need for the project. The following is a list of the components included in the proposed action (Alternative 2). The proposed action and all alternatives are presented in more detail in Chapter 2 of this draft environmental impact statement (EIS).

- **Parking and Access Expansion:** The two existing parking areas nearest the Visitor Center would be combined and the layout improved to provide more parking and create separation between commercial and private vehicles.

The existing gravel bus lot about one-quarter mile south of the main parking area would be reconfigured and partially paved to provide commercial and overflow parking and staging. A new maintenance building would be added. The existing remote-control airstrip would remain.

- **Welcome Center Complex:** The existing pavilion and parking area shelter would be replaced with a new single story, 14,000 square-foot Welcome Center near the main parking area. Other planned Welcome Center area improvements include a pedestrian bridge over Kettle Pond; expansion of Photo Point Trail; wayfinding and interpretive signs; a covered amphitheater; improvements to, connections between, and extensions of existing trails; and covered shelters.
- **Visitor Center Improvements:** Proposed renovations to the upper floor and theater area would provide a more immersive and hands-on visitor experience; improvements to the railing and trail surface leading up to the Visitor Center would provide a safer route for visitors; and a canopy-style roof over the external staircases and a covered area outside the main upper doors would provide shelter from the weather upon entry and exit. The lower level would undergo minor infill expansion to better meet staff needs and deferred maintenance needs would be addressed.
- **Glacier Spur Road Trailheads:** Three new paved trailheads (Dredge Lakes, Crystal Lake, and Powerline; 20-car maximum) would be added along Glacier Spur Road and would include trailhead kiosks and road corridor and trail signs.
- **Lakeshore Trail:** A new trail would be constructed along the south shore of Mendenhall Lake from the Welcome Center Complex to the Mendenhall Campground (via a pedestrian bridge across Mendenhall River) and Skater's Cabin Road; trail spurs would connect the trail to the Dredge Lakes trail system.

A new day-use parking area would be added in the Mendenhall Campground for access to the Lakeshore Trail, and some existing walk-in campsites would be replaced, relocated, or converted to day-use picnic sites.
- **Public Use Cabins:** Five new public use (rental) cabins would be constructed in the Mendenhall Campground.
- **Nugget Falls Trail Expansion:** Nugget Falls Trail and the existing informal trail along the shore of Mendenhall Lake would be improved and connected to form a loop trail.
- **Steep Creek Habitat Restoration and Enhancement:** About 1,500 feet of Steep Creek that was channelized during previous road construction would be shifted to the west. It would be realigned to restore and enhance salmon habitat, maintain stream and floodplain function, and accommodate natural sediment transport. Two existing perched culverts under Glacier Spur Road at Steep Creek would be replaced with a bridge to improve stream resilience and aquatic organism passage and allow for a wildlife and pedestrian underpass. The culvert under Glacier Spur Road leading to the Pond of Time would also be replaced.

- **Steep Creek Trail Expansion:** Steep Creek Trail would be realigned and extended on the west side of Steep Creek to connect to the proposed Lakeshore Trail near the Welcome Center and also extended under Glacier Spur Road to the Trail of Time. Most of the trail would be constructed as an elevated boardwalk, with several fish and wildlife viewing platforms added, including an elevated spur trail and cleared viewing area at Dipper Falls.
- **Dredge Lakes Multi-Use Trails:** Several user-created and/or user-proposed mountain bike and hiking trails in the Dredge Lakes management unit would be incorporated into the MGRA trail network and upgraded to meet Forest Service or National Forest System (NFS) standards.
- **Boat Docks and Related Support Facilities:** Three boat docks designed to be removed in the winter would be installed on Mendenhall Lake: near the proposed Welcome Center; at the proposed Remote Glacier Facility; and at the West Glacier parking lot. Commercial motorized boats would be allowed on the lake under special use permit. A fenced, upland winter storage area for docks, temporary remote facilities, or other seasonal needs would be constructed adjacent to the existing West Glacier parking lot.
- **Remote Glacier Visitor Area:** Four seasonal, relocatable structures and restroom facilities would be installed near the glacier. An accessible trail would connect the boat dock to the glacier facilities and could be extended as the glacier retreats.
- **West Glacier Unit Trails:** A new spur trail would connect the proposed Remote Glacier Visitor Area to the existing West Glacier Trail. A user-proposed multi-use trail system would be constructed in the area to the north of Skater's Cabin Road.
- **Visitor Capacity and Commercial Use Management Changes:** As facility improvements under this project are constructed, capacity of the MGRA would be better able to accommodate the anticipated increases in visitation that will occur over the next 30 years. Additionally, the number of commercial permit service days¹ allocated to outfitters, guides, transporters, and other service providers would be increased as existing facilities are improved and new facilities are constructed. The permitting process for commercial service providers would be managed using an adaptive management plan developed in conjunction with this project (Appendix B).
- **Management Unit Boundaries and Recreation Opportunity Spectrum Adjustments:** MGRA management units' (Visitor Center, Dredge Lakes, and West Glacier) boundaries would be adjusted to group together similar activities and facilities proposed in this project. Existing Recreation Opportunity Spectrum (ROS) designations would be updated to describe expected user experiences.

¹ A service day is an allocation of use constituting a day or any part of a day on NFS lands for which an outfitter, guide, or transporter provides services to a client. Each commercial client that visits the MGRA represents one service day for that vendor. Special use permits are distributed to different commercial guide, outfitter, and transport services, issued as a total number of service days. See Chapter 3, Section 3.2.2.1 for further discussion regarding capacity, special use permits, and service days.

Why is the project being proposed?

The purpose of the project is to update infrastructure and create recreation opportunities at the Mendenhall Glacier Recreation Area (MGRA) that can accommodate projected future visitor use while protecting the unique characteristics and outstanding beauty of the area. The project is needed to continue to provide quality opportunities for all visitors to enjoy the recreation area, to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, to meet the demand of the visitor industry and support the economy of Southeast Alaska, and to protect the area from environmental impacts associated with increased visitation.

Alternatives: What other action would meet the same need?

The Forest Service developed and analyzed four alternatives in detail, including the No Action Alternative (Alternative 1), and three action alternatives: Alternative 2 (proposed action), Alternative 3, and Alternative 4. The Forest Service addressed issues identified during public and internal scoping through either modifications to Alternative 2 (proposed action) or through development of the two other action alternatives. The comparison of alternatives table in Chapter 2 (Table 2-7) summarizes the project components and their associated actions. These components together achieve the goals and objectives of the purpose and need by updating aging infrastructure; accommodating demands for increased capacity; and supporting local tourism, fish and wildlife habitat, local and regional economies and scenery objectives.

Alternative 1 – No Action

Under Alternative 1, none of the activities proposed in the draft EIS would be constructed or implemented. The No Action Alternative is defined as a continuation of current operation and maintenance activities. Under the No Action Alternative, there would be no new infrastructure or improvements to existing infrastructure, no new recreation or wildlife opportunities offered at the MGRA, and no changes to capacity, or commercial use management actions.

Details regarding the existing MGRA facilities and their conditions are included in Chapter 2.

Alternative 2 – Proposed Action (as modified)

Alternative 2 is the proposed action designed to address the purpose and need. This alternative was developed to update infrastructure and create recreation opportunities that can accommodate projected future visitor use while protecting the unique characteristics and outstanding beauty of the area. The Forest Service addressed issues identified during public and internal scoping through modifications to Alternative 2 (proposed action). This alternative bases infrastructure development, capacity, and commercial use management actions on expected increases in visitation over the next 30 years. Project components included in the proposed action are described above (see “What actions are proposed?”).

Alternative 3

Alternative 3 was developed in response to the issues identified during public scoping related to wildlife and wildlife habitat, visitor experiences, and aquatic resources. This alternative incorporates infrastructure development, capacity, and commercial use management actions based on expected increase in visitation using 20-year projections.

Alternative 4

Alternative 4 was developed to respond to public comments desiring an alternative that focuses development mainly within the already concentrated area near the Visitor Center rather than spread throughout the MGRA. This alternative also addresses wildlife and aquatic resources concerns raised during scoping. It proposes new facilities and infrastructure, capacity, and commercial use management actions based on visitation increases over the next 15 years.

How do the alternatives respond to the issues raised during scoping?

The Forest Service identified issues from public comments received during scoping, following publication of the notice of intent to publish an EIS, and during public meetings. Alternatives to the proposed action were developed to address these issues. Chapter 2, Alternatives, Including the Proposed Action, presents the alternatives in full, describing how the alternatives respond to the issues. Chapter 3, Affected Environment and Environmental Consequences, examines the existing condition and compares the potential effects of the alternatives to project area resources and the environment. The following summarizes these effects:

Issue 1: Wildlife and Vegetation

Issue Statement: *Proposed facility developments, increased visitor use, and changes in visitor distribution could adversely impact the wildlife (particularly bears and migratory birds), reduce or alter habitat, and increase the potential for wildlife-human interactions.*

Alternative 1 (no action) would have a negligible effect on threatened, endangered, and special status species. All action alternatives would have minor effects on threatened, endangered, and special status species, including Queen Charlotte Goshawks, due to few permanent infrastructure or intermittent construction, operations, and maintenance impacts; however, there would be no population-level effects. Alternative 1 would have a minor effect on migratory birds and wildlife, but would have a moderate effect on bears due to existing problematic human bear interactions and persistent risk of bear and vehicle collisions. Alternatives 2 and 3 would have moderate effects on migratory birds, bears, and other wildlife but those impacts would not affect animals on the population level. Alternative 4 would have a minor effect on migratory birds, bears, and wildlife. Alternative 1 would have a negligible effect on wildlife habitat and vegetation. All action alternatives would have a minor effect on wildlife habitat and vegetation due to relatively small infrastructure footprint within local vegetation and habitat.

Issue Statement: *Proposed activities could introduce or spread invasive species such as reed canarygrass, impacting native plants and watershed condition, particularly within riparian areas and around the Dredge Lakes Unit.*

Alternative 1 would have a minor effect on invasive species, due to the likely continued development of user-created trails. All action alternatives would have a moderate effect on invasive species primarily because of the risk of spread during construction activities.

Issue Statement: *The proposed improvements could damage successional plant life near the glacier, thereby reducing diversity and slowing the natural succession pathways.*

Alternative 1 would have a negligible effect on successional plant life. Alternative 4 would have a minor effect, and Alternatives 2 and 3 would have a moderate effect on early successional species due to the placement of permanent infrastructure and associated construction activities in areas where the glacier has recently receded.

Issue 2: Recreation and Visitor Experience

Issue Statement: *Proposed increases in visitor capacity and commercial use allocations, changes in management unit boundaries, and the addition of motorized boats on Mendenhall Lake could adversely impact visitor experience by creating increasing encounters between groups and causing visual and noise impacts.*

Alternatives 1, 2, and 3 would have a moderate effect on social encounters as more encounters would be experienced in multiple locations and (for action alternatives) more visitors would be expected where new facilities are added at popular or high-value areas. Alternative 4 would have a minor effect on social encounters since fewer additional facilities would spread visitors to locations away from the crowded visitor center, and visitor levels would stay lower. Alternative 1 would have a negligible effect on scenic resources. Alternative 2 and 3 would have a major effect on scenic resources due to new infrastructure in areas that have Existing Scenic Integrity (ESI) and Scenic Integrity Objectives (SIOs), while Alternative 4 would have moderate scenic resources effects because there would be less infrastructure within viewsheds with high ESI and SIO. Alternative 1 would have a minor effect on noise since independent visitation is likely to increase and there would be no added facilities to distribute visitors or traffic. Alternative 2 would have moderate effect on noise due to construction, substantial increases in buses and other vehicles (but improved traffic flow), and boat operations. Alternatives 3 and 4 would have minor effects on noise due to less construction noise, increased bus traffic (but improved traffic flow), and no boats (Alternative 4) or quiet, electric-powered boats (Alternative 3).

Issue 3: Watersheds, Wetlands, and Aquatic Habitat

Issue Statement: *Proposed developments including parking lot expansion, trail expansion and construction, bridge construction, Steep Creek realignment and restoration, and the addition of docks on Mendenhall Lake could impact wetlands, aquatic habitat, and water quality.*

Alternatives 2 and 3 would have a moderate effect on wetlands and aquatic habitat due to permanent and temporary impacts associated with proposed infrastructure. With no or fewer infrastructure components proposed, Alternative 1 and 4 would have minor effect on wetlands and aquatic habitat. Alternatives 2 and 3 would have a minor effect on water quality because of the creation of impervious surfaces near Class 1, II and III streams and proposed boat operations. Alternatives 1 and 4 would have a negligible effect on water quality due to no additional or small areas of new impervious surfaces.

Issue 4: Heritage Resources

Issue Statement: *Proposed developments could impact the MGRA's potentially eligible historic resources, including the historic Visitor Center and historic trails, and a Native Alaskan tribe's culturally important glacier.*

The Forest Service is developing a project-specific Programmatic Agreement (PA) with the State Historic Preservation Officer (SHPO), the Advisory Council of Historic Preservation (ACHP)

and local tribal entities to comply with Section 106 of the NHPA for this project. Impacts from Alternatives 2, 3, and 4 on the historic Visitor Center and known heritage resources would be assessed and mitigated through the process of PA development. Previous cultural resource surveys in areas of proposed disturbance and recent glacial retreat indicates that the discovery of additional undiscovered historic properties in the MGRA is unlikely. Alternative 1 is unlikely to impact heritage resources since no new infrastructure is planned.

Issue 5: Air Quality

Issue Statement: *Proposed increase in number of tour buses and the addition of motorized boats at the MGRA could contribute to periods of poor air quality in the Mendenhall Valley.*

Alternative 1 would have negligible effects on air quality. Alternative 2 would have a localized, minor effect on air quality due to additional motorized vehicles in the Visitor Center parking area and boats on the lake. Although electric-powered boat would not impact air quality, Alternatives 3 and 4 would have a minor effect on air quality due to additional motorized vehicles at the Visitor Center parking area.

Issue 6: Climate Change and Greenhouse Gas Emissions

Issue Statement: *Projected changes in climate and continued retreat of the Mendenhall Glacier may have effects on the proposed project and the MGRA.*

Issue Statement: *Greenhouse gas emissions from a greater number of tour buses and the addition of gas-powered boats on the lake could hasten the effects of climate change.*

Alternatives 1 and 4 would generate the least amount of additional greenhouse gas emissions over existing levels at the MGRA since few motorized vehicles would be added to the Visitor Center parking area and since there would be no motorized boats on the lake.

Issue 7: Socioeconomics and Environmental Justice

Issue Statement: *Proposed developments could impact minority and/or low-income populations at a higher level than the general public.*

Issue Statement: *Proposed activities may impede local traffic flows and impact resident quality of life.*

Issue Statement: *The Forest Service has a duty to help people share and enjoy the forest that it might not be meeting at the MGRA due to crowded conditions and limited infrastructure.*

Since there is no minority population that exceeds 50 percent or is greater than the percentage in Juneau or the state of Alaska in the study area, and since there is not a significant portion of the population identified as low income in the study area, there would be negligible effects to those populations. Alternative 1 would have a negligible effect on traffic flow. Alternatives 2 and 3 would have a moderate effect and Alternative 4 would have a minor effect on traffic flow and associated quality of life. Alternative 1 would have a moderate effect on Juneau and Southeast Alaska's local and regional economy and visitor industry because it would not be responding to anticipated future growth. Alternatives 2 and 3 would have a moderate beneficial effect on the local and regional economy and visitor industry because it would create ample visitor opportunities and infrastructure. Alternative 4 would have a minor beneficial effect on the local

and regional economy and visitor industry, since limited opportunities and infrastructure are proposed, primarily on the east side of the MGRA.

Chapter 2, Section 2.6 provides a summary of the effects of implementing each alternative. Table 2-7 is structured around the key issues and indicators, which are more fully analyzed in Chapter 3.

What factors will be used when making the decision among alternatives?

The decision will be informed by how the alternatives respond to Forest Plan direction and how they move the project area toward desired conditions in the Forest Plan. This will be based on how the alternative components integrate to meet the goals, objectives, and desired conditions for management of Special Interest Areas, including:

- *To provide for the inventory, maintenance, interpretation, and protection of the existing characteristics and attributes of areas with unique cultural, geological, botanical, zoological, recreational, scenic, or other special features.*

The Forest Plan also includes many goals, objectives, and desired future conditions that apply Forest-wide, including:

- *Provide a range of recreation opportunities consistent with public demand, emphasizing locally popular recreation places and those important to the tourism industry.*
- *Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.*
- *Provide Forest visitors with visually appealing scenery, with emphasis on popular recreation places.*
- *Maintain ecosystems capable of supporting the full range of native and desired non-native species and ecological processes.*
- *Maintain or restore the natural range and frequency of aquatic habitat conditions to sustain the diversity and production of fish and other freshwater organisms.*
- *Identify, evaluate, preserve, and protect heritage resources.*

Are there any ways to mitigate adverse effects?

In addition to complying with required consultation and coordination with Federal, State, local and tribal entities (Chapter 1, Sections 1.6 and 1.7) and obtaining all applicable permits (Chapter 1, Section 1.9), there would be mitigation measures incorporated into all action alternatives intended to minimize, mitigate, or avoid anticipated impacts. These measures include best management practices (BMPs) and resource-specific mitigation measures. Project components would be designed to meet all applicable Forest Plan Standards and Guidelines and Forest Service Manual and Handbook direction. Adaptive management would also be applied to all action alternatives, as outlined in Appendix B.

Resource-specific project mitigation measures have been incorporated into all action alternatives. Mitigation measures minimize potential adverse effects from natural or human-caused disturbances. Design features and mitigation measures common to all action alternatives are described in Chapter 2, Section 2.4.

What project monitoring is necessary?

An adaptive management plan included in Appendix B has been developed for all action alternatives to provide a strategy for adjusting commercial use at the MGRA using a system based on monitoring and clearly defined outcomes. Monitoring will focus on outcomes and will inform if permitted service days would remain the same, increase, or decrease to achieve desired outcomes. Adaptive management provides a structure to evaluate how to best meet the project's short-term and long-term goals, and helps answer the basic question: Are our management actions having the predicted or desired effects?

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Acronyms and Abbreviations

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AHRS	Alaska Heritage Resources Survey
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
APE	area of potential effect
AQI	air quality index
AWC	Anadromous Waters Catalog
AWR	AWR Engineering, LLC
BTEX	benzene, toluene, ethylbenzene, and xylene
BMP	best management practice
CBJ	City and Borough of Juneau
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
C ₄ H	methane
CO ₂	carbon dioxide
CWA	Clean Water Act
DOT&PF	Alaska Department of Transportation and Public Facilities
EA	environmental assessment
EFH	Essential Fish Habitat
EIS	environmental impact statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FEMA	Federal Emergency Management Agency
Forest Plan	Tongass Land and Resource Management Plan
FSH	Forest Service Handbook
FSM	Forest Service Manual
GHG	greenhouse gas emissions
GMU	Game Management Unit
IPCC	Intergovernmental Panel on Climate Change
LED	light-emitting diode
LUD	land use designation
Master Plan	Mendenhall Glacier Master Plan
MGRA	Mendenhall Glacier Recreation Area
MIS	management indicator species
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFS	National Forest System

NHPA	National Historic Preservation Act
N ₂ O	nitrous oxide
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Marine Fisheries Service
NRHP	National Register of Historic Places
PA	programmatic agreement
PAOT	people at one time
pH	potential hydrogen
ppm	parts per million
RCP	Representative Concentration Pathway
RMA	Riparian Management Area
ROD	record of decision
ROS	Recreation Opportunity Spectrum
SHPO	State Historic Preservation Office
SIA	special interest area
Solstice	Solstice Alaska Consulting, Inc.
sq ft	square feet
TAH	total aromatic carbons
TAqH	total aqueous hydrocarbons
tons	U.S. tons
TSS	total suspended solids
U.S.	United States
Corps	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
Visitor Center	Mendenhall Glacier Visitor Center
WAA	Wildlife Analysis Area
WOTUS	wetlands and waters of the U.S.

Chapter 1. Purpose of and Need for Action

1.1 Introduction

In December 2020, the USDA Forest Service (Forest Service) published a notice of intent in the Federal Register to analyze a variety of actions at the Mendenhall Glacier Recreation Area (MGRA) within the scope of the Mendenhall Glacier Visitor Facility Improvements Project. The Forest Service proposes to construct new facilities and trails; make improvements to existing facilities and trails; and determine how much commercial use (outfitter, guide, and transport, and other services) to permit at the MGRA. The MGRA is located on the Tongass National Forest, Juneau Ranger District, in Juneau, Alaska. The forest supervisor is the responsible official for this project.

This draft environmental impact statement (EIS) discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives, as required by the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations (40 Code of Federal Regulation [CFR] 1500-1508).¹ Originally initiated as an environmental assessment (EA), the level of analysis under NEPA for the proposed action was changed to an EIS based on input received during the initial scoping period. The document is organized as follows:

- *Chapter 1. Purpose of and Need for Action:* This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
- *Chapter 2. Alternatives, including the Proposed Action:* This chapter provides a detailed description of a no action alternative, the agency's proposed action, and two other action alternatives to the proposed action that were developed to address issues raised by the public and other agencies. This section provides summary tables to compare alternatives and the environmental consequences associated with each alternative.
- *Chapter 3. Affected Environment and Environmental Consequences:* This chapter describes the environmental effects of implementing the proposed action and alternatives. The analysis is focused on issues identified during scoping.
- *Chapter 4. Consultation and Coordination:* This chapter provides a list of preparers and agencies consulted during the development of the draft EIS.
- *References:* This section provides a list of citations in the draft EIS.
- *Glossary:* This section provides definitions of terms that may be either uncommon or specialized to the draft EIS.

¹ The CEQ published new NEPA-implementing regulations on September 14, 2020; those regulations apply to projects initiated on or after that date (40 CFR 1506.13). The Mendenhall Glacier Visitor Facility Improvements Project began in February 2020, and the Tongass National Forest has determined it will continue this project under the previous (1978) CEQ regulations.

- *Index*: The index provides page numbers by document topic.
- *Appendices*: The appendices provide more detailed information to support the analyses presented in the draft EIS:
 - Appendix A, “Visitor Capacity Analysis,” describes the visitor use capacity of facilities and trails at the MGRA.
 - Appendix B, “Commercial Use Allocations and Adaptive Management Plan for Outfitter, Guide, Transport, and Other Services,” describes estimated commercial use allocations (permitted service days) and an adaptive management plan for each action alternative. Adaptive management includes phasing in and adjusting the amount of commercial use based on facility construction, monitoring information, and visitor demand.
 - Appendix C contains an assessment of anticipated visual impacts from the project alternatives and renderings of specific project components.

Additional documentation is in the project record and is available by request to the Tongass National Forest Juneau Ranger District office.

1.1.1 Background and Location

The MGRA is located approximately 12 miles north of downtown Juneau, Alaska, at the head of the Mendenhall Valley. The land upon which the MGRA is situated is part of the traditional home of Tlingit clan Aak’w Kwaan, who inhabited several villages in the Auke Bay area north of the Mendenhall Valley. The glacier’s Tlingit name is Aak’wtaaksit (the Glacier Behind the Little Lake).

In 1907, the Tongass National Forest was established, encompassing much of the Juneau Icefield, Mendenhall Glacier, and the surrounding landscape. In 1947, the Forest Service established the MGRA for public recreation use, and in 1962 the Mendenhall Glacier Visitor Center was built to accommodate 23,000 visitors annually. The MGRA encompasses roughly 5,800 acres adjacent to the Mendenhall Glacier and includes three management units: the Visitor Center Unit, the Dredge Lakes Unit, and the West Glacier Unit (Figures 1-1 and 1-2).

The Mendenhall Glacier carved out the Mendenhall Valley and left behind a network of rivers, kettle ponds, and moraines. Mendenhall Glacier is located between Mount McGinnis to the west and Mount Bullard to the east, which each rise almost 4,000 feet above the surrounding landscape (Figures 1-1 and 1-2). The MGRA is upstream of and provides source water to the Mendenhall River, which is now bound on both sides by neighborhoods that house 40 percent of Juneau residents.

The MGRA is an important recreation area for Juneau residents as well as visitors from around the world. There are opportunities for hiking, biking, canoeing and kayaking, skiing, snowshoeing, wildlife viewing, and camping. An estimated 85 percent of visitors to the MGRA arrive with commercial service providers (cruise ships and independent tour companies) and the remaining 15 percent arrive independently (locals and independent visitors).

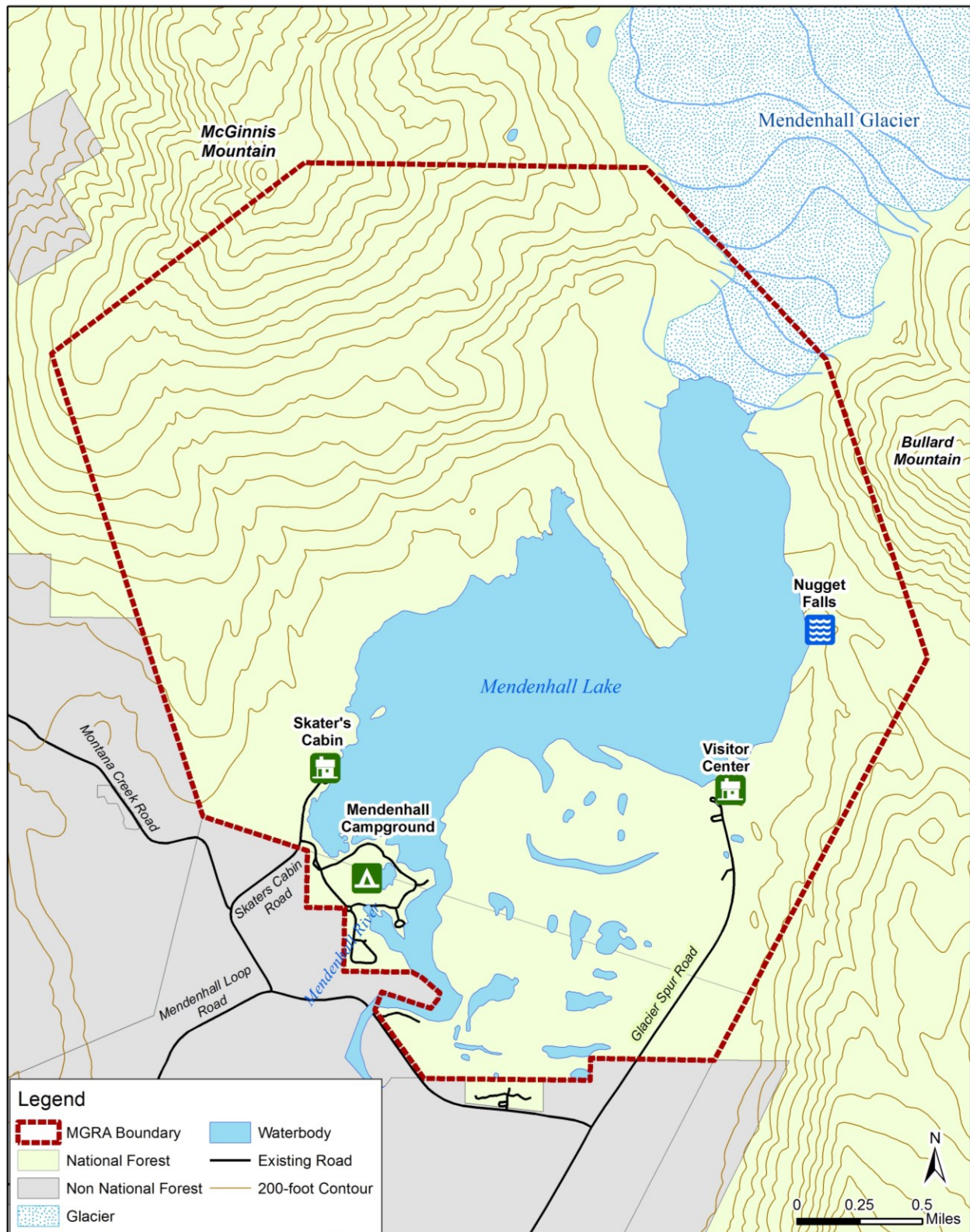
In 2016, the Forest Service initiated a master planning effort to identify existing conditions, current uses, and issues at the MGRA. The outcome of the effort was the Mendenhall Glacier Master Plan (Master Plan; USDA Forest Service 2019), which presents a vision and mission for

the MGRA over the next 10, 20, and 50 years. Elements from the Master Plan including proposed changes to facilities and trails were further refined and are described as the proposed action in this EIS. This draft EIS presents another opportunity for past and new planning participants to identify needs for facilities, trails, and commercial services at the MGRA before a final decision is made.

Figure 1-1. Mendenhall Glacier Visitor Facility Improvements Project Location and Vicinity Map



Figure 1-2. Mendenhall Glacier Visitor Facility Improvements Project Area Map



1.1.2 Forest Plan Direction

The 2016 Tongass National Forest Land and Resource Management Plan (Forest Plan) designates the MGRA as a Special Interest Area because of its proximity to the Mendenhall Glacier, outstanding scenery, and history as the first Forest Service visitor center built in the country.

The proposed action and alternatives have been designed to meet the goals, objectives, and desired conditions for management of Special Interest Areas on the Tongass (Tongass Forest Plan, p. 3-39), including:

Goals

- To provide for the inventory, maintenance, interpretation, and protection of the existing characteristics and attributes of areas with unique cultural, geological, botanical, zoological, recreational, scenic, or other special features.

Objectives

- Provide opportunities for public study, use, and enjoyment of unique natural areas that are suitable to, and do not compromise, the characteristics of each area.
- Allow only facilities and recreation developments that contribute to the interpretation of natural features or provide for compatible public uses, and that blend with the natural setting.
- Provide for existing Recreation Opportunity Spectrum (ROS) opportunities and activities, unless public use is specifically restricted for the protection of other resources.
- Consider withdrawing each area from mineral entry, subject to valid existing rights, on a case-by-case basis, if mineral development would not be consistent with protecting the unique features of the area.
- Apply the High Scenic Integrity Objective except around developed interpretive facilities, and other developments or structures.
- Allow fish, wildlife, and/or soil and water improvements if they are compatible with the purposes for which each Special Interest Area was established.
- Develop management plans for those Special Interest Areas needing specific direction for achieving these goals and objectives.

Desired Conditions

- Scenic areas are comprised of landscapes of outstanding beauty or natural characteristics, such as glaciers, alpine, and areas of diverse vegetative patterns/coverage. These are areas that could be viewed for a long duration from specific vantage points, such as developed recreation sites, trails, anchorages, travel routes, and communities.

The Forest Plan also includes many goals, objectives, and desired future conditions that apply Forest-wide. This project contributes to the following Forest-wide goals (USDA Forest Service 2016, pp. 2-3 to 2-5):

- Provide a range of recreation opportunities consistent with public demand, emphasizing locally popular recreation places and those important to the tourism industry.
- Provide a diversity of opportunities for resource uses that contribute to the local and regional economies of Southeast Alaska.

- Provide Forest visitors with visually appealing scenery, with emphasis on...popular recreation places.
- Maintain ecosystems capable of supporting the full range of native and desired non-native species and ecological processes.
- Maintain or restore the natural range and frequency of aquatic habitat conditions to sustain the diversity and production of fish and other freshwater organisms.
- Identify, evaluate, preserve, and protect heritage resources.

1.1.3 Mendenhall Glacier Recreation Area Management Plan

Consistent with the objectives for management of Special Interest Areas, a Mendenhall Glacier Recreation Area Management Plan was developed to provide specific management direction at the MGRA, including desired future conditions, management objectives, and implementation strategies. It also summarizes visitor capacities and sets commercial allocations for outfitters, guides, transporters, and other service providers (via service days; see Section 1.3). The MGRA Management Plan was originally developed in 1960 and has been updated several times, in 1965, 1975, 1996, and most recently in 2015.

Mendenhall Glacier Recreation Area Management Plan direction is purposely broad to provide flexibility in responding to future changing uses. However, the Forest Service must periodically review its management to keep pace with changing policy, use patterns, and expectations of the public. To the extent possible, this project is designed consistent with the MGRA Management Plan. In cases where there may be inconsistencies between this project decision and the 2015 MGRA Management Plan (e.g., management unit boundaries, ROS designations, estimated visitor use and visitor capacity², commercial allocations), the MGRA Management Plan would be updated based on this environmental analysis process.

1.2 Purpose of and Need for Action

The Mendenhall Glacier has been a local, national, and international destination since the 1920s, and many changes in facilities and management of the MGRA have occurred over the years. Changed conditions influencing this project and proposed action include increases in visitation, extended tourism seasons, and glacial retreat.

The number of visitors to the MGRA is projected to increase at a rate of approximately 2 percent annually for the next 30 years as the cruise industry continues to grow in the region and the tourism season expands, with a projection of 1,000,000 annual visitors by 2050 (Appendix A Visitor Capacity Analysis). This level of growth was not foreseen by past planning efforts. For example, in 2017, the master planning team estimated there were about 700,000 visitors to the MGRA, exceeding the capacity determination of 635,552 made in the 2015 Decision Notice for the MGRA Management Plan Revision (USDA Forest Service 2015).

Part of the increase in visitors is attributable to the cruise industry adding earlier- and later-season sailings, thereby extending Juneau's tourist season. In 2015, the tourism season was estimated to last 153 days from May 1 through September 30. In 2022, Juneau is scheduled to

² Visitor capacity is the maximum amount and type of visitor use than an area can accommodate while achieving and maintaining the desired resource conditions and visitor experiences that are consistent with the purposes for which the area was established (Interagency Visitor Use Council 2019).

have cruise ships in port from April 25 through October 18. The existing capacity of facilities such as parking lots, restroom facilities, the Visitor Center, and trails does not meet current demand on high visitation days and does not allow room for growth within the tourism sector of the local and regional economy. Although tourism declined during 2020 and 2021 because of the COVID-19 pandemic and subsequent reduction of Alaska cruise ship traffic, it is important that planning for this project continue in anticipation of the recovery of the tourism industry.

In addition to changes in visitation, the Mendenhall Glacier has been receding at an increased rate over the last 20 years, creating a changed environment. As the glacier continues to recede, one of the main attractions for visitors to the MGRA could be out of view from the Visitor Center within 20 to 40 years, creating a need for additional types of visitor experiences and education opportunities to maintain the desired condition of the Special Interest Area and its draw as a tourism destination.

The Forest Service must consider the current and future demands on MGRA resources as visitor use increases so that issues such as wildlife-visitor interactions, terrestrial and aquatic habitat conservation, and climate change can be addressed proactively rather reactively. The Forest Service has an opportunity to design facilities to ensure that the outstanding beauty of the Mendenhall Glacier and surrounding habitats are able to be viewed and enjoyed through a variety of recreational opportunities. Ignoring known issues and postponing solutions could diminish visitor experience, damage habitats and sensitive resources, and add deferred maintenance costs. As the retreating Mendenhall Glacier is changing the landscape, the MGRA and its interpretive and recreational facilities have the opportunity to adapt to maintain and diversify the visitor experience.

1.2.1 Purpose and Need Statement

The purpose of the project is to update infrastructure and create recreation opportunities at the MGRA that can accommodate projected future visitor use while protecting the unique characteristics and outstanding beauty of the area. The project is needed to continue to provide quality opportunities for all visitors to enjoy the recreation area, to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, to meet the demand of the visitor industry and support the economy of Southeast Alaska, and to protect the area from environmental impacts associated with increased visitation.

1.3 Proposed Action

The Forest Service proposes to implement a variety of projects over several years to meet the purpose and need for the project. The following is a summary of the proposed action (Alternative 2). The proposed action and all alternatives are presented in more detail in Chapter 2 of this draft EIS.

- **Parking and Access Expansion:** The two existing parking areas nearest the Visitor Center would be combined and the layout improved to provide more parking and create separation between commercial and private vehicles.

The existing gravel bus lot about one-quarter mile south of the main parking area would be reconfigured and partially paved to provide commercial and overflow parking and

staging. A new maintenance building would be added. The existing remote-control airstrip would remain.

- **Welcome Center Complex:** The existing pavilion and parking area shelter would be replaced with a new single story, 14,000 square-foot Welcome Center near the main parking area would include restrooms, information area, food service, and a retail area. Other planned Welcome Center area improvements include a pedestrian bridge over Kettle Pond between the Welcome Center and the historic Visitor Center; expansion of Photo Point Trail; wayfinding and interpretive signs; a covered amphitheater; improvements to, connections between, and extensions of existing trails; and covered shelters.
- **Visitor Center Improvements:** Proposed renovations to the upper floor and theater area would provide a more immersive and hands-on visitor experience; improvements to the railing and trail surface leading up to the Visitor Center would provide a safer route for visitors; and a canopy-style roof over the external staircase and a covered area outside the main upper doors would provide shelter from the weather upon entry and exit. The lower level undergo minor infill expansion to better meet staff needs and deferred maintenance needs would be addressed.
- **Glacier Spur Road Trailheads:** Three new paved trailheads (Dredge Lakes, Crystal Lake, and Powerline; 20-car maximum) would be added along Glacier Spur Road and would include trailhead kiosks and road corridor and trail signs.
- **Lakeshore Trail:** A new paved trail would be constructed along the south shore of Mendenhall Lake from the Welcome Center Complex to the Mendenhall Campground (via a pedestrian bridge across the river) and Skater's Cabin Road; trail spurs would connect the trail to the Dredge Lakes trail system.

A new day-use parking area would be added in the Mendenhall Campground for access to the Lakeshore Trail, and some existing walk-in campsites would be replaced, relocated, or converted to day-use picnic sites.

- **Public Use Cabins:** Five new public use (rental) cabins would be constructed in the Mendenhall Campground.
- **Nugget Falls Trail Expansion:** Nugget Falls Trail and the existing informal trail along the shore of Mendenhall Lake would be improved and connected to form a loop trail.
- **Steep Creek Habitat Restoration:** About 1,500 feet of Steep Creek that was channelized during previous road construction would be shifted to the west. It would be realigned to restore and enhance salmon habitat, maintain stream and floodplain function, and accommodate natural sediment transport. Two existing perched culverts under Glacier Spur Road at Steep Creek would be replaced with a bridge to improve stream resilience and aquatic organism passage and allow for a wildlife and pedestrians to pass under the road. The culvert under Glacier Spur Road leading to the Pond of Time would also be replaced.
- **Steep Creek Trail Expansion:** Steep Creek Trail would be realigned and extended on the west side of Steep Creek to connect to the proposed Lakeshore Trail near the Welcome Center and also extended under Glacier Spur Road to the Trail of Time. Most

of the trail would be constructed as an elevated boardwalk, with several fish and wildlife viewing platforms added, including an elevated spur trail and cleared viewing area at Dipper Falls.

- **Dredge Lakes Multi-Use Trails:** Several user-created and/or user-proposed mountain bike and hiking trails in the Dredge Lakes Unit would be incorporated into the MGRA trail network and upgraded to meet National Forest System (NFS) standards.
- **Boat Docks and Related Support Facilities:** Three boat docks designed to be removed in the winter would be installed on Mendenhall Lake: near the proposed Welcome Center; at the proposed Remote Glacier Visitor Area; and at the West Glacier parking lot. Commercial motorized boats would be allowed on the lake under special use permit. A fenced, upland winter storage area for docks, temporary remote facilities, or other seasonal needs would be constructed adjacent to the existing West Glacier parking lot.
- **Remote Glacier Visitor Area:** Four seasonal, relocatable structures and restroom facilities would be installed near the glacier. An accessible trail would connect the boat dock to the glacier facilities and could be extended as the glacier retreats.
- **West Glacier Unit Trails:** A new spur trail would connect the proposed Remote Glacier Visitor Area to the existing West Glacier Trail. A user-proposed multi-use trail system would be constructed in the area to the north of Skater's Cabin Road.
- **Visitor Capacity and Commercial Use Management Changes:** As facility improvements under this project are constructed, capacity of the MGRA would be better able to accommodate the anticipated increases in visitation that will occur over the next 30 years. Additionally, the number of commercial permit service days³ allocated to outfitters, guides, transporters, and other service providers would be increased as existing facilities are improved and new facilities are constructed. The permitting process for commercial service providers would be managed using an adaptive management plan developed in conjunction with this project (Appendix B).
- **Management Unit Boundary and Recreation Opportunity Spectrum Adjustments:** MGRA management units' (Visitor Center, Dredge Lakes, and West Glacier) boundaries would be adjusted from those documented in the MGRA Management Plan to group similar activities and facilities proposed in this project. Existing ROS designations would be updated to describe expected user experiences.

1.4 Decision Framework

Given the purpose and need for this project, the responsible official will review the proposed action, the other alternatives, and the environmental consequences of each alternative to make the following decisions:

³ A service day is an allocation of use constituting a day or any part of a day on NFS lands for which an outfitter, guide, or transporter provides services to a client. Each commercial client that visits the MGRA represents one service day for that vendor. Special use permits are distributed to different commercial guide, outfitter, and transport services, issued as a total number of service days. See Chapter 3, Section 3.2.2.1 for further discussion regarding capacity, special use permits, and service days.

- whether to implement facility improvements as described in the proposed action;
- whether to implement facility improvements as described in an alternative to the proposed action;
- whether to implement a combination of alternatives analyzed in detail;
- whether to adopt proposed changes to management unit boundaries and commercial use as part of the selected alternative;
- whether to adopt identified mitigation measures and monitoring requirements, including those associated with the adaptive management plan, as part of the selected alternative; or
- whether to take no action.

1.5 Issues

Two rounds of public scoping were initiated prior to the publication of this draft EIS. Public and internal comments received during both the EA and EIS notice of intent scoping periods revealed several issues associated with the project and proposed action. Forest Service staff considered these comments and developed issue statements to be addressed in this environmental analysis. Issues were addressed by developing alternatives to the proposed action or by modifying the proposed action and are analyzed in the effects analysis to determine if additional mitigations or design features are needed. Some concerns raised by the public were found to be outside the scope of the proposed action; already decided by law, regulation, Forest Plan, or other higher-level decision; irrelevant to the decision to be made; or conjectural and not supported by scientific or factual evidence. These are documented in the project record but are not analyzed further in the EIS.

1.5.1 Issue Statements

The following issue statements were used to develop alternatives to the proposed action or modify the proposed action and are analyzed in Chapter 3 of the EIS. The issue statements below represent concerns raised by commenters and are not conclusions found through the analysis.

Issue 1: Wildlife and Vegetation

Issue Statement: *Proposed facility developments, increased visitor use, and changes in visitor distribution could adversely impact wildlife (particularly bears and migratory birds), reduce or alter habitat, and increase the potential for wildlife-human interactions.*

Issue Statement: *Proposed activities could introduce or spread invasive species such as reed canarygrass, impacting native plants and watershed condition, particularly within riparian areas and around the Dredge Lakes Unit.*

Issue Statement: *The proposed improvements could damage successional plant life near the glacier, thereby reducing diversity and slowing the natural succession pathways.*

Issue 2: Recreation and Visitor Experience

Issue Statement: *Proposed increases in visitor capacity and commercial use, changes in management unit boundaries, and the addition of motorized boats on Mendenhall Lake could adversely impact visitor experience by creating increasing encounters between groups and causing visual and noise impacts.*

Issue 3: Watersheds, Wetlands, and Aquatic Habitat

***Issue Statement:** Proposed developments including parking lot expansion, trail expansion and construction, bridge construction, Steep Creek realignment and restoration, and the addition of docks on Mendenhall Lake could impact wetlands, aquatic habitat, and water quality.*

Issue 4: Heritage Resources

***Issue Statement:** Proposed developments could impact the MGRA's potentially eligible historic resources, including the historic Visitor Center and historic trails, and a Native Alaskan tribe's culturally important glacier.*

Issue 5: Air Quality

***Issue Statement:** Proposed increase in number of tour buses and the addition of motorized boats at the MGRA could contribute to periods of poor air quality in the Mendenhall Valley.*

Issue 6: Climate Change and Greenhouse Gas Emissions

***Issue Statement:** Projected changes in climate and continued retreat of the Mendenhall Glacier may have effects on the proposed project and the MGRA.*

***Issue Statement:** Greenhouse gas emissions from a greater number of tour buses and the addition of gas-powered boats on the lake could hasten the effects of climate change.*

Issue 7: Socioeconomics and Environmental Justice

***Issue Statement:** Proposed developments could impact minority and/or low-income populations at a higher level than the general public.*

***Issue Statement:** Proposed activities may impede local traffic flows and impact resident quality of life.*

***Issue Statement:** The Forest Service has a duty to help people share and enjoy the forest that it might not be meeting at the MGRA due to crowded conditions and limited infrastructure.*

1.6 Tribal Consultation

The Forest Service must engage with tribes in timely and meaningful consultation on projects and policies that could impact them. In Alaska, Indian tribes, as defined by the National Historic Preservation Act (NHPA), include Federally-recognized tribes, as well as village and regional corporations created by the Alaska Native Claims Settlement Act.

The following Federally-recognized tribal governments and corporations were invited to consult about this project:

- Douglas Indian Association
- Central Council Tlingit and Haida Indian Tribes of Alaska
- Goldbelt, Inc.
- Sealaska Corporation

In addition, the Forest Service held meetings with the Aak’w Kwaan, a non-Federally recognized tribe whose homeland encompasses the MGRA to gather input on the interpretive plan (AldrichPears Associates 2022) that was prepared in conjunction with the project.

1.7 Public Involvement

The proposed action and alternatives presented in this EIS are based on the master planning process that the Forest Service conducted for the MGRA between 2016 and 2019, which included public working sessions, workshops, and gathering input from Forest Service specialists. The goal of the effort was to determine ways to improve visitor experiences and to anticipate future needs at the MGRA. The outcome of the effort was the Master Plan (distinct from the above referenced MGRA Management Plan), which details a future vision for the MGRA’s facilities and visitor capacity.

1.7.1 Public Scoping

Public scoping is a process is used to openly share information, invite public participation, and identify issues related to a proposal early in an environmental analysis process. In addition to public involvement in the Master Plan from 2016-2019, two public scoping periods have been held to initiate this environmental analysis.

On February 18, 2020, a 30-day scoping comment period was initiated for this project anticipating an EA as the level of environmental analysis. The comment period was announced via a letter distributed to recipients on the Forest Service’s email list for subscribers of Mendenhall Glacier Visitor Facility Improvements Project, announced on the Tongass National Forest Facebook page, and posted to the project website at <https://www.fs.usda.gov/project/?project=53780>. An open house was held on Thursday, February 20, 2020, at the Mendenhall Glacier Visitor Center in Juneau, Alaska. During the EA scoping comment period, a total of 136 responses were received from individuals, groups, and agencies. The 136 comment letters were further separated into approximately 800 discrete comments.

Based on public scoping comments, the Forest Service determined that an EIS would be a more appropriate level of environmental analysis for this project and that the EIS process would continue under the 1978 Council on Environmental Quality (CEQ) regulations. A notice of intent to prepare an EIS was published in the Federal Register on December 16, 2020, and served as the official start of the EIS process (Vol. 85, No. 242). The notice of intent requested public comment on the proposal from December 16, 2020 to January 15, 2021. The availability of the notice of intent and comment period timing was announced via a letter distributed to recipients on the Forest Service’s email list for subscribers of Mendenhall Glacier Visitor Facility Improvements Project, announced on both the Tongass National Forest and the Mendenhall Glacier Visitor Center Facebook pages, and posted to the project website. During the EIS notice of intent comment period, the Forest Service held informational meetings with elected State officials and interested groups within the Juneau community to answer questions about the planned improvements. About 1,800 discrete comments were identified from a total of 195 responses received.

The Forest Service generated a scoping report including public outreach and comments received during both comment periods. This report and individual comment letters are available on the

project website. All public comments are available to view and download on the project reading room at <https://cara.ecosystem-management.org/Public//ReadingRoom?Project=53780>.

Comments from individuals, organizations, and other agencies identified issues to be addressed through development of alternatives to the proposed action or modification of the proposed and analyzed in the EIS (Section 1.5)

1.7.2 Consultation with Other Government Agencies

The Forest Service is committed to working with other agencies at all stages of planning and is responsible for coordinating project reviews by several other agencies. In some cases, the reviews are required because another agency has the authority to issue permits for a specific activity proposed by the Forest Service. In other cases, the reviews provide a time for dialogue with agencies responsible for ensuring that certain environmental conditions are met, such as clean water or healthy wildlife populations. This interagency communication helps provide information about area resources, ensure laws and regulations are followed, and identify ways to avoid or mitigate environmental effects. In many cases, an ongoing professional dialogue is maintained with these agencies throughout the planning process.

1.7.2.1 Alaska Department of Fish and Game

The Forest Service and the Alaska Department of Fish and Game (ADF&G) have responsibilities to cooperate in the common stewardship of fish and wildlife and their habitats on NFS lands. The Forest Service has initiated discussions with ADF&G that will continue throughout the project.

1.7.2.2 Alaska Department of Natural Resources, Office of History and Archaeology

The Office of History and Archaeology serves as Alaska's State Historic Preservation Office (SHPO) pursuant to the National Historic Preservation Act (NHPA) of 1966. The Forest Service initiated consultation with the SHPO on June 9, 2020, in accordance with Section 106 of the NHPA for effects to heritage resources within the MGRA.

The Forest Service and Alaska SHPO are developing a programmatic agreement for addressing cultural resources at the MGRA. The programmatic agreement is expected to define the direct and indirect areas of potential effect, describe how to consult on maintenance and preservation of the historic Visitor Center, develop a process to mitigate any adverse effects to other historic properties, describe requirements for survey and consultation for trails and infrastructure projects, and describe how to integrate the Section 106 consultation process with Tribal consultation. The programmatic agreement will be complete and signed before the record of decision for this project is signed. As discussed in Chapter 3, Section 3.9, all build alternatives would follow the programmatic agreement during project implementation.

1.7.2.3 Alaska Department of Transportation and Public Facilities

Glacier Spur Road, Skater's Cabin Road (to the USFS sign/obelisk), and the Mendenhall Loop Road provide access to the MGRA and are owned and maintained by the Alaska Department of Transportation and Public Facilities (DOT&PF). The Forest Service will continue to work with DOT&PF regarding impacts from the proposed action, including replacement of the Steep Creek culverts with a bridge on the Glacier Spur Road.

1.7.2.4 National Marine Fisheries Service

The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) is a formal cooperating agency on this project. NOAA Fisheries has authority for fisheries management, species protection, and habitat conservation activities derived primarily from the Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, and Endangered Species Act (ESA). This includes most marine life, anadromous salmon, and essential fish habitat (EFH). NOAA Fisheries is serving as a cooperating agency to enhance consultation related Pacific salmon and EFH and is contributing their special expertise on these topics in the EIS.

The Forest Service prepared a Biological Evaluation (BE) for the project to document effects to threatened, endangered, and sensitive species per the Forest Service Manual (FSM) 2670. It was determined that this action would have “no effect” to threatened, endangered, or proposed species or to critical habitat because none are present within the project area.

NOAA Fisheries requested preparation of an EFH Assessment to examine the environmental consequences of the project on EFH in the project area. An EFH Assessment was completed for the project and is discussed in Chapter 3.

1.7.2.5 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) has jurisdiction over waters of the U.S., including wetlands. Wetlands mapping was completed to estimate impacts of the proposed action on wetlands in the project area. Permits would be obtained from the Corps prior to initiating any project work that impacts waters or wetlands in the MGRA. Anticipated wetlands impacts are discussed in Chapter 3.

1.7.2.6 U.S. Coast Guard

The U.S. Coast Guard (USCG) has jurisdiction over certain inland navigable waters in accordance with 33 CFR Part 2. The Forest Service met with the USCG to determine navigability of Mendenhall Lake and Mendenhall River during initial design of proposed projects that would impact these waterways. A navigability determination was completed for Mendenhall River and submitted to the USCG in August of 2020. Although it has yet to be officially designated and such a designation may take years, the USCG suggested that project design should assume navigability for the Mendenhall River, and as discussed in Chapter 2, Section 2.3.4.2, the Lakeshore Trail pedestrian bridge would be designed to maintain the river’s navigability.

1.7.2.7 U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) provides a general review in accordance with their responsibilities under NEPA, Section 309 of the Clean Air Act, and Section 402 of the Clean Water Act. The EPA provided scoping comments on the project that are addressed in this document.

1.7.2.8 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) has legal jurisdiction over a host of Federal legal mandates including the ESA, Migratory Bird Treaty Act, Bald and Golden Eagle Act, and Fish and Wildlife Coordination Act. The Forest Service prepared a BE for the project to document

effects to threatened, endangered, and sensitive species as required by the Forest Plan and FSM 2670. It was determined that this action would have “no effect” to threatened, endangered, or proposed species or to critical habitat because none are present within the project area.

1.8 Other Related Efforts

1.8.1 Interpretive Plan

A new Interpretive Plan is being developed to update educational exhibits, signage, and kiosks throughout the MGRA. Elements could include structures or signs along trails or adjacent to trails. Any elements of the Interpretive Plan that may have environmental effects will be considered as part of the environmental analysis documented in this EIS. The current draft of the Interpretive Plan is posted to the project web site (<https://www.fs.usda.gov/project/?project=53780>).

1.8.2 Master Planning Process

Separate from the MGRA Management Plan, the Forest Service completed a master planning process for the MGRA between 2016 and 2019. The goal of the effort was to determine ways to improve visitor experiences and to anticipate future needs at the MGRA.

The Master Plan details a future vision for the MGRA’s facilities and visitor capacity, and provides the basis for the proposed action and alternatives presented in this EIS. It is posted to the project web site (<https://www.fs.usda.gov/project/?project=53780>).

1.8.3 Issuance of Forest Orders

Following the record of decision for this project, Forest Orders may be issued to enforce some of the management actions proposed in the proposed action and alternatives. These are listed in Chapter 2, “Associated Actions Common to All Action Alternatives.”

1.8.4 Special Use Permitting

Following the record of decision for this project, a process may be initiated to increase service days for special use permit holders or to invite competitive interest in special use permits for outfitter, guide, transport, and other services.

1.9 Applicable Permits

Prior to implementation of the project, the Forest Service would obtain all necessary permits or authorizations from other Federal and State agencies. These may include the following:

1. Corps:

- Approval of discharge of dredged or fill material into the waters of the U.S. under Section 404 of the Clean Water Act
- Approval of the construction of structures or work in navigable waters of the U.S. under Section 10 of the Rivers and Harbors Act of 1899

2. NOAA Fisheries:
 - Concurrence on the effects of the action on EFH (Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act)
3. State of Alaska, Department of Environmental Conservation (ADEC):
 - Certification of Compliance with Alaska Water Quality Standards (401 Certification) Chapter 20
 - Construction General Permit/Storm Water Pollution Prevention Plan (Section 402 of the Clean Water Act)
 - Spill Prevention Control and Countermeasure Plan
 - Solid Waste Disposal Permit
4. State of Alaska, ADF&G:
 - Fish Habitat Concurrence for construction activities in fish-bearing water bodies (Title 16/Alaska Fish Conservation)
5. Alaska Department of Natural Resources, Office of History and Archaeology
 - Concurrence with a Finding of Effect (Section 106 of the National Historic Preservation Act)
6. State of Alaska, DOT&PF:
 - Driveway or approach road permit (17 Alaska Administrative Code 10.020)

Chapter 2. Alternatives, Including the Proposed Action

2.1 Introduction

This chapter describes and compares the alternatives considered for the Mendenhall Glacier Visitor Facility Improvements Project within the Mendenhall Glacier Recreation Area (MGRA). It includes a description of each alternative considered and presents alternatives in comparative form. Differences between alternatives provide the basis for a project decision by the responsible official.

2.2 Development of the Alternatives

Under Council on Environmental Quality (CEQ) regulations, the USDA Forest Service (Forest Service) is required to study, develop, and describe alternatives. This analysis is necessary to recommend a course of action for a proposal that involves unresolved conflicts concerning alternative uses of available resources, as provided by Section 102(2)(E) of the National Environmental Policy Act (NEPA). The action alternatives provided in this analysis were developed to meet the purpose and need as described in Chapter 1, while taking into consideration comments received through public and internal scoping (see Chapter 1, Section 1.5).



The Mendenhall Glacier Visitor Center has been the prime viewing location for the Mendenhall Glacier since its construction in 1962. It will continue to serve that role under all alternatives. Photo by Chelsea McCann, Walker Macy.

2.3 Alternatives Considered in Detail

The Forest Service analyzed four alternatives in detail, including the No Action Alternative (Alternative 1), and three action alternatives: Alternative 2 (Proposed Action, as modified), Alternative 3, and Alternative 4. The Forest Service addressed issues identified during public and internal scoping through either modifications to Alternative 2 or through development of the two other action alternatives. Table 2-1 offers a summary comparison between the four alternatives. Maps providing visual a representation of the project components are included following the narrative descriptions. Three map extents are provided for each alternative: Visitor Center and Dredge Lakes Area, West, and North (Figure 2-1).

Table 2-1. Summary Comparison of Alternatives

Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Parking Access and Expansion: Main Parking Lot	- Three lots with 75 standard parking spaces and 6 bus spaces (90,000 square feet [sq ft]) - Overflow parking along Glacier Spur Road	- Construct parking lot with 81 standard parking spaces, 3 spaces meeting Americans with Disabilities Act (ADA) standards, 5 bus arrival spaces, 8 bus departure spaces, and 7 for-hire spaces (142,000 sq ft) - Fill Zig Zag Pond completely (20,000 sq ft)	- Construct parking lot with 71 standard parking spaces, 2 ADA spaces, 8 bus arrival spaces, 5 bus departure spaces, and 7 for-hire spaces (118,000 sq ft) - Install walkway over and fill in 2,500 sq ft of Zig Zag Pond	- Construct parking lot with 72 standard parking spaces, 2 ADA spaces, 5 bus arrival spaces, 5 bus departure spaces, and 7 for-hire spaces (110,000 sq ft) - Install walkway around and fill in 2,500 sq ft of Zig Zag Pond
Parking Access and Expansion: Commercial Overflow Parking Lot	- Gravel parking for buses and vans (140,000 sq ft) - City and Borough of Juneau (CBJ) snow storage (50,000 sq ft)	- Pave north two-thirds of lot (90,000 sq ft) and shift entrance south to align with Powerline Trailhead - Install 20 van spaces, 60 bus spaces, maintenance building (2,000 sq ft), and a portable toilet - Realign trail connections to improve flow - Maintain CBJ snow storage (50,000 sq ft)	Same as Alternative 2	Same as Alternative 2
Welcome Center Complex: Welcome Center	A small pavilion with views of the glacier and lake	Construct: Welcome Center building (14,000 sq ft) with restrooms, information area, food service, and retail area	Same as Alternative 2	Same as Alternative 2

Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Welcome Center Complex: Plaza Area	Informational signs, a waiting shelter, and an outdoor restroom facility near parking	Construct: - Curved elevated walkway over Kettle Pond - Arrival and wayfinding area (20,000 sq ft) - Interpretive plaza (5,000 sq ft) with an upper and lower area and terraced seating - Amphitheater	Similar to Alternative 2, with a slightly smaller arrival and wayfinding area (18,000 sq ft)	Construct: - Curved elevated walkway over Kettle Pond - Arrival and wayfinding area (17,500 sq ft) - Small upper plaza area (1,500 sq ft) - No lower plaza area or amphitheater
Welcome Center Complex: Photo Point Loop	Out-and-back trail along east edge of the peninsula	- Extend existing Photo Point Trail around the west edge of the peninsula to create a loop back to the Welcome Center Plaza - Build a short bridge to connect to the Lakeshore Trail	Same as Alternative 2	Create a loop trail through the middle of the peninsula that connects back to existing start of Photo Point Trail
Visitor Center Improvements	Deferred maintenance only	- Infill minor area (200 sq ft) on lower floor to expand office area - Add cover to existing main entry staircase and emergency exit staircase	Same as Alternative 2	Same as Alternative 2
Glacier Spur Road Trailheads	Parking along Glacier Spur Road	Construct: - Dredge Lakes Trailhead: 12 parking spaces (7,000 sq ft) - Crystal Lake Trailhead: 12 parking spaces (7,000 sq ft) - Powerline Trailhead: 20 parking spaces (12,000 sq ft)	Same as Alternative 2	Same as Alternative 2

Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Lakeshore Trail: Main Alignment	Winter-only trail through Dredge Lakes Unit near the lakeshore	Construct: 2.2-mile-long, 14-foot-wide trail along lake edge with 4 gravel spur trails for viewpoints or trail connections (1,800 feet) - Pedestrian bridge across Mendenhall River to campground	Construct: 2.6-mile-long, 14-foot-wide trail - Western portion of trail inland from lake with 4 spurs to shoreline (1,700 feet) - Pedestrian bridge across Mendenhall River to campground	Construct: 1-mile-long, 8-foot-wide inland trail 6 spurs to shoreline (3,600 feet) - No pedestrian bridge over Mendenhall River
Lakeshore Trail: Campground Changes	- No parking area within campground 7 walk-in, 44 drive-in, and 19 Recreational Vehicle (RV) campsites	- Construct Lakeshore Trail parking lot (30 spaces, 18,000 sq ft) - Trail through campground to Skater's Cabin Road, across from Aak'w Sit' Trail - Abandon some campsites and convert some to day-use picnic sites, add new day-use picnic sites	Same as Alternative 2	Same as Alternative 1
Lakeshore Trail: Dredge Lakes Outer Loop	Dredge Lake Trail through south of Dredge Lakes Unit	Create loop trail around the Dredge Lakes Unit connecting Lakeshore Trail, Moose Lake Trail, Dredge Lake Trail, Trailhead Connector, and Boat Dock Trail	Same as Alternative 2	- Construct Moose Lake Connector - No other trail connections – loop trail not constructed
Public Use Cabins	- No public use cabins 7 walk-in, 44 drive-in, and 19 RV campsites	- Construct four 600-sq ft and one 840-sq ft public use rental cabins - Remove 4 existing campsites and create 1 new site	Same as Alternative 2	Same as Alternative 2

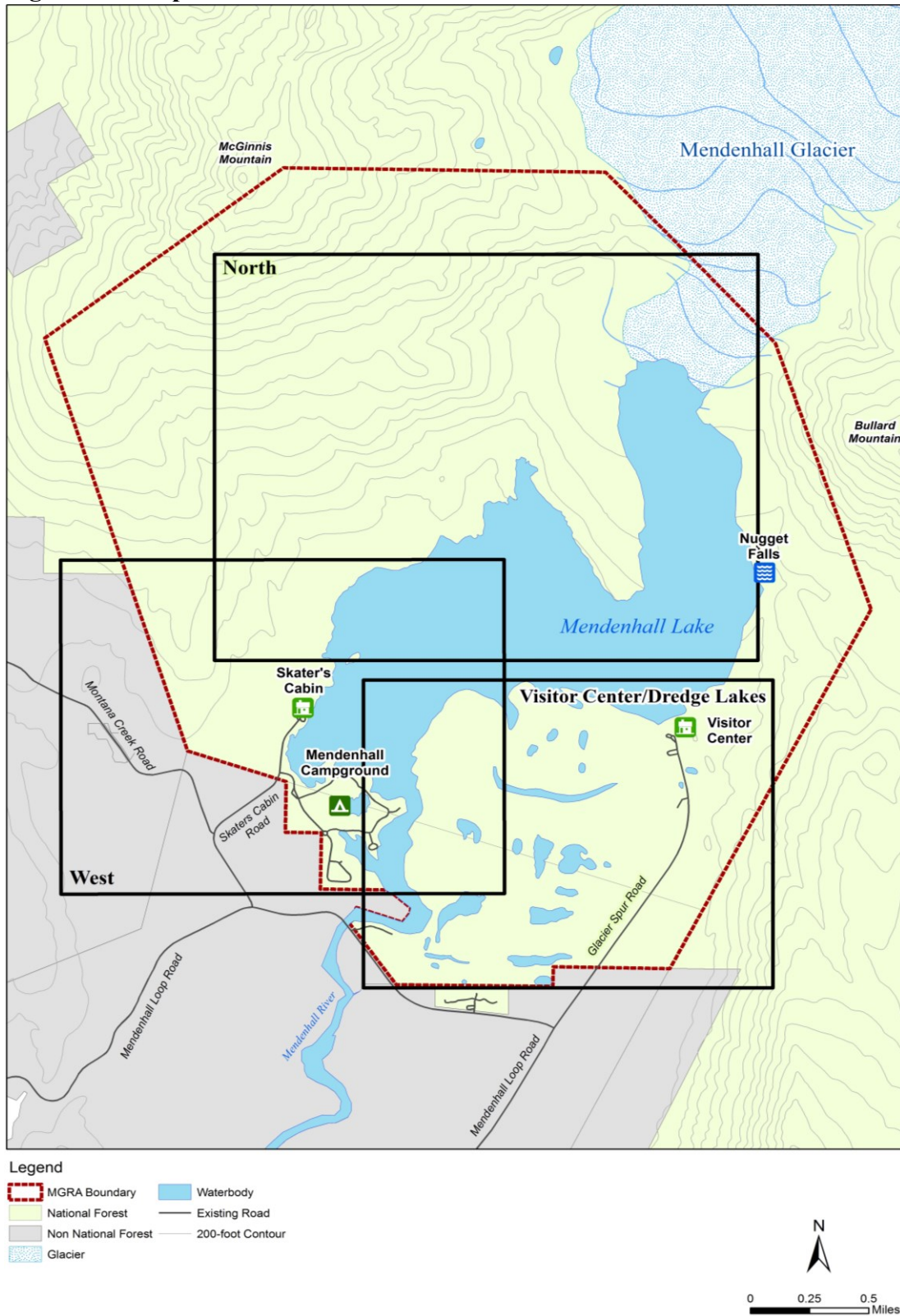
Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Nugget Falls Trail Expansion	• Out-and-back trail to Nugget Falls • User-created trail along the lake	• Expand and improve user-created trail (2,400 feet) to create a loop trail • Decommission existing sections and realign trail as needed • Elevate two small sections on pilings over Mendenhall Lake	• Same as Alternative 2	• Same as Alternative 2
Steep Creek Habitat Restoration	• No change to degraded spawning gravels • Repair perched culverts under Glacier Spur Road and to Pond of Time • Backside Pond not connected	• Realign, restore, and regrade 1,500 feet of Steep Creek to provide a buffer from the parking area, an adequate floodplain, and improve fish habitat • Replace culverts under Glacier Spur Road with a vehicular bridge • Replace and improve Pond of Time culvert • To mitigate impacts, enlarge and establish augmented connectivity to Backside Pond	• Same as Alternative 2	• Same as Alternative 2
Steep Creek Trail Expansion	• Elevated boardwalk trail creates a loop around Steep Creek	• Construct boardwalk along east bank of Steep Creek under Glacier Spur Road starting at Lakeshore Trail and ending at Trail of Time • Install up to 8 fish viewing overlooks (700 sq ft each) off trail • Decommission boardwalk along the west bank and Dike Trail	• Construct boardwalk trail along east bank of Steep Creek starting at Boat Dock Trail • Install up to 7 fish viewing overlooks off trail • Connect trail to improved Dike Trail	• Construct boardwalk trail along east bank of Steep Creek starting at Boat Dock Trail • Install up to 4 out-and-back-type fish viewing overlooks off trail • Terminate trail at Glacier Spur Road • Create pedestrian crosswalk at Glacier Spur Road to connect to improved Dike Trail

Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Steep Creek Trail Expansion: Dipper Falls Improvements	User-created trail off of Trail of Time	Elevate 250 feet of Trail of Time and construct viewing blind (500 sq ft)	Same as Alternative 2	Same as Alternative 2
Dredge Lakes Multi-Use Trails	- Network of existing Forest Service trails would receive ongoing maintenance - User-created network of mountain bike and hiking trails would not be maintained	- Network of existing Forest Service trails would receive ongoing maintenance - Improve user-created network of mountain bike/hiking trails	Same as Alternative 2	Same as Alternative 1
Boat Docks and Related Support Facilities: Welcome Center Dock	Non-motorized boat launches allowed from hardened shoreline areas	- Construct floating dock within a constructed inland basin - Dredge as needed to maintain facility	- Construct floating dock - Dredge as needed to maintain facility	Same as Alternative 1
Boat Docks and Related Support Facilities: West Glacier Dock	Non-motorized public and commercial use boat launch near West Glacier Trailhead	- Construct dock at north end of West Glacier Trailhead parking - Create upland storage area and reconfigured parking	- Construct dock between West Glacier Trailhead parking and Skater's Cabin - Create upland storage area and reconfigured parking - Dredge as needed to maintain facility	Same as Alternative 1
Boat Docks and Related Support Facilities: Remote Glacier Dock	Natural, unimproved kayak landing beach	Construct a seasonal floating dock for motorized boats operating under special use permit and non-motorized landing area at one of two possible locations near glacier	Construct landing beach for motorized landing craft operating under special use permit and non-motorized vessels at one of two possible locations near glacier	Same as Alternative 1

Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Boat Docks and Related Support Facilities: Boats	Non-motorized boats only	- Allow 49-passenger capacity boats with alternative fuel or low-emissions motors (Stage V European Emission Standards) - Update in the MGRA Management Plan	- Allow 35-passenger capacity electric powered boats - Update in the MGRA Management Plan	Same as Alternative 1
Remote Glacier Visitor Area	No facilities near glacier	Install seasonal, elevated building modules (600 sq ft) powered by solar electricity with a primitive bathroom facility located on shore near the lake	Install seasonal, elevated building modules (600 sq ft) powered by solar electricity with a primitive bathroom facility located on a small barge on the lake	Same as Alternative 1
West Glacier Unit Trails	- User-created trail over rough terrain - User-created network of mountain bike and hiking trails	- Improve and formalize user-created trail to the glacier - Construct multi-use loop trail connecting to West Glacier Trail - Improve and formalize certain user-created network of mountain bike and hiking trails	Same as Alternative 2	Improve and formalize user-created trail to the glacier
Visitor Capacity and Commercial Use Management	- Visitor Center Unit capacity at 543,000 (2019 Supplemental Information Report [SIR]; 95% commercial use) - West Glacier Unit capacity at 150,000 (2019 SIR; 33% commercial use) - No capacity set for the Dredge Lakes Unit	- Change Visitor Center Unit capacity to 999,000 (projected 30-year growth; 87% commercial use) - Change West Glacier Unit capacity to 249,000 (40% commercial use) - Establish Dredge Lakes Unit capacity as 77,040 (30% commercial use)	- Change Visitor Center Unit capacity to 830,000 (projected 20-year growth; 85% commercial use) - Change West Glacier Unit capacity to 249,000 (40% commercial use) - Establish Dredge Lakes Unit capacity as 77,040 (30% commercial use)	- Change Visitor Center Unit capacity to 752,000 (projected 15-year growth; 85% commercial use) - Change West Glacier Unit capacity to 210,000 (45% commercial use) - No capacity set for the Dredge Lakes Unit

Project Component	Alternative 1: No Action (Existing Conditions)	Alternative 2: Proposed Action (As Modified)	Alternative 3	Alternative 4
Management Unit Boundary and ROS Adjustments	- Existing boundaries and ROS designations to remain - No change in recreation capacity	Adjust management unit boundaries and ROS designations in the MGRA Management Plan	Same as Alternative 2	Adjust Visitor Center Unit boundary to include Moraine Ecology Trail but do not change ROS designations in the MGRA Management Plan
Adaptive Management Plan	Follow current plan for management of commercial use allocations	Use adaptive management plan to implement increases in commercial use allocations as infrastructure is added/improved (Appendix B)	Same as Alternative 2	Same as Alternative 2
Forest Orders	Follow existing Tongass Forest Juneau Ranger District Forest Orders	- Add Forest Orders related to off-leash dog management, non-smoking areas, food consumption areas, use of wheeled devices, and nighttime closures - Update in the MGRA Management Plan	Same as Alternative 2	Same as Alternative 2

Figure 2-1. Map Extents



2.3.1 Alternative 1 – No Action

The No Action Alternative provides a baseline for comparing the effects of the action alternatives. The No Action Alternative is defined as a continuation of current operation and maintenance activities. Under the No Action Alternative, there would be no new infrastructure or improvements to existing infrastructure, no new recreation or wildlife viewing opportunities offered at the MGRA, and no changes to capacity or commercial use management. Installation of culverts or other required drainage structures, grading, removal of outdated infrastructure and materials, vegetation management, and ongoing facilities and trails maintenance would continue to be performed as directed by the Forest Plan.

The 1996 MGRA Management Plan, revised in 2015, establishes overall management direction for the MGRA and defines three geographical areas, or units, based on visitation, each having different management actions (Figure 2-2). The Visitor Center Unit is the primary destination for many visitors to the MGRA and includes the Visitor Center, parking area, and interpretive trails in the immediate area. The Dredge Lakes Unit is only available for independent visitor use (commercial service providers are not permitted to use these trails). This unit encompasses the Dredge Lakes area and trails bounded by Mendenhall Lake to the north, Glacier Spur Road to the east (excluding Steep Creek Trail and part of Moraine Ecology Trail), and Mendenhall River to the west. The West Glacier Unit includes Mendenhall Lake, the areas west and north of the lake, Skater's Cabin, Mendenhall Campground, Mendenhall Glacier, and provides the main non-motorized access to the lake via the West Glacier boat launch and parking area.

The months when tourism, especially cruise ship visitation, is at its peak in Juneau correspond with the highest level of use at the MGRA and is referred to in this document as the “primary use season.” In 2015, the primary use season was estimated to last 153 days from May 1 through September 30. More recently, however, the season has been extended due to earlier and later season ship sailings. A recent public opinion survey that polled Juneau residents regarding tourism and visitor-related impacts reported that 57 percent of respondents report being “very affected” or “somewhat affected” by crowding at Mendenhall Glacier during the summer/primary use season (McKinley Research Group 2021).

The existing Visitor Center parking area is divided into two separate lots and a vehicle turnaround area that provides 60 standard vehicle spaces and 6 bus parking spaces. The two lots equal about 90,000 square feet (sq ft; Figure 2-3). There is a narrow parking area adjacent to Glacier Spur Road that provides 15 standard parking spaces. Additionally, during times of high visitation, visitors often park alongside Glacier Spur Road as there is no parking available in the lots. Several transportation and guiding companies offer transport and tours to the MGRA under special use permits issued by the Forest Service. These companies use the commercial lot located just south of the main parking areas with 140,000 sq ft (3.2 acres) of parking and staging for tour buses and vans, and a snow storage area used by the City and Borough of Juneau (CBJ) in the winter.

A small pavilion, visitor contact station, waiting shelter, and outdoor restroom facility are located just north of the Visitor Center parking area. The pavilion is an open, covered shelter offering views of Mendenhall Glacier, Mendenhall Lake, and the surrounding mountains. The visitor contact station is an orientation and welcome kiosk area for visitors featuring maps and informational signs. The waiting shelter has covered seating designed for 20 people.

The existing Visitor Center is a timber and stone structure featuring expansive views of the lake, glacier, and mountains from the bank of windows facing north on the upper floor of the building. The upper floor also contains an auditorium, interpretive exhibits, a gift shop, and a small indoor restroom facility. The lower floor contains Forest Service offices and staff areas.

There are over 22 miles of trails throughout the MGRA. They are used year-round by Juneau and other Southeast Alaska residents and are often crowded with visitors during the primary use season, especially those trails directly adjacent to the Visitor Center. Trails with the highest density of use are Nugget Falls Trail, Steep Creek Trail, Photo Point Trail, Moraine Ecology Trail, East Glacier Trail, and West Glacier Trail. Particularly popular when bears are active, the Steep Creek Trail is an elevated boardwalk that runs alongside Steep Creek, a salmon fishing location for the MGRA's bear population.



Particularly popular when bears are active, the Steep Creek Trail is an elevated boardwalk that runs alongside Steep Creek, a salmon fishing location for the MGRA's bear population.

In the 1960s, Steep Creek was relocated to accommodate construction of Glacier Spur Road. Over time, due to straightening of the channel and poor culvert connectivity, salmon spawning gravels have washed away, leading to degraded stream substrate and impacts on spawning and rearing habitat. Today, the two existing pipe arch culverts that were installed to convey Steep Creek under Glacier Spur Road are a partial barrier to the efficient migration to all life stages of fish due to a steep gradient in one pipe and perched outfall in the other pipe. The culverts are roughly 8 feet wide by 6 feet high and 90 feet in length; both are undersized for this stream crossing. As a result, they have caused bank scour downstream of the crossing and are impacting fish habitat in the creek. The lack of adequate culvert crossings at this location would be addressed by the Forest Service independently of this action as directed by the Forest Plan (USDA Forest Service 2016, p. 4-11).

On the west side of the MGRA, the Mendenhall Campground contains 7 walk-in campsites for tents, 44 drive-in campsites for automobiles, and 19 drive in campsites for larger recreational vehicles (RVs) along the shoreline of Mendenhall Lake and Mendenhall River (Figure 2-4). Skater's Cabin is a cobble structure located on the lakeshore north and west of the campground.

Inside the cabin there is a stone hearth and woodstove, and outside is a picnic area, large group fire ring, and a ramp to the beach. A parking area for about 30 vehicles is adjacent to the cabin on Skater's Cabin Road. At the end of Skater's Cabin Road, there are two additional parking areas (60 vehicle spaces plus 6 larger spaces for commercial vans or buses) used for access to non-motorized boat launching by guided groups and independent boaters and access to the West Glacier Trailhead. A few guiding companies provide water-based activities on the lake, including kayaking and canoeing, through Forest Service special use permits. The West Glacier Trail leads hikers in the general direction of Mendenhall Glacier and is used to access Mount McGinnis, although over time a well-traveled trail south of the main trail was developed by users to lead more directly to the toe of the glacier where it terminates in Mendenhall Lake (Figure 2-5).

The MGRA Management Plan gives guidance on management objectives, desired future conditions, and implementation strategies for the area, and also sets visitor capacities and guidelines for issuing special use permits for commercial activities, but direction is purposely broad to provide flexibility in responding to future changing uses. Under the No Action Alternative, management of the MGRA and boundaries of the three management units would remain as defined in the 2015 Decision Notice for the MGRA Management Plan Revision and the 2019 MGRA Commercial Capacity Limits Supplemental Information Report (SIR). Visitor capacity would not be increased and the amount of commercial use allocation (via service days) would remain at the current level (Table 2-2). A service day is an allocation of use constituting a day or any part of a day on National Forest System (NFS) lands for which an outfitter, guide, or transporter provides services to a client. Each commercial client that visits the MGRA represents one service day for that vendor. Special use permits are distributed to different commercial service providers, issued as a total number of service days; service days are only allocated to service providers during the primary use season. See Section 3.7.2.1 for further discussion regarding management of capacity, special use permits, and service days.

Table 2-2. Visitor Capacity and Commercial Allocation (Service Days) by Management Unit –Alternative 1

Management Unit	Visitor Capacity ^a	Number of Service Days Allocated to Commercial Use	Designated Commercial Use (Percentage of Capacity)
Visitor Center Unit	543,000	515,850	95%
Dredge Lakes Unit ^b	Not established	0	0%
West Glacier Unit ^c	150,552	55,000	33%

^a The Forest Plan defines recreation capacity as “the number of people that can take advantage of the supply of a recreation opportunity during an established use period without substantially diminishing the quality of the recreation experience or the resources” (p. 7-47).

^b Dredge Lakes Unit's total capacity was not specified in either the 1996 or 2015 Management Plan Revisions.

^c West Glacier Unit numbers include non-motorized boat use on Mendenhall Lake and Mendenhall River and shoreline activities.

Figure 2-2. Management Unit Boundaries – Alternative 1

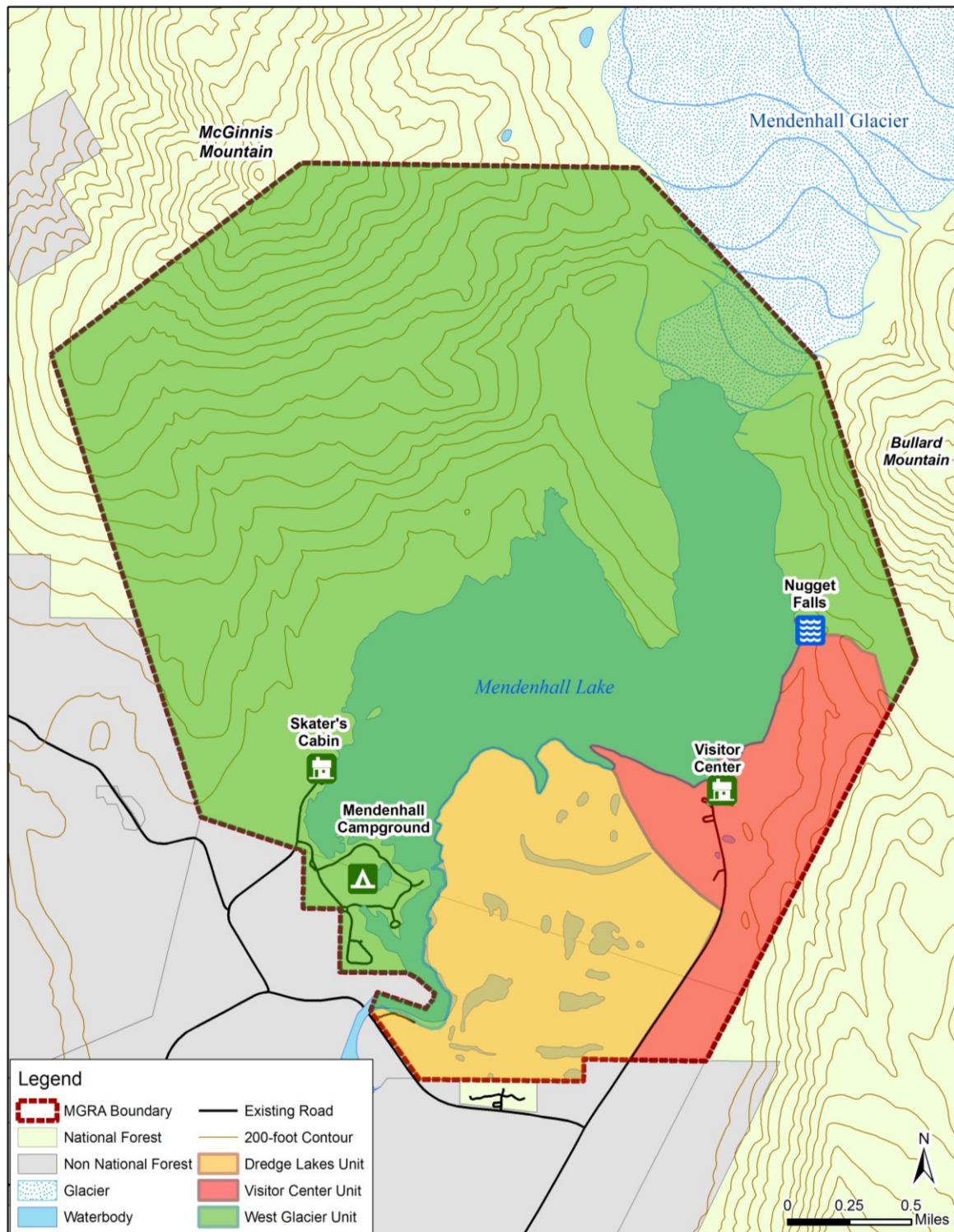


Figure 2-3. MGRA Visitor Center and Dredge Lakes Area - Alternative 1

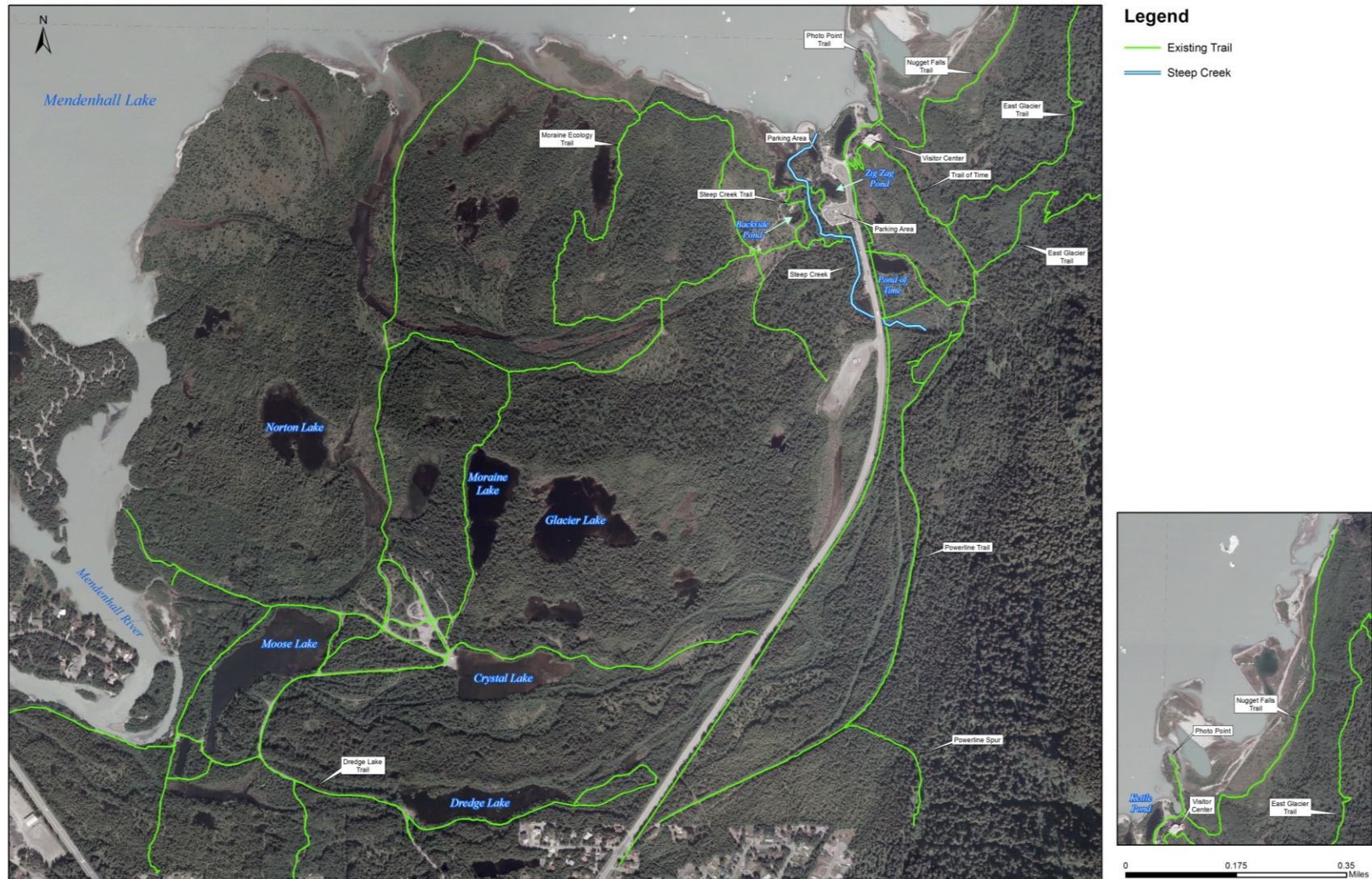
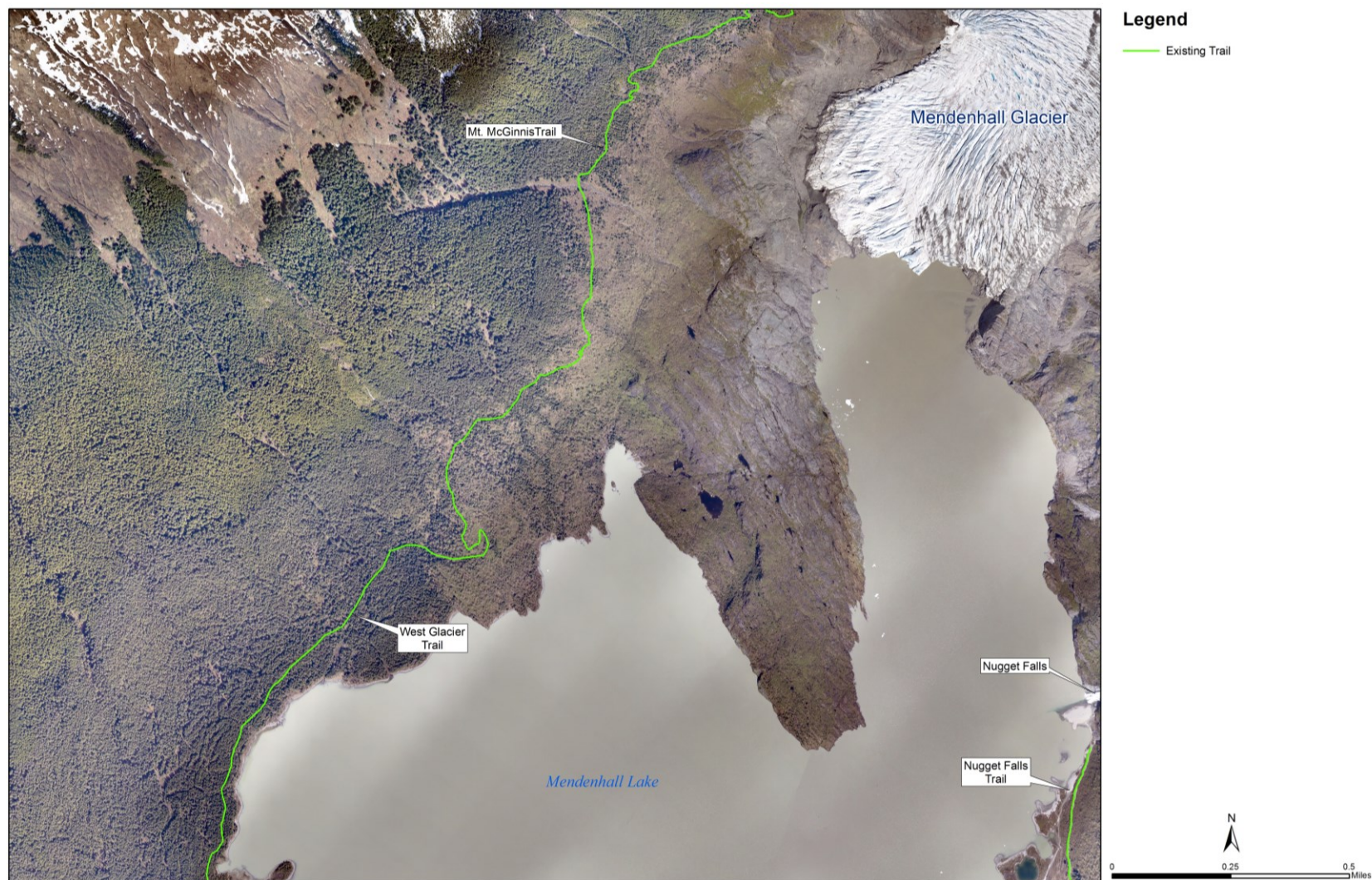


Figure 2-4. MGRA West - Alternative 1



Figure 2-5. MGRA North - Alternative 1



2.3.2 Actions Common to All Action Alternatives

Alternatives 2, 3, and 4 are made up of several individual components, described in Table 2-1. This section presents those components that are identical in all action alternatives. Project components with features unique to each alternative are presented in the individual alternatives' sections (2.3.4, 2.3.5, 2.3.6).

A design package posted to the project website (<https://www.fs.usda.gov/project/?project=53780>) includes schematic diagrams and renderings of many of the components of the action alternatives. Please see the design package to develop a more in-depth understanding of the proposed facilities. Only a few images are included here to help with descriptions of the alternatives.

2.3.2.1 Welcome Center

The existing pavilion and parking area waiting shelter would be removed with most demolition materials reused for new kiosks and unsuitable material disposed of at a permitted landfill location. A new Welcome Center building would serve as a visitor reception hub in the approximate location of the removed pavilion, just north of the Visitor Center parking area (Figure 2-6; Figure 2-7; Figure 2-8; Figure 2-9; Figure 2-10; Figure 2-11; Appendix C). Comments received during scoping led the Forest Service to reduce the size and change the orientation of the Welcome Center building to lessen the impact on the viewshed.

The 14,000-sq ft Welcome Center building would accommodate tour gathering, MGRA orientation programs, administrative use (Forest Service and partner offices), restrooms, food service, retail, and a visitor lounge. A partial basement and a mezzanine would accommodate mechanical and storage needs. The building would be oriented approximately perpendicular to the lakeshore to minimize impacts on views from outside the building across the lake to the glacier. Large floor-to-ceiling windows would offer views overlooking the beaver pond to the west, the glacier to the north, and the existing Visitor Center to the east. A covered outdoor area immediately adjacent to the building would accommodate visitors waiting for transportation. The building would be designed to meet U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver certification. LEED certification is based on sustainable design choices for new building elements such as lighting, heating and ventilation, materials, and construction site management.



Under all action alternatives, a new Welcome Center would serve as a visitor reception hub with restrooms, food service, retail, and a visitor lounge. More details and renderings are available in Appendix C and in the design package posted to the project website (<https://www.fs.usda.gov/project/?project=53780>).

2.3.2.2 Visitor Center Improvements

An exterior wall of the lower floor of the Visitor Center would be moved out by about 200 sq ft under the existing roof overhang and building footprint to increase the Forest Service Office area interior space. The area would receive interior renovations to better support Forest Service staff.

The upper floor of the Visitor Center would be renovated as recommended by the interpretive plan (AldrichPears Associates 2022) to provide an updated interpretive experience. Hands-on exhibits would be added, and the theater space would be redesigned. Renovations to the original observatory portion of the upper floor would help return the experience of the space to the Visitor Center's 1960s character. Additional improvements would be made to the outside railing and trail surface leading up to the Visitor Center to match the proposed Welcome Center Complex hardscape and to provide a safer route for visitors. A new covered area outside the main upper doors would provide shelter from the weather upon entry and exit. To address an existing safety hazard, a canopy-style roof would be added over the Visitor Center outside staircase and two emergency exits. Visitor Center maintenance items would be performed including: 1) heating and ventilation system renovation; 2) envelope improvements to reduce heat loss such as insulation and air sealing upgrades; 3) improvements to the visitor space such as door repair, flooring replacement, plumbing upgrades, interior and exterior painting, lighting replacement, ceiling leak repair, stone masonry repointing, and fire protection upgrades.

The intent from the 2019 Mendenhall Glacier Master Plan (Master Plan) was to expand both the lower and upper floors of the building (USDA Forest Service 2019). After the scoping period, expansion of the Visitor Center building was reduced and limited to only a minor expansion of the lower floor to accommodate increased office space needs of Forest Service staff.

2.3.2.3 Glacier Spur Road Trailheads

Three new paved trailheads would be added alongside Glacier Spur Road to increase safety for pedestrians accessing the Dredge Lakes, Crystal Lake, and Powerline trails (Figure 2-9; Figure 2-10; Figure 2-11). Trailheads would include parking for 12 to 20 vehicles and trailhead kiosks. Minor trail reroutes and grading may be necessary to connect trails to the new parking areas. The proposed location of the Powerline Trailhead was updated after scoping to better coordinate with access to the commercial parking lot across Glacier Spur Road. Details regarding the parking lots include:

- **Dredge Lakes Trailhead** (west side of Glacier Spur Road near where Dredge Lakes Trail approaches the road): approximately 7,000 sq ft with 12 parking spaces.
- **Crystal Lake Trailhead** (west side of Glacier Spur Road near where Crystal Lakes Trail intersects the road): approximately 7,000 sq ft with 12 parking spaces.
- **Powerline Trailhead** (east side of Glacier Spur Road where Powerline Trail meets the road): approximately 10,000 sq ft with 20 parking spaces.

2.3.2.4 Nugget Falls Trail Expansion

This component was added after concerns about crowding along this trail were raised during the early 2020 scoping effort. The main Nugget Falls Trail and the existing user-created trail along the lakeshore would be connected to form a loop trail (Figure 2-9; Figure 2-10; Figure 2-11). The trail extension would be 10 feet wide and about 2,400 feet long.

The lower trail near the lakeshore would be 12 inches above existing grade and constructed to withstand periodic flooding. Two elevated sections, approximately 70 and 100 feet long, would be constructed where the trail crosses sections of Mendenhall Lake.

2.3.2.5 Steep Creek Habitat Restoration

About 1,500 feet of Steep Creek would be realigned, regraded, and restored to provide improved salmon habitat, create space between the proposed parking lot improvements and the creek, and develop an appropriate floodplain with a balanced movement of creek substrates (Figure 2-9; Figure 2-10; Figure 2-11). The new floodplain would be constructed slightly west of its current location. Natural channel features, including pools, riffles, and meanders would be created. Near the stream's outlet into Mendenhall Lake, the stream channel would be relocated 30 to 200 feet west of its current location and regraded to a low gradient of just over 1 percent to facilitate fish movement. A small stream section 300 feet downstream (north) of the existing culverts under Glacier Spur Road would instead be shifted about 30 feet east to take advantage of existing topography. The existing stream channel and ponded area downstream of the road crossing would be abandoned and filled with natural material obtained from excavation of the new stream channel to facilitate proper hydraulic function of the proposed channel. The channel width and depth would be designed to meet optimal natural conditions for Steep Creek. Banks would be constructed to mimic the natural stream bank using native earthen material, rocks, logs, woody vegetation, and vegetative mats.

Revegetation of the relocated floodplain would be designed to generally match existing floodplain characteristics using native vegetation. Under the proposed bridge (described below), to support bridge abutments and retain stream alignment, streambanks would be reinforced with riprap.

Steep Creek Vehicular Bridge

The two existing culverts under Glacier Spur Road would be replaced with a vehicular bridge to improve aquatic organism and wildlife passage (Figure 2-9; Figure 2-10; Figure 2-11). The bridge opening would be designed to accommodate Steep Creek and allow wildlife passage under the road. To achieve the needed bridge height and width, the side slopes of Glacier Spur Road would need to be widened north and south of the bridge. The bridge would be 80 feet long, sized to accommodate creek bank full width of 18 feet, modeled 100-year flood flows plus debris and bed load. The bridge deck would be 50 feet wide to accommodate two driving lanes, shoulders, and a 10-foot separated walkway on the east side of the road.

As currently designed, the bridge would not include any piers, and any abutments would be set above the creek's ordinary high-water mark. Because Glacier Spur Road is owned and managed by the State of Alaska Department of Transportation and Public Facilities (DOT&PF), close coordination on final design and permitting of the new bridge will be required prior to implementation.

Backside Pond Improvements

Improvements to Backside Pond were added after the scoping period to mitigate for impacts to fish habitat from other project components by providing additional anadromous fish habitat (Figure 2-9; Figure 2-10; Figure 2-11).

Backside Pond on the west side of Glacier Spur Road would be enlarged and a 30-foot-long, 4-foot-wide stream channel would be constructed to create a seasonal connection between the pond and Steep Creek and provide new Coho Salmon over-wintering and rearing habitat. The connection profile would be graded to a level set to flow when the pond and/or Steep Creek channel water surface are elevated. Banks would be constructed to mimic the natural stream bank using native earthen material, rocks, logs, woody vegetation, and vegetative mats. This habitat enlargement would be intended to act as mitigation for project impacts to wetlands.

2.3.2.6 Public Use Cabins

This project component was added after the early 2020 scoping period to provide a desired recreation experience. Up to five new public use cabins would be built in the Mendenhall Campground (Figure 2-12; Figure 2-13; Figure 2-14). These dry¹ Forest Service cabins would include a wood stove, bed platforms, and a small counter and table. No vegetation clearing or ground leveling would be required for Cabins A, B, C, or D. The proposed sites are as follows:

- Cabin A (840 sq ft) would be placed at existing campsite 70 (host site) near the campground entrance and information board. This would make it possible to have hosts with or without an RV. There would be a reception area in front to greet visitors. The cabin could be used as a public use cabin during the winter months (November through March).
- Cabin B (600 sq ft) would replace existing campsite 2.
- Cabin C (600 sq ft) would augment or replace existing campsite 15.
- Cabin D (600 sq ft) would augment or replace existing campsite 21.

¹ "Dry" indicates no water or sewer at the site or in the cabin.

- Cabin E (600 sq ft) would be a new campsite located near the information board, parking, and restrooms in the RV loop. Development of this campsite would require clearing about 2,400 sq ft of vegetation and ground leveling.

2.3.2.7 Associated Actions Common to All Action Alternatives

In addition to the project components mentioned above, the following actions would be included as a part of each action alternative.

A plan to incorporate adaptive management into all action alternatives to moderate increases in permitted special use service days has been developed and is described below in Section 2.4.3 and Appendix B: Commercial Use Allocations and Adaptive Management for Commercial Outfitter, Guide, Transportation, and Other Services.

The 1996 MGRA Management Plan, revised in 2015, is being updated through the analysis presented in this draft EIS. The MGRA Management Plan provides management direction for the recreation area and is reviewed and updated periodically (supported by NEPA analysis) as changes in recreation use volumes or patterns arise. An updated version of the MGRA Management Plan would be finalized if the Record of Decision (ROD) signed for this project selects an action alternative and may be updated multiple times as the different project elements are implemented into the future.

Several Forest Orders would be included in the updates to the MGRA Management Plan if an action alternative is selected. Forest Orders describe prohibitions that close or restrict entry or use of specific areas of the forest for safety or resource protection. Proposed Forest Orders for the MGRA include:

- Prohibition of all dogs on Steep Creek boardwalk to further reduce conflicts between bears, humans, and pets. There is currently a leash requirement throughout the MGRA, but this order would increase security in a high use area for bears.
- Prohibition of food consumption or open beverage containers in parking lots, sidewalks, and certain trails in the Visitor Center Unit (Photo Point Loop, Moraine Ecology, Trail of Time, and Steep Creek). In the Visitor Center Unit, food and beverages other than water would only be allowed in the Welcome Center and inside the Visitor Center.
- Prohibition of riding wheeled devices such as bikes, electric bikes, skateboards, and roller skates on sidewalks and plazas in the Visitor Center unit and on the Steep Creek boardwalk, from April 1 to October 31 each year to minimize disturbance to wildlife and conflict among users. Wheeled devices can be walked in these areas.
- Closure of all MGRA recreation areas including the Skater's Cabin from 12 a.m. (midnight) to 6 a.m. each day, except for visitors using the overnight areas of the Mendenhall Campground. This special closure would extend the default closure of Forest Service recreation areas from 10 p.m. to 12 a.m. (midnight).
- Prohibition of smoking in any area within the Visitor Center Unit except for designated smoking areas. Designated smoking areas are provided adjacent to each major parking lot.

A new interpretive plan has been developed to serve as a blueprint to guide interpretation and education opportunities at the MGRA. The plan includes updated educational exhibits, wayfinding signage, benches, covered shelters, and discovery 'nodes' geared towards children's education to be located throughout the MGRA. Some interpretive elements have been developed

as mitigation for impacts to heritage resources. Installation of interpretive elements are considered in the analysis presented in this draft EIS.

Installation of culverts or other required drainage structures, grading, removal of outdated infrastructure and materials, vegetation management to preserve views, revegetation, and ongoing facilities and trails maintenance would be required for each action alternative.

Trail Management Objectives that define the allowable types of use and maintenance levels for trails will be established for new trails and may be adjusted for existing trails throughout the MGRA project area.

2.3.3 Actions Common to Alternatives 2 and 3

Project components that are identical in Alternatives 2 and 3 only are described below.

2.3.3.1 Welcome Center Complex

A concrete plaza area and a network of connecting walkways would be constructed adjacent to the Welcome Center, parking area, and existing Visitor Center (Figure 2-6; Figure 2-7; Figure 2-9; Figure 2-10). A 20,000-sq ft (slightly smaller in Alternative 3, see Table 2-1) arrival and wayfinding area would be constructed immediately north of the parking area to help orient visitors. The arrival and wayfinding area would be the first stop for many visitors and lead to the rest of the Welcome Center Complex. Serving as an outdoor orientation and interpretation area with connections between the Welcome Center, Visitor Center, and other buildings and to nearby trails, the Welcome Center Complex would include several components as described below.

Crescent Bridge

A 260-foot-long crescent-shaped pedestrian bridge and overlook across Kettle Pond would link the Welcome Center to the Visitor Center's existing access walkway and offer views of Mendenhall Lake and Glacier (Figure 2-6; Figure 2-7; Figure 2-9; Figure 2-10). The bridge would be elevated above the estimated glacial lake outburst flood level to avoid and minimize piles within the water and obstructions to flood flow.

Interpretive Plaza

A 5,000-sq ft interpretive plaza area with an upper area and lower area would be constructed to the north of the Visitor Center (Figure 2-9; Figure 2-10). The existing underground storage area would be decommissioned to be replaced by a 50-person amphitheater that would be partially sheltered by a grassy roof and recessed into the existing topography to limit the views of the structure from the Visitor Center. Interpretive elements constructed from natural materials, including wood and glacial erratics (large rocks transported by the glacier and left behind when it retreated), would be located at the perimeter of this plaza.

Welcome Center Complex Trails

Trails in the Welcome Center Complex would vary between 6 and 14 feet wide. Bear fencing could be installed on at-grade trail areas near Steep Creek as needed to reduce bear/visitor interaction and to keep visitors on trails.

Wayfinding and interpretive signs would be installed throughout the Welcome Center Complex as guided by the interpretive plan (AldrichPears Associates 2022). Hardscape trails would be added or improved within the Welcome Center Complex. Walkway ramps would lead down to the existing Steep Creek Trail boardwalk, and another would lead down towards the lakeshore from the Welcome Center.

Photo Point Trail

Photo Point Trail would be lengthened to form a loop back to the Welcome Center interpretive plaza, consisting of at-grade and elevated segments (Figure 2-9; Figure 2-10). A short, elevated segment would be constructed to cross over Mendenhall Lake and connect to the lower plaza area in front of the Visitor Center. In response to public comments about bear movements, the alignment was shifted to the west along the lakeshore instead of over the top of the peninsula to avoid an area frequented by bears.

2.3.3.2 Dredge Lakes Multi-Use Trails

In response to requests made via public comments, several trails in the Dredge Lakes Unit are proposed to be upgraded and designated as NFS multi-use trails (Figure 2-9; Figure 2-10). Approximately 35,000 linear feet (6.6 miles) of existing user-created primitive trails would be improved to achieve NFS standards. Generally, trail improvements would involve minimal vegetation removal and maintenance such as minor widening, drainage improvements, and replacement of existing bridges to create trails between 2 and 4 feet wide that could be used for a variety of year-round uses. Most of the existing user-created trails in the Dredge Lakes Unit would be designated as NFS trails. A small number of existing user-created trails on the western portion of the management unit would be decommissioned due to drainage and flooding issues, and areas would be restored to a more natural and stable condition in degraded locations. Around 33,000 linear feet (6.25 miles) of existing NFS trails in the Dredge Lakes Unit would undergo general maintenance.

A new trail connection would be constructed between the proposed trailheads along Glacier Spur Road and the commercial overflow parking lot (also described below as part of the Dredge Lakes Outer Loop, Section 2.3.4.2). Short trail segments from the commercial overflow parking lot and the Powerline Trailhead would connect the Dredge Lakes trail network with trails on the east side of Glacier Spur Road.

2.3.3.3 Remote Glacier Visitor Area

A modular and movable visitor area focused on education and science would be developed near the glacier on the north side of Mendenhall Lake (Figure 2-15; Figure 2-16). The station would be accessed by boat or via the proposed new West Glacier Spur Trail (described below in Section 2.3.3.4).

An 8-foot-wide accessible gravel trail would be constructed connecting the proposed Remote Glacier Dock to the glacier facilities and the proposed West Glacier Spur Trail. This trail would be extended as the glacier retreats. The trail would be constructed to withstand periodic Forest Service All-Terrain Vehicle use for maintenance and facilities movement. In addition, similar 8-foot-wide trails would be built to access features of the changing landscape. A 50-foot-long paved surface bridge would be installed across a large drainage between the Remote Glacier Dock and the Remote Glacier Visitor Area.

Four to six seasonal, relocatable building modules (up to 600 sq ft each) would be installed near the glacier in an area not visible from the Visitor Center or new Welcome Center. An elevated platform structure would serve as a base for the modules. The elevated platform would be supported by a pile foundation secured in place by rock anchors. The building modules would be removed annually during the winter months but the platform would remain in place year-round.

The station, including the relocatable modules and platform, would be relocated to follow the glacier as it recedes. There would be minimal trace of building structures after relocation by simply unbolting the foundation piles from the rock anchor stubs. It is expected that the station would move every 5 to 10 years, depending on glacier recession rates. Solar electrical service would be provided for the facility. A primitive bathroom facility would be located on shore near the lake (Alternative 2) or on a small, anchored barge located near shore by the vessel landing area (Alternative 3). On-shore facilities would be serviced by pumping waste into holding tanks on a boat and transporting it to the West Glacier Dock at a frequency to be determined based on use. The barge would be moved to the West Glacier Dock to have septic holding tanks pumped out by truck. Facilities would be maintained in accordance with Federal, State, and local regulations and direction given by Forest Service policy related to solid waste to reduce risks of contamination during operations and use.

2.3.3.4 West Glacier Unit Trails

West Glacier Spur Trail

A new West Glacier Spur Trail would connect the Remote Glacier Visitor Area to the existing West Glacier Trail to allow safer access by foot and create a loop option (Figure 2-15; Figure 2-16). The existing user-created trail from West Glacier Trail to the glacier would be upgraded and realigned, including construction of a 50-foot-long bridge. All sections of the trail, except for the new bridge, would be constructed at grade. Portions of the trail would require rock work (including potential blasting in places).

Multi-Use Trails

A new 9,000-foot-long (1.7 mile) trail would be constructed to create multi-use West Glacier High and Low Loops in combination with the first portion of the West Glacier Trail. These would be groomed in the winter as conditions allow. Additionally, some existing user-created mountain bike and hiking trails in the West Glacier Unit would receive improvements to achieve Forest Service trail standards and would be designated as NFS trails (Figure 2-12; Figure 2-13). This component was introduced after scoping in response to requests by public commenters.

2.3.3.5 Management Unit Boundary and Recreation Opportunity Spectrum Adjustments

Management unit boundaries would be adjusted to combine similar activities and facilities proposed under this alternative. The Visitor Center Unit would be expanded to include Mendenhall Lake, portions of the shoreline on both the north and south lake shores, and Moraine Ecology Trail. These adjustments are shown in Figure 2-18. Recreation Opportunity Spectrum (ROS) designation would be changed for certain recreation features at the MGRA. The Forest Service ROS is a descriptive system used to portray user experience and is based on several factors (see Chapter 3; Section 3.7.2.1). Adjustments to the ROS for certain facilities would be made as part of this project to better describe existing and expected user experiences (see Appendix A). The 1996 (revised in 2015) MGRA Management Plan would be updated after a final decision on this project to incorporate new information regarding management unit boundaries and ROS designations.

2.3.4 Alternative 2 –Proposed Action (as modified)

This alternative was developed and modified to meet the purpose and need as described in Chapter 1, including to continue to provide quality opportunities for all visitors to enjoy the

recreation area, to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, to meet the demand of the visitor industry and support the economy of Southeast Alaska, and to protect the area from environmental impacts associated with increased visitation. In addition to the components described above in Sections 2.3.2 and 2.3.3, the following would be implemented under Alternative 2.

2.3.4.1 Parking and Access Expansion

Main Parking Lot

The two existing parking areas nearest to the Visitor Center would be combined to provide a total of about 142,000 sq ft (3.25 acres) of parking and pedestrian sidewalks (Figure 2-6; Figure 2-9). The new layout would create separation between commercial and private vehicles, offering 84 passenger vehicle parking spaces, 7 for-hire/taxi/rideshare² spaces, and 13 bus pick-up/drop-off spaces. The proposed combination would eliminate the 20,000-sq ft anadromous kettle pond between the two parking lots (Zig Zag Pond) to accommodate increased parking capacity. After the scoping period, design of the bus pick-up/drop-off spaces was modified to reduce the angle of entry into each space, allowing for exiting without needing to reverse from any of the drop-off or pick-up spaces, increasing safety while reducing the need for back-up alarms, and helping to minimize parking lot noise.

² "Rideshare" refers to transportation services that match passengers with vehicle drivers via websites or mobile apps. Permitting for these services is currently being analyzed in a separate action (Alaska Region Supplement to Forest Service Manual 2720: Special Uses; Outfitting and Guiding Permit for Strictly Point-To-Point Commercial Transportation to, From, and Within the Mendenhall Glacier Visitor Center Subunit of the Mendenhall Glacier Recreation Area).

Figure 2-6. Schematic Design for Visitor Center Parking – Alternative 2

See design package posted on the project website for more detail. The two existing parking areas nearest to the Visitor Center would be combined to create separation between commercial and private vehicles. This parking configuration would fill Zigzag Pond.

Commercial Overflow Parking Lot

The existing 140,000-sq ft (3.2-acre) gravel “bus overflow” lot about one-quarter mile south of the main parking area would be reconfigured and two-thirds of the lot (90,000 sq ft or 2.1 acres) would be paved to provide commercial parking and staging as well as overflow parking (Figure 2-9). Access to the parking lot off Glacier Spur Road would be shifted to the south to accommodate the proposed Steep Creek Bridge (Section 2.3.2.5). The paved overflow and staging area would contain 20 van spaces, 60 bus staging spaces, a 2,000-sq ft maintenance building, and a portable toilet. The existing 50,000-sq ft snow storage area would remain gravel and continue to be used as a snow storage space by the CBJ. While the existing remote-control airstrip area would be altered by paving, use of the lot by aeromodellers would be accommodated within the newly paved area, subject to terms and conditions in their special use permit with the Forest Service. Trailhead kiosks and wayfinding signs would be added at various locations, and

some existing trails would be realigned and connections updated (e.g., to Moraine Ecology Trail) to improve flow.

2.3.4.2 Lakeshore Trail

A new, approximately 2.4-mile-long trail would be constructed along the south shore of Mendenhall Lake to link existing and proposed trails and become part of a recreational loop around the Dredge Lakes Unit (Figure 2-9; Figure 2-12). Beginning at Photo Point Trail, the trail would connect the Welcome Center Complex across the north section of the Dredge Lakes area to the Mendenhall Campground via a pedestrian bridge across the Mendenhall River to end at Skater's Cabin Road.

Lakeshore Trail

The Lakeshore Trail and additions/extensions to existing trails would include at-grade and elevated segments. Around 5,800 feet (about half the length) of the trail along the lakeshore would be placed on fill. The trail surface would be up to 5 feet above the ground, 14 feet wide, and paved. Along the lakeshore, the trail would cross through areas that experience flooding and a number of unnamed drainages that flow into Mendenhall Lake. It is expected that about 1,800 feet of the trail would be elevated up to 8 feet above grade on 18-inch-diameter piles spaced approximately 20 feet apart where flooding is expected or where drainages are more than about 50 feet wide.

Smaller (6-foot-wide) at-grade gravel spur trails totaling about 1,800 linear feet would branch off the main trail at 4 locations to access scenic locations at the lakeshore, inland lakes, Mendenhall River, or to connect to other trails. These gravel spur trails would be an average of 12 inches above grade.

On the west side of Mendenhall River, the trail would continue for about 3,950 feet through Mendenhall Campground (included in the 2.4-mile total length listed above) and the width would be reduced to 8 feet wide at grade. The west end of the trail would terminate at Skater's Cabin Road.

Lakeshore Trail Bridge

A pedestrian bridge would be constructed across the Mendenhall River near the outlet of the lake and the campground to provide a connection between the MGRA's eastern and western trail systems. The single-span bridge would be about 14 feet wide by about 340 feet long and supported by concrete piers (Figure 2-12).

The bridge would be designed to accommodate the Federal Emergency Management Agency (FEMA) 100-year flood elevation to avoid or minimize obstructions to stream flow, including floating debris and bedload. The bridge would be designed to meet navigability requirements of the U.S. Coast Guard.

Campground Changes

To allow access to the west end of the Lakeshore Trail, an 18,000-sq ft parking lot and trailhead would be constructed within the Mendenhall Campground in the location of walk-in tent sites 23 through 29, near the existing campground restroom (Figure 2-12). The parking lot would provide 30 day-use spaces for users to access either the west or east side of the MGRA. Two existing drive-in campsites (sites 31 and 32) would be abandoned to accommodate the trail route. Several campsites would be considered for conversion from tent sites to day-use picnic sites, and new day-use picnic sites could be added near the trail and parking lot.

Dredge Lakes Outer Loop

Extensions and realignments to existing trails would connect currently disconnected trail segments which, when combined with the Lakeshore Trail, create a complete recreational loop around the Dredge Lakes Unit (Figure 2-9). The Dredge Lakes Outer Loop includes:

- **Moose Lake Connector:** A trail running north-south along the east side of Mendenhall River would be constructed from Lakeshore Trail to Moose Lake. It would be a 12-foot-wide gravel trail and would be located partially within the FEMA-designated floodplain. The entire trail would be designed to accommodate flooding and full immersion.
- **Trailhead Connector:** A new trail paralleling Glacier Spur Road would be constructed to connect the Crystal Lake Trailhead and Dredge Lakes Trailhead. This trail is also described as part of the Dredge Lakes Multi-Use Trails in Section 2.3.3.2.
- **Boat Dock Trail:** A trail connecting the commercial overflow parking lot to the proposed Welcome Center Dock would be constructed at-grade and paved.

2.3.4.3 Steep Creek Trail Expansion

The Steep Creek Trail would be realigned and extended (Figure 2-9). The trail would start at the shore of Mendenhall Lake on the west side of Meadow Pond with a connection to Lakeshore Trail, cross to the east side of Steep Creek, then continue up the creek and cross under Glacier Spur Road to join with Trail of Time near Dipper Falls. To provide bears and other wildlife improved access to Steep Creek and reduce the potential for adverse human/bear interactions, the new trail would mostly follow the east bank of the creek rather than creating a loop encompassing both the east and west banks. The existing trail portion west of Steep Creek would be removed or realigned. A pedestrian ramp would provide access from the Glacier Spur Road sidewalk at the bridge crossing to the Steep Creek Trail. The existing Dike Trail between the Trail of Time and Glacier Spur Road would be decommissioned.

Up to eight fish and wildlife viewing overlooks would be added along the length of the boardwalk trail. The overlooks would extend a few feet over the creek at some locations, but most would be located at the edge of the streambank and about 3 feet above the creek. Measuring about 700 sq ft each, the overlooks would accommodate around 60 people without interrupting circulation.

Wildlife and Pedestrian Underpass

Steep Creek Trail would cross under Glacier Spur Road on the north side of Steep Creek (Figure 2-9). A barrier would be installed along the length of the underpass along the pedestrian side to reduce potential for negative human-bear interactions. The south bank of Steep Creek under the bridge would be kept clear for wildlife passage.

Dipper Falls Viewing Area

A popular nature viewing spot near Dipper Falls currently lacks a developed approach, which leads visitors to create their own trails that damage the area (Figure 2-9). An elevated spur trail and cleared viewing area would be constructed off the Trail of Time near the intersection with Steep Creek boardwalk to provide an improved fish and wildlife viewing opportunity. Approximately 300 feet of the Trail of Time would be rebuilt as elevated trail to improve wildlife passage and mitigate existing erosion and steep embankment challenges. An observation platform with a 500-sq ft wildlife viewing blind would be constructed near the creek to allow observing and photography. The Dipper Falls viewing area was added after the scoping period to address Forest Service concerns about erosion at this heavily-travelled area.

2.3.4.4 Boat Docks and Related Support Facilities

Three separate boat docks would be installed on Mendenhall Lake:

- **Welcome Center Dock** (south shore near the proposed Welcome Center);
- **West Glacier Dock** (west shore near the existing kayak launch); and
- **Remote Glacier Dock** (north shore near the proposed remote visitor facilities at the glacier).

All docks would be in a minimum water depth of 8 feet to allow the design vessels 4 feet under keel clearance at low water, and the floats would be composed of modular steel pontoons and framing members with either timber or concrete decking, to be determined during development of final design. All three locations would feature floating docks. The floats would be designed to be removed in the winter, but all anchor piles would stay in place, and gangways would remain but be lifted out of the water. Because anchor piles will remain in place, they would be designed to resist ice loads. Commercial (guided) motorized boats would be allowed on the lake under the terms of special use permits. Specific details for all docks are provided below.

Welcome Center Dock

The seasonal Welcome Center Dock would be accessed from Lakeshore Trail on the south shore of Mendenhall Lake west of the Visitor Center and the Welcome Center (Figure 2-9). The dock would consist of a 10-foot-wide, 40-foot-long modular float unit and would accommodate up to two 50-foot vessels with the possibility of expansion to meet future demands. A passenger waiting shelter located on an associated pad would be connected to water and electrical service. In addition, power would be provided to floats.

Shoreline excavation and dredging would be used to create a partial inland basin and locate the float close to shore. An area of shoreline would be excavated and dredged to create a cove area with a depth of 8 feet below low water level to achieve appropriate depth for the dock. Periodic maintenance dredging within the basin would likely be required to maintain appropriate water depth.

West Glacier Dock and West Glacier Parking Improvements

A permanent boat launch ramp with an associated seasonal loading dock would be constructed on the west shore to provide vessel launch and retrieval (Figure 2-12). The launch would be available for public non-motorized vessel launching when not in use by commercial service providers.

The boat launch ramp would consist of a 16-foot-wide and 120-foot-long concrete driveway. The ramp would extend at a 12 percent downslope to the bottom of the lake to a depth of 8 feet during low water and 9 to 14 feet during a typical summer. An 8-foot-wide, 120-foot-long pile-supported removable seasonal float would be constructed adjacent to the ramp to assist with vessel launching.

The dock would be located adjacent to the northeast end of the existing West Glacier Trailhead parking area, which would be reconfigured to accommodate dock access and a turnaround area. An 8-foot-tall, fenced seasonal storage area would be added within an existing disturbed area on the west side of the existing parking area to provide secure winter storage for docks, temporary remote facility infrastructure, or other seasonal needs.

Remote Glacier Dock

An 80-foot-long by 8-foot-wide seasonal floating dock would be installed to accommodate the unloading/offloading and berthing near the glacier on the north side of Mendenhall Lake (Figure 2-15). The floating dock would be made up of two 40-foot-long floats connected in series and attached to a concrete abutment installed on the beach. The transfer float (shoreside) would be designed to be grounded during low water. The loading float (waterside) would be secured by removable anchors and chains. Two potential locations near the glacier would be analyzed for this dock. A south dock location would be about 4,100 feet and a north location would be about 150 feet from the terminal end of the glacier (as of summer 2020), respectively (Figure 2-15).

Primitive bathroom facilities would be available on shore. Facilities would be serviced by pumping waste into holding tanks on a boat and transporting it to the West Glacier Dock at a frequency to be determined based on use.

In addition to the constructed dock, landing craft vessels and non-motorized vessels could land on existing gravel beach area on the northwest side of Mendenhall Lake. All sharp underwater bedrock outcroppings in front of the landing area would be removed. As the glacier recedes, the landing area and floating dock could be relocated to newly-uncovered beaches closer to the glacier.

Motorized Boats

It is expected that day-use vessels with capacity for up to 49 passengers would be authorized for use by permitted commercial guides on the lake. Boat speed will be limited to reduce wake and avoid measurable shore erosion and wildlife disturbance.

The vessels would be powered by alternative energy fuel sources or have low-emissions motors. The proposed vessel emissions would meet the requirements of Stage V European Emission standards, which are more stringent than current Environmental Protection Agency (EPA) standards. These standards set stricter limits on emissions of particulate matter, carbon monoxide, hydrocarbons, and nitrogen oxides from non-road engines (Regulation [European Union] 2016/1628 of the European Parliament and of the Council of 14 September 2016).

No on-site fuel storage would be allowed; fueling would occur as needed from the commercial boat operator's fuel truck at the West Glacier Dock. Spill prevention equipment and response procedures would need to meet all applicable local, State, and Federal requirements. If electric vessels are used, they could be recharged at the Welcome Center Dock, either directly from service lines or via onshore batteries.

The Forest Service would require the design and operation of passenger vessels to meet U.S. Coast Guard (USCG) requirements. The USCG requires all commercial vessels transporting over 6 passengers to meet the provisions of 46 Code of Federal Regulations (CFR) Subchapter T – Small Passenger Vessels (under 100 gross tons). This includes a review of the vessel design and an approved, well-defined travel route and operations plan.

Any guided use would be authorized under the special uses process and would have to be within the visitor capacity established in this analysis and decision (see Section 2.3.4.5, Visitor Capacity, below).

2.3.4.5 Visitor Capacity and Commercial Use Management Changes

To respond to the project's purpose and need, the proposed infrastructure improvements would increase the overall visitor capacity for the Visitor Center Unit from 543,000 to an estimated

999,000 annual visitors to meet expected demand over the next 30 years. Average Juneau tourist visitation is anticipated to increase 2 to 4 percent annually (McDowell Group 2017; USDA Forest Service 2019). Therefore, capacity for the Visitor Center Unit is based on a projected 2 percent annual growth in visitation over 30 years with 2019 actual visitation as starting point. Adjustments to specific trails, sites, or facilities is based on existing and proposed use, including review of existing monitoring data and a projection of future growth.

Additionally, as cruise ship sailings have been occurring earlier and later in the year in Southeast Alaska, the primary use season at the MGRA now spans 214 days, from April 1 through October 31. An increase in commercial service days reflects this longer season. Table 2-3 below shows proposed capacity increases and number of service days allocated to commercial use by management unit. Motorized boat use would be set at 214,000 service days annually and is included in the number of service days for the Visitor Center Unit. A detailed analysis of visitor capacity for MGRA places that support commercial use is presented in Appendix A.

Table 2-3. Visitor Capacity and Commercial Allocation (Service Days) by Management Unit – Alternative 2

Management Unit	Visitor Capacity ^a	Number of Service Days Allocated to Commercial Use	Designated Commercial Use (Percentage of Capacity)
Visitor Center Unit ^b	999,000	869,130	87%
Dredge Lakes Unit ^c	77,040	23,110	33%
West Glacier Unit ^d	249,000	99,600	40%

^a The Forest Plan defines recreation capacity as “the number of people that can take advantage of the supply of a recreation opportunity during an established use period without substantially diminishing the quality of the recreation experience or the resources” (p. 7-47).

^b Includes commercial motorized boat use on Mendenhall Lake.

^c Total capacity was not specified for Dredge Lakes Unit in either the 1996 or 2015 Management Plan Revisions, but this document proposes commercial use for this management unit. The proposed capacity is based on the Dredge Lakes Outer Loop only and does not reflect capacity for the trail network inside the management unit, which would remain excluded from commercial use.

^d Includes non-motorized boat use on Mendenhall Lake and Mendenhall River and shoreline activities.

If an action alternative is selected, the ROD for this project will determine (based on the alternative selected) the percentage of capacity that would be allocated to commercial and non-commercial users in each management unit. As a result, commercial use may be allocated on specific trails or in units where it is not currently allowed. The percentage of commercial use at the MGRA exceeds the 50 percent guideline included in the Forest Plan Recreation and Tourism Standards and Guidelines (USDA Forest Service 2016, p. 4-44). However, the Forest Plan states that different allocations may be considered for Special Interest Areas based on historical use and changing demands, and the Forest Service should set commercial use allocation percentages based on an area’s specific management plan. MGRA has historically had commercial use allocations over 50 percent, and in the Visitor Center Unit, it is close to 90 percent. Under Alternative 2, commercial use allocations on most trails would remain under the 50 percent guideline.

The 1996 (revised in 2015) MGRA Management Plan would be updated after a final decision on this project to incorporate new information regarding visitor capacity and commercial allocation.

2.3.5 Alternative 3

Alternative 3 was developed in response to the issues identified in Chapter 1 related to wildlife and vegetation (issue 1); recreation and visitor experience (issue 2); watersheds, wetlands, and aquatic habitat (issue 3); air quality (issue 4); and climate change and greenhouse gas emissions (issue 5). It incorporates infrastructure development based on expected increase in visitation using 20-year projections. In addition to those facilities in Sections 2.3.2 and 2.3.3, the following sections list facilities or parts of facilities that would be implemented or eliminated under this alternative.

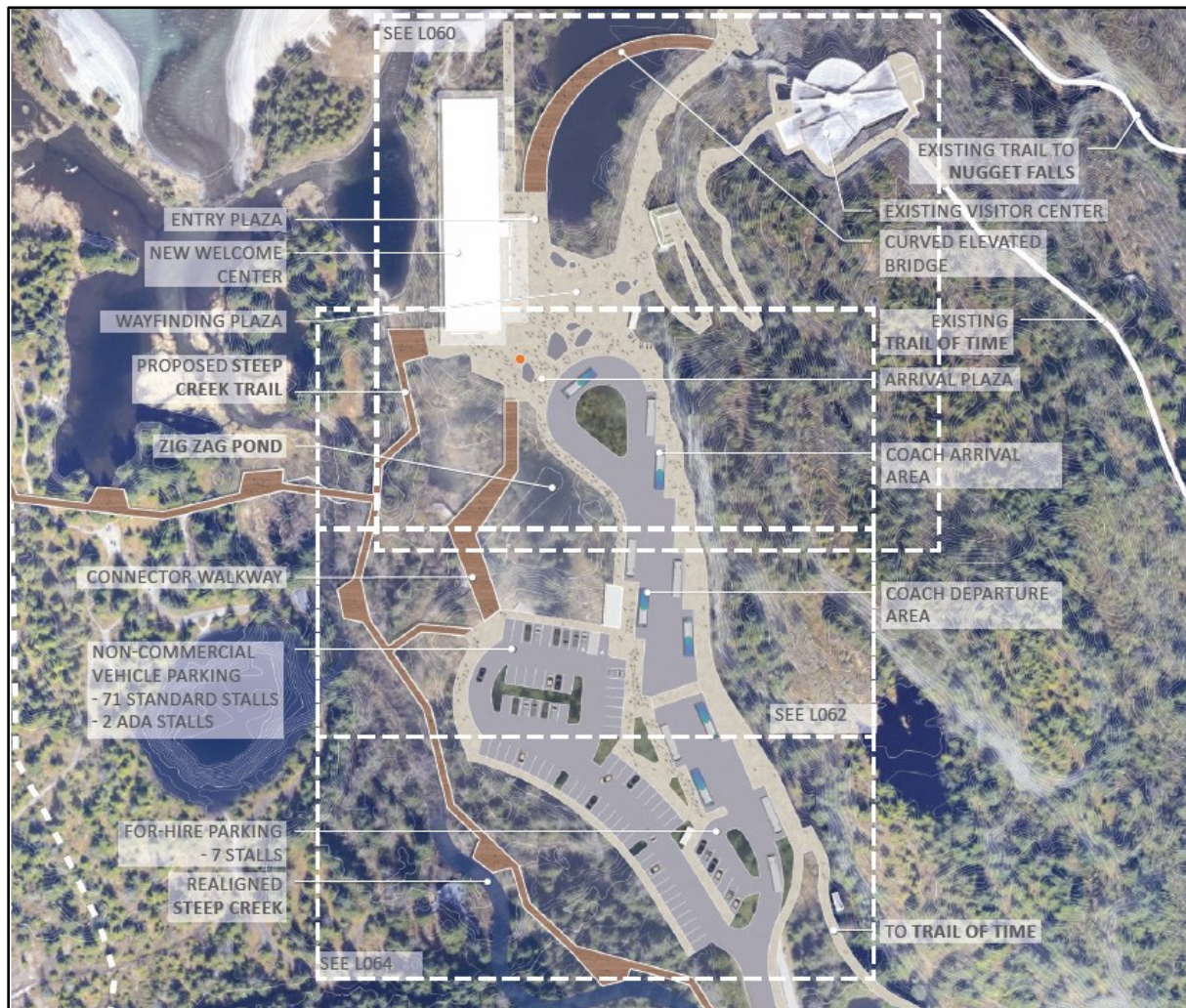
2.3.5.1 Parking and Access Expansion

Alternative 3 would combine the two existing parking areas near the Visitor Center in a different configuration to create a smaller, 118,000-sq ft (2.7 acre) parking area with separation between commercial and private vehicles (Figure 2-10). The size of the parking area would be based on the 20-year demand estimate of 74 passenger vehicle parking spaces, 7 for-hire/taxi/rideshare spaces, and 13 bus drop-off/pick-up spaces. Fill within Zig Zag Pond would be limited to 2,500 sq ft (Figure 2-7). Other features include:

- A 240-foot-long, 14- to 20-foot-wide elevated boardwalk would connect the private vehicle parking area directly to the Welcome Center Complex overtop of Zig Zag Pond.
- Bus parking would be located to the east side of the parking area to move buses away from Steep Creek.

The commercial overflow parking lot and trail additions and reroutes intersecting this lot would match Alternative 2.

Figure 2-7. Schematic Design for Visitor Center Parking - Alternative 3



See design package posted on the project website for more detail. This configuration would create separation between commercial and private vehicles while filling only a small portion of Zigzag Pond. An elevated boardwalk over the pond would connect the private vehicle parking area directly to the Welcome Center Complex.

2.3.5.2 Lakeshore Trail

To address concerns regarding bird nesting areas along the lakeshore (issue 1) and visibility of the trail (issue 2) from other areas of the MGRA, about 1 mile of Lakeshore Trail's alignment east of Mendenhall River would be routed approximately 400 feet inland from the shore rather than being located directly on the lakeshore (Figure 2-10). The trail would begin at the Welcome Center Dock and would not connect with Photo Point Trail in front of the Visitor Center. The trail would be about 2.2 miles long and 14 feet wide and would follow higher ground and require less fill than Alternative 2. About 1,000 feet of the trail would be elevated on pilings up to 8 feet above grade in locations where drainages are more than about 50 feet wide or in a known flood area.

Four 6-foot-wide gravel spur trails would be constructed similarly to Alternative 2; however, some spur trails would need to be extended to span the greater distance between the main Lakeshore Trail and the lakeshore. Total length of spur trails would be about 1,700 feet. The

pedestrian bridge, campground improvements, and trail termination point at Skater's Cabin Road would match Alternative 2. At Mendenhall River, the trail would also turn south to continue along the river edge to connect to existing and improved trails to form the Dredge Lakes Outer Loop around Dredge Lakes Unit as described above (Section 2.3.4.2).

2.3.5.3 Steep Creek Trail Expansion

Steep Creek Trail boardwalk alignment would match Alternative 2 from the Glacier Spur Bridge downstream to the delta (Figure 2-10). To reduce impacts to wildlife and vegetation (issue 1) and watersheds, wetlands, and aquatic habitat (issue 3), the trail would continue west at the delta to intersect with the Boat Dock Trail rather than north to the Lakeshore Trail segment that connects to Photo Point Trail (which is not proposed in this alternative). Up to seven fish and wildlife viewing overlooks would be added along the length of the boardwalk trail. Other features of the trail would be similar to Alternative 2, including supports, building materials, new elevated portion of the Trail of Time, and Dipper Falls Viewing Area.

Wildlife and Pedestrian Underpass

Under Alternative 3, the trail would pass under Glacier Spur Road at-grade in the same manner as Alternative 2. However, on the east side of Glacier Spur Road, Steep Creek Trail would tie into the existing gravel Dike Trail to connect to the Trail of Time instead of continuing as boardwalk adjacent to Steep Creek, to reduce additional infrastructure within wildlife habitat (Figure 2-10).

2.3.5.4 Boat Docks and Related Support Facilities

Concerns were raised during scoping about resource impacts and altering the existing experience at the MGRA by having motorized boats on Mendenhall Lake (issues 1 – 3). Alternative 3 addresses this by reducing the number of docks and tightening restrictions on boat operations. Two separate boat dock facilities would be installed on Mendenhall Lake:

- **Welcome Center Dock** (south shore near the proposed Welcome Center); and
- **West Glacier Dock** (west shore near the existing kayak launch).

Both facilities would feature floating docks designed to be removed in the winter. Because anchor piles will remain in place, they would be designed to resist ice loads. The Remote Glacier Dock would not be constructed. For access near the glacier, a landing craft with a bow ramp would be required as there would be no dock for passenger offloading.

Welcome Center Dock

Dock design would be identical to that presented in Alternative 2 with regard to approximate location, removable floats, gangway, and materials used (Figure 2-10). However, under Alternative 3, the dock would be located farther out in the lake and not within a constructed inland basin. Periodic maintenance dredging within the lake would likely be required to maintain appropriate water depth at the dredged area.

West Glacier Dock and West Glacier Parking Improvements

Under Alternative 3, the West Glacier Dock would be located between Skater's Cabin and the existing West Glacier Trailhead parking lot (Figure 2-13). The launch ramp and dock would be accessed via a 20-foot-wide by 150-foot-long access road from Skater's Cabin Road. A 30-foot-wide by 100-foot-long boat trailer pullout area adjacent to Skater's Cabin Road would be

constructed to minimize traffic conflicts. A locking gate would be installed across the access road for security.

An 8-foot-wide, 300-foot-long concrete pathway would be added to the northwest side of Skater's Cabin Road to connect to the West Glacier Trailhead parking area. The parking area would be expanded to the southwest side to add 8 parking stalls. As in Alternative 2, a storage area enclosed by an 8-foot-tall fence would be added on the west side of the trailhead parking area to provide storage and other seasonal needs. Additional parking would be added within the existing parking area, and a 25-foot-long segment of existing pathway between the existing kayak launches on the east side of the lot would be widened to 8 feet.

Alternative 3's boat launch dimensions, slope, and float dock configuration would be identical to Alternative 2. Existing bathymetry in this location indicate dredging of an area approximately 80 feet wide by 200 feet long to a depth of 8 feet below low water would be needed. Periodic maintenance dredging within the lake would likely be required to maintain appropriate water depth at the dredged area.

Remote Glacier Landing Area

Near the glacier, landing craft vessels and non-motorized vessels could land on existing gravel beach area on the northwest side of Mendenhall Lake (Figure 2-16). Similar to Alternative 2, one of two potential landing locations near the glacier would be selected, including a south landing location about 4,100 feet from the terminal end of the glacier (as of summer 2020) and a north landing location about 150 feet from the glacier. All sharp underwater bedrock outcroppings in front of the landing area would be removed. Portable bathroom facilities would be available aboard a barge anchored near the dock and would include a flush toilet with a central holding tank for sewage contained within the barge structure. The barge would be transported to the West Glacier Dock for periodic maintenance and sewage pumping and removed in the winter.

Motorized Boats

Guided day-use vessels accommodating 35 passengers on the lake would be allowed under a special use permit. Similar to Alternative 2, the boat's wake would be limited to produce no measurable shore erosion and minimal wildlife disturbance. To reduce impacts related to noise (issue 2), aquatic habitat (issue 3), air quality (issue 4), and climate change and greenhouse gas emissions (issue 5), vessels would be electric powered only. Vessels would be recharged at the Welcome Center Dock, either directly from service lines or via onshore batteries. The 1996 (revised in 2015) MGRA Management Plan would be updated after a final decision on this project to incorporate new authorizations for electric-powered motorized boats operating on the lake under a special use permit.

2.3.5.5 Visitor Capacity and Commercial Use (Transporter, Outfitter, and Guide) Management Changes

To address public concerns about visitation estimates being too high while still addressing existing crowding issues in the Visitor Center Unit, proposed infrastructure improvements are based on a projected visitation calculated using a 2 percent annual growth projection for the tourism industry over 20 years with actual 2019 visitation as a starting point.

Alternative 3 would increase capacity of the MGRA but to a lesser extent than Alternative 2 (Section 2.3.4.5). Proposed facilities and sites would increase overall capacity for the Visitor Center Unit to 830,000 visitors and would respond to the project purpose and need regarding

current visitor numbers causing crowding within certain facilities. Commercial use allocation would be set at 87 percent of capacity for the Visitor Center Unit (722,100). Service days (included in the Visitor Center Unit total) for motorized boats would be restricted to 100,000 service days annually to respond to scoping concerns about sensitive wildlife habitat (issue 1) near the glacier.

The 1996 (revised in 2015) MGRA Management Plan would be updated after a final decision on this project to incorporate new information regarding visitor capacity and commercial allocation.

Table 2-4. Visitor Capacity and Commercial Allocation (Service Days) by Management Unit – Alternative 3

Management Unit	Visitor Capacity ^a	Number of Service Days Allocated to Commercial Use	Designated Commercial Use (Percentage of Capacity)
Visitor Center Unit ^b	830,000	722,100	87%
Dredge Lakes Unit ^c	77,040	23,110	33%
West Glacier Unit ^d	249,000	99,600	40%

^a The Forest Plan defines recreation capacity as “the number of people that can take advantage of the supply of a recreation opportunity during an established use period without substantially diminishing the quality of the recreation experience or the resources” (p. 7-47).

^b Includes commercial motorized boat use on Mendenhall Lake.

^c Total capacity was not specified for Dredge Lakes Unit in either the 1996 or 2015 Management Plan Revisions, but this proposes commercial use for this management unit. The proposed capacity is based on the Dredge Lakes Outer Loop only and does not reflect capacity for the trail network inside the management unit, which would remain excluded from commercial use.

^d Includes non-motorized boat use on Mendenhall Lake and Mendenhall River and shoreline activities.

2.3.6 Alternative 4

Alternative 4 addresses issues 1 through 7, including responding to comments desiring an alternative that focuses development mainly within the already concentrated visitor area near the Visitor Center rather than spread throughout the MGRA (issue 2; recreation and visitor experience). It proposes new facilities and infrastructure based on visitation increases using 15-year projections. In addition to those described in Section 2.3.2, the following sections describe components that would be constructed and some that would not be included under Alternative 4.

2.3.6.1 Parking and Access Expansion

To address concerns about wildlife habitat (issue 1) and watersheds, wetlands, and aquatic habitat impacts (issue 3), Alternative 4 would combine the two existing parking areas nearest the Visitor Center in a similar configuration to Alternative 3 to create a smaller, 110,000-sq ft (2.5 acre) parking area and create separation between commercial and private vehicles (Figure 2-8). The size of the parking area would be based on the 20-year demand estimate of 74 passenger vehicle parking spaces and 7 for-hire/taxi/rideshare spaces, but with fewer bus drop-off/pick-up spaces (10 rather than 13). Placement and layout of the parking area would be similar to Alternative 3, but the elevated boardwalk from the private vehicle parking area to the Welcome Center would be adjacent to (rather than over) Zig Zag Pond.

Figure 2-8. Schematic Design for Visitor Center Parking – Alternative 4

See design package posted on the project website for more detail. This configuration would create separation between commercial and private vehicles while filling only a small portion of Zigzag Pond. An elevated boardwalk adjacent to the pond would connect the private vehicle parking area directly to the Welcome Center Complex.

2.3.6.2 Welcome Center Complex

The Welcome Center building and Crescent Bridge would be built in the same manner as in the other action alternatives. However, to reduce the amount of new impervious surface areas and associated impacts to wetlands and aquatic habitat (issue 3), design of the surrounding plaza area would be changed slightly. The arrival and wayfinding plaza would be slightly smaller than in Alternatives 2 and 3 (17,500 sq ft; see Table 2-1). Other changes to the Welcome Center Complex are listed below.

Photo Point Trail

Photo Point Trail would be shifted to an inland alignment and no overwater connection would be made to the interpretive plaza area to avoid lake impacts (Figure 2-11).

Interpretive Plaza

The interpretive plaza in front of the Visitor Center would be reduced to a smaller upper area only (1,500 sq ft). There would be no lower plaza area or amphitheater (Figure 2-11).

2.3.6.3 Lakeshore Trail

To address impacts related to issue 1 (wildlife and vegetation) and issue 2 (recreation and visitor experience) and issue 3 (wetlands and aquatic habitat), Lakeshore Trail would start at the existing Moraine Ecology Trail and would remain inland for most of the length of the trail to the Mendenhall River (Figure 2-11). The 8-foot-wide and about 1-mile-long trail would be gravel rather than paved, with six smaller spur trails totaling 3,600 feet extending towards the shoreline for viewpoints. About 800 feet of the trail would be elevated on pilings up to 8 feet above grade in locations where drainages are more than about 50 feet wide or in a known flood area.

At Mendenhall River, the trail would turn south and continue adjacent to the river to connect to existing trails in the Dredge Lakes Unit as in Alternatives 2 and 3. Different from the other action alternatives, a loop trail would not be constructed around the Dredge Lakes Unit connecting the proposed trailheads along Glacier Spur Road and the commercial overflow parking lot. The pedestrian bridge over Mendenhall River and parking area in the campground would not be constructed. No tent or drive-in campsites would be reconfigured except for those that would be replaced by the new public use cabins (Section 2.3.2.6).

2.3.6.4 Steep Creek Trail Expansion

To provide a buffer for wildlife, the alignment of Steep Creek Trail boardwalk would be located farther from Steep Creek with up to four viewing overlooks designed as out-and-back walkways (Figure 2-11). The trail would terminate at the intersection with Glacier Spur Road and an at-grade portion of the trail would not be extended under the road. A signed and marked pedestrian crosswalk would be established to cross Glacier Spur Road at the proposed bridge and connect to the existing Dike Trail on the east side of the road. The elevated portion of the Trail of Time and Dipper Falls Viewing Platform would match Alternatives 2 and 3.

Wildlife Underpass

The underpass at the Steep Creek Vehicular Bridge would allow free passage for wildlife only with space available on both sides of the creek. The design of the bridge would be the same as proposed under Alternatives 2 and 3.

2.3.6.5 Dredge Lakes Multi-Use Trails

The proposed improvements and additions to the multi-use trail network through the Dredge Lakes Unit are not included in this alternative.

2.3.6.6 Boat Docks and Related Support Facilities

This alternative omits all proposed docks and upland support facilities on Mendenhall Lake. The existing non-motorized boat launch areas north of the Welcome Center Complex and near Skater's Cabin would remain.

2.3.6.7 Remote Glacier Visitor Area

This project component is eliminated under Alternative 4 to address concerns received about impacts to the glacier, sensitive bird nesting areas, and early successional habitat (Figure 2-17). No development would occur on the north side of the lake except for improvements to West Glacier Trail (Section 2.3.6.8).

2.3.6.8 West Glacier Unit Trails

The West Glacier Spur Trail would be the same as described in Alternatives 2 and 3 (Section 2.3.3.4). The user-proposed multi-use trails would not be constructed nor would existing user-created trails be improved or incorporated into the NFS trail system (Figure 2-14).

2.3.6.9 Visitor Capacity and Commercial Use (Transporter, Outfitter, and Guide) Management Changes

Under Alternative 4, infrastructure projects designed to increase capacity are based on calculations using a projected 2 percent annual growth in visitation for the tourism industry 15 years into the future with actual 2019 visitation as a starting point. Proposed facilities and sites under this alternative would increase Visitor Center Unit capacity to 752,000 visitors annually (Table 2-5). To address public concerns related to issue 2 (recreation and visitor experience) about commercial use being extended into areas with low use currently, no commercial use would be allocated to the Lakeshore Trail or any trails in the Dredge Lakes Unit.

The 1996 (revised in 2015) MGRA Management Plan would be updated after a final decision on this project to incorporate new information regarding visitor capacity and commercial allocation.

Table 2-5. Visitor Capacity and Commercial Allocation (Service Days) by Management Unit – Alternative 4

Management Unit	Visitor Capacity ^a	Number of Service Days Allocated to Commercial Use	Designated Commercial Use (Percentage of Capacity)
Visitor Center Unit	752,000	654,240	87%
Dredge Lakes Unit ^b	Not established	0	0%
West Glacier Unit ^c	210,000	94,500	45%

^a The Forest Plan defines recreation capacity as “the number of people that can take advantage of the supply of a recreation opportunity during an established use period without substantially diminishing the quality of the recreation experience or the resources” (p. 7-47).

^b Total capacity was not specified for Dredge Lakes Unit in either the 1996 or 2015 Management Plan Revisions, and no commercial use for Dredge Lakes Unit is proposed under this alternative.

^c Includes non-motorized boat use on Mendenhall Lake and Mendenhall River and shoreline activities.

2.3.6.10 Management Unit Boundary and Recreation Opportunity Spectrum Adjustments

Modifications to the Visitor Center Unit boundary are included in Alternative 4 to the Moraine Ecology Trail only (Figure 2-19). Minimal modifications to existing ROS for certain facilities would occur, but no modifications to ROS would occur in the West Glacier Unit (see Appendix A). The 1996 (revised in 2015) MGRA Management Plan would be updated after a final decision on this project to incorporate new information regarding management unit boundaries.

2.3.7 Action Alternatives Figures

Three map extents are provided for each action alternative: Visitor Center and Dredge Lakes Area, West, and North (Figure 2-1).

Figure 2-10. MGRA Visitor Center and Dredge Lakes Area – Alternative 3

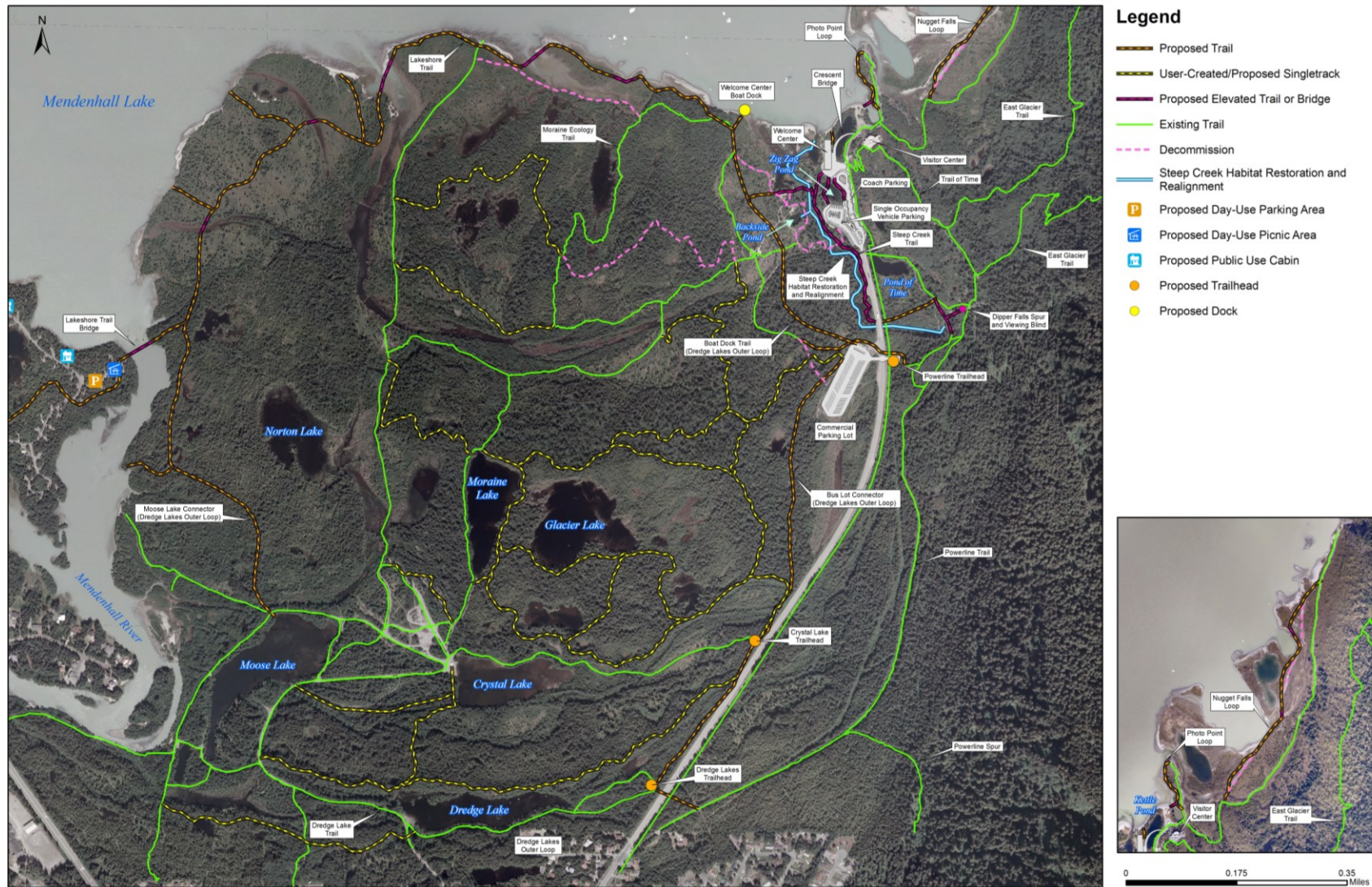


Figure 2-11. MGRA Visitor Center and Dredge Lakes Area – Alternative 4

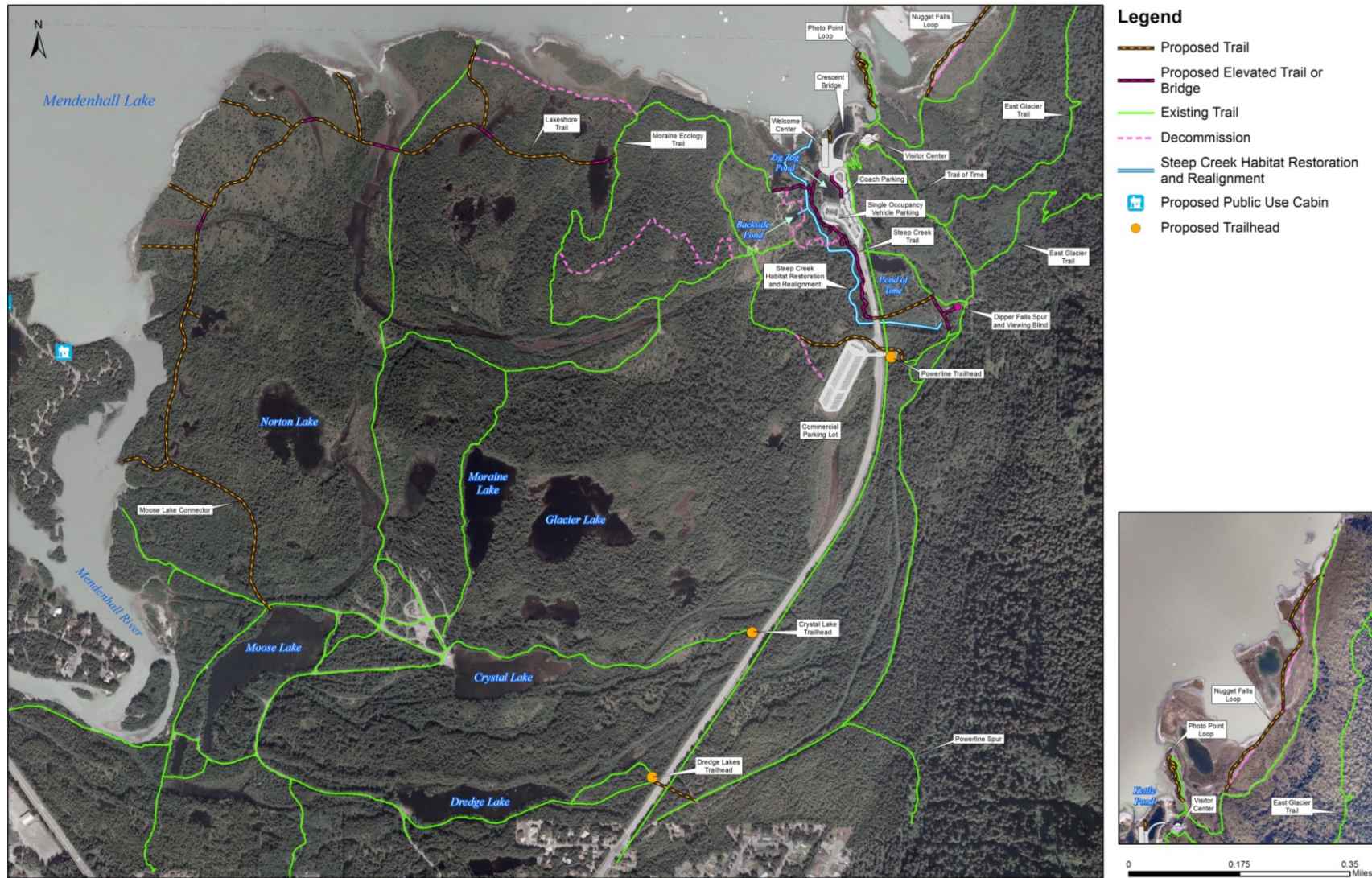


Figure 2-12. MGRA West – Alternative 2

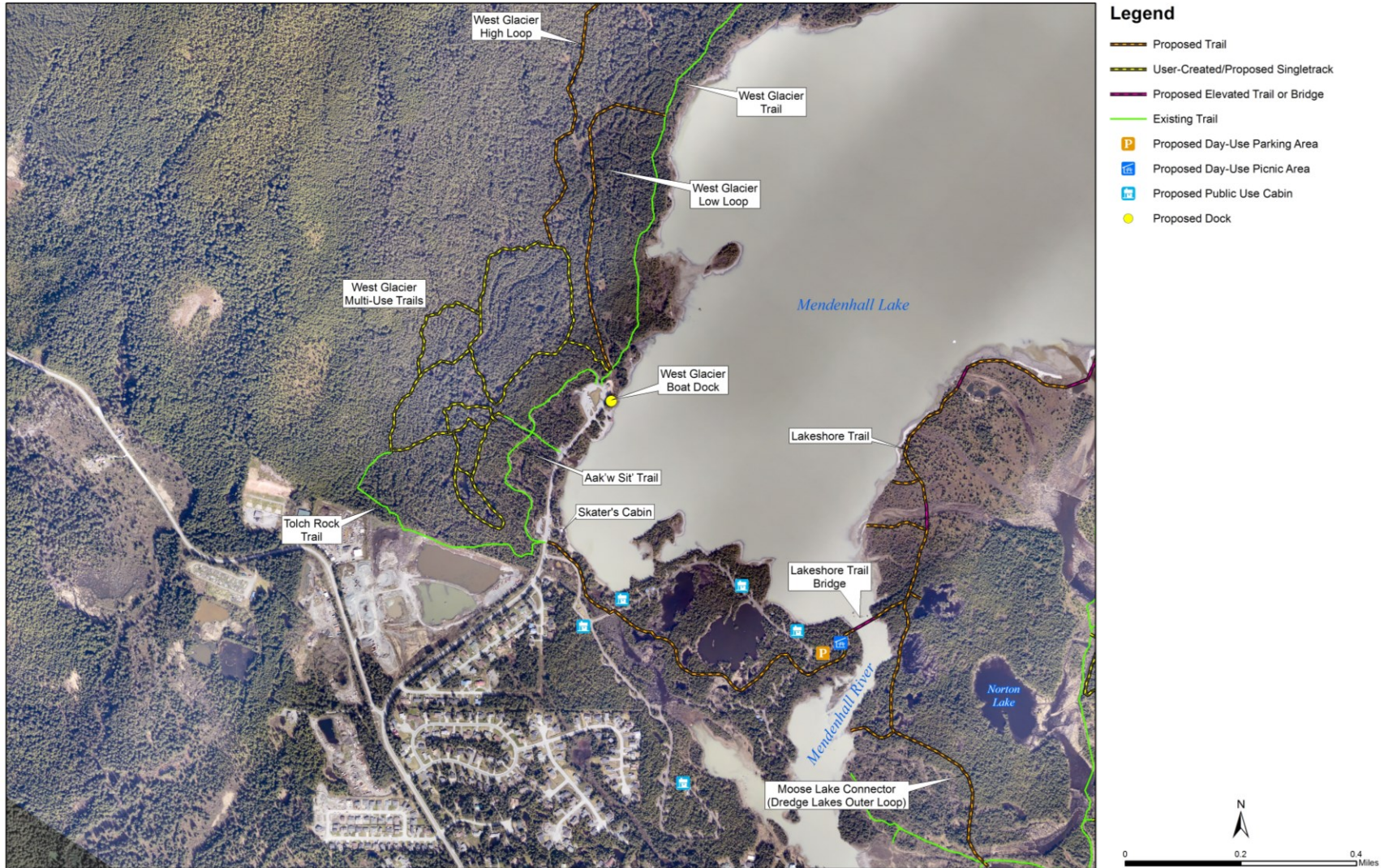


Figure 2-13. MGRA West – Alternative 3

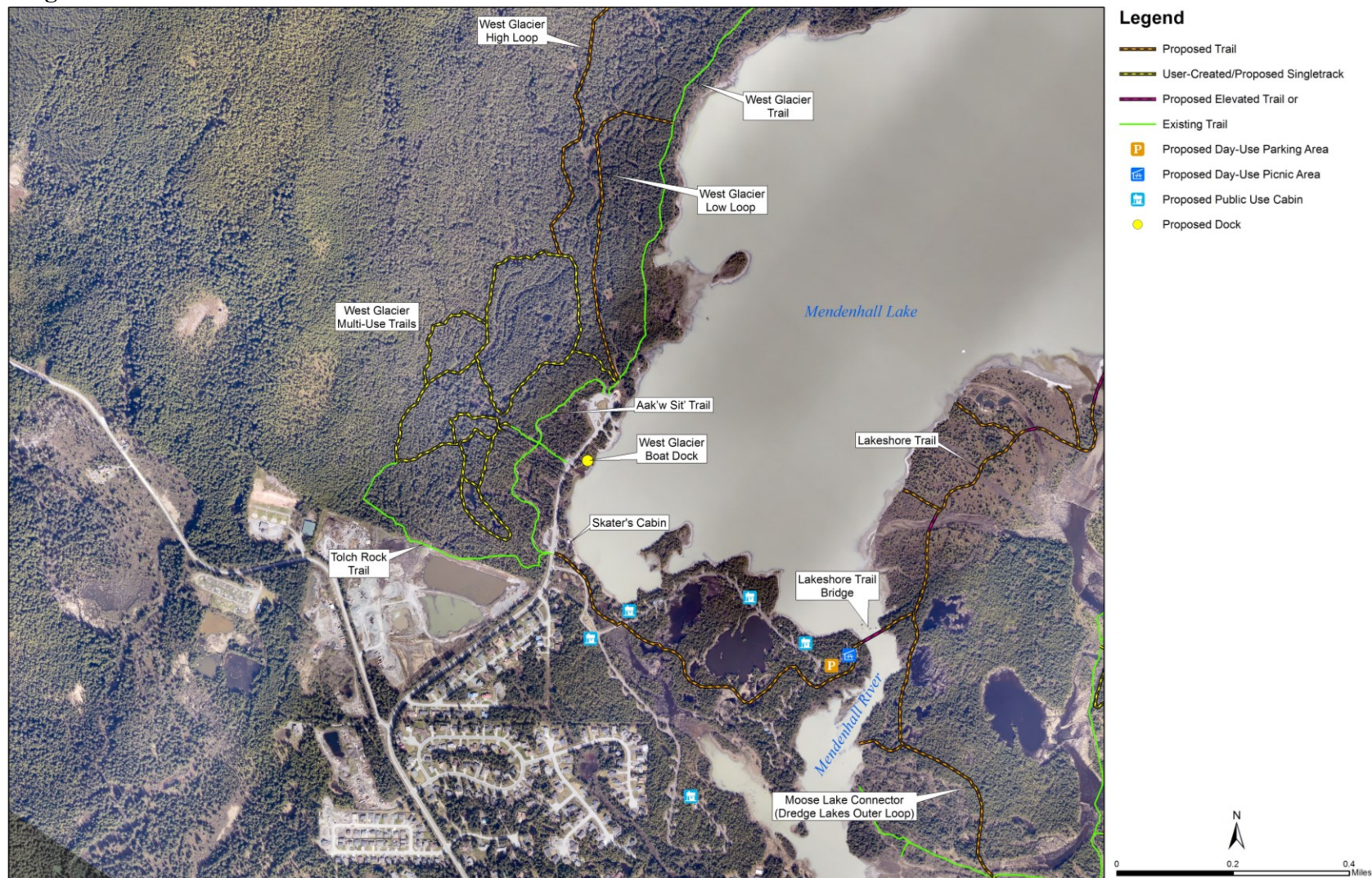


Figure 2-14. MGRA West – Alternative 4

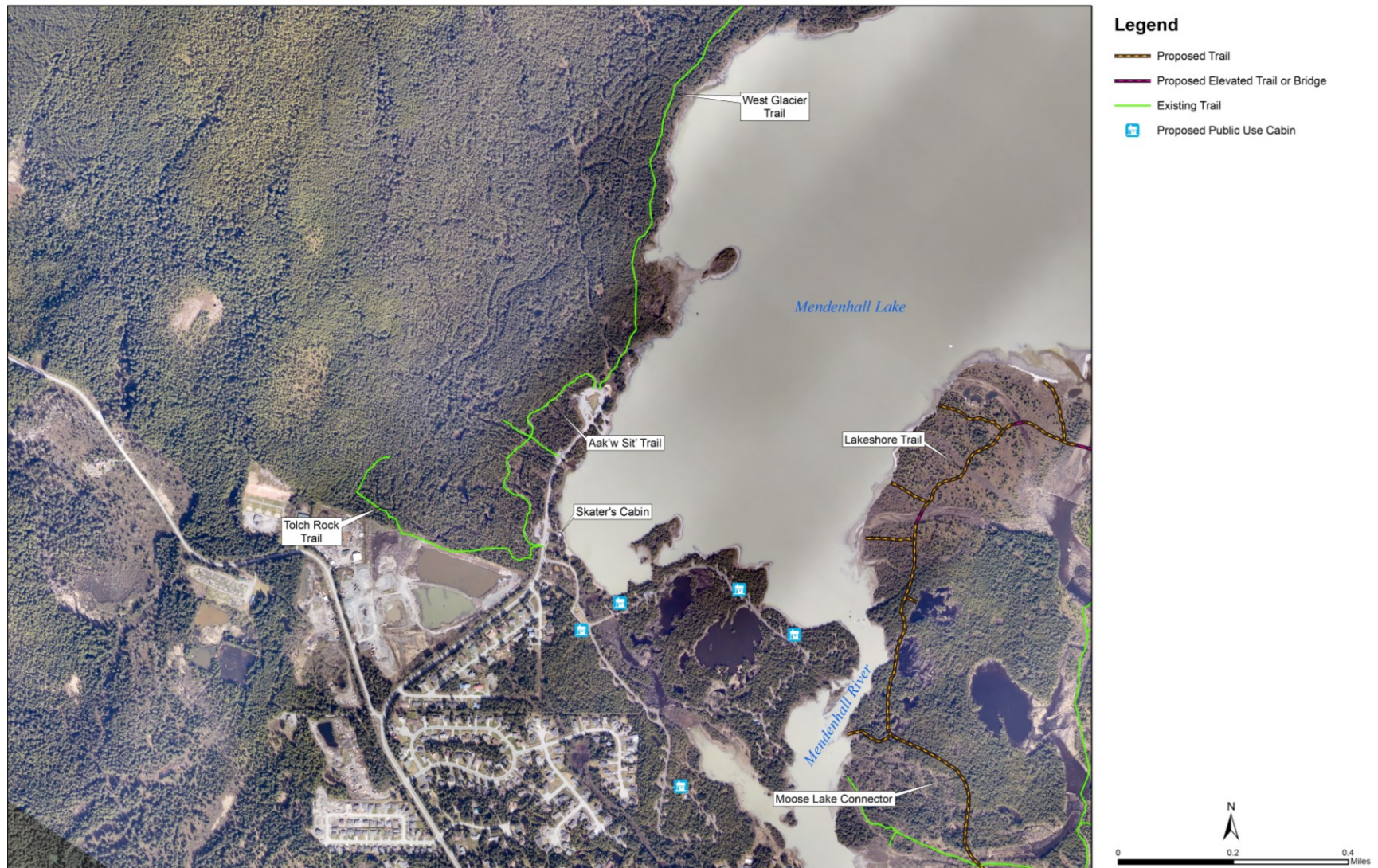


Figure 2-15. MGRA North – Alternative 2

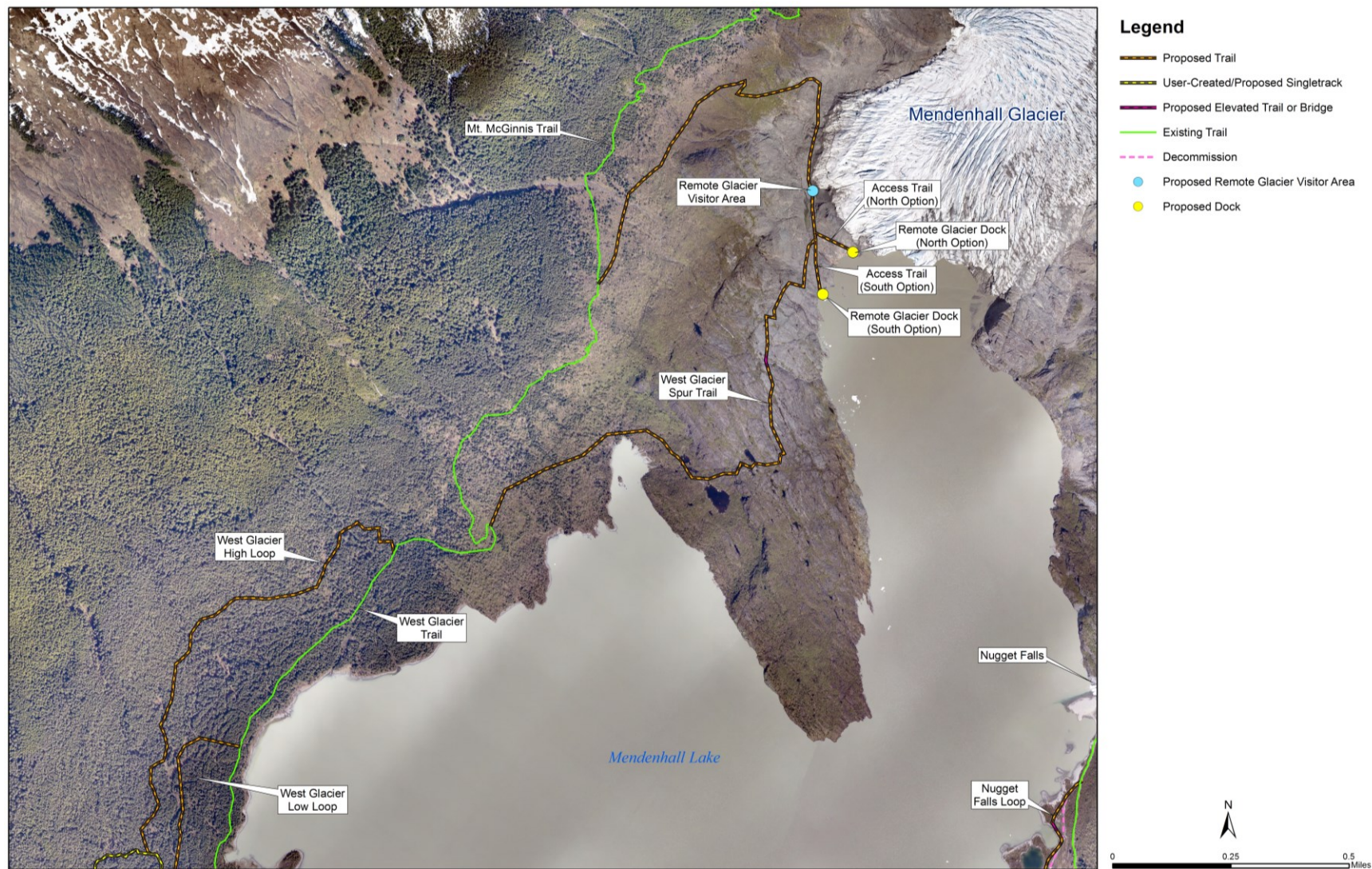


Figure 2-16. MGRA North – Alternative 3

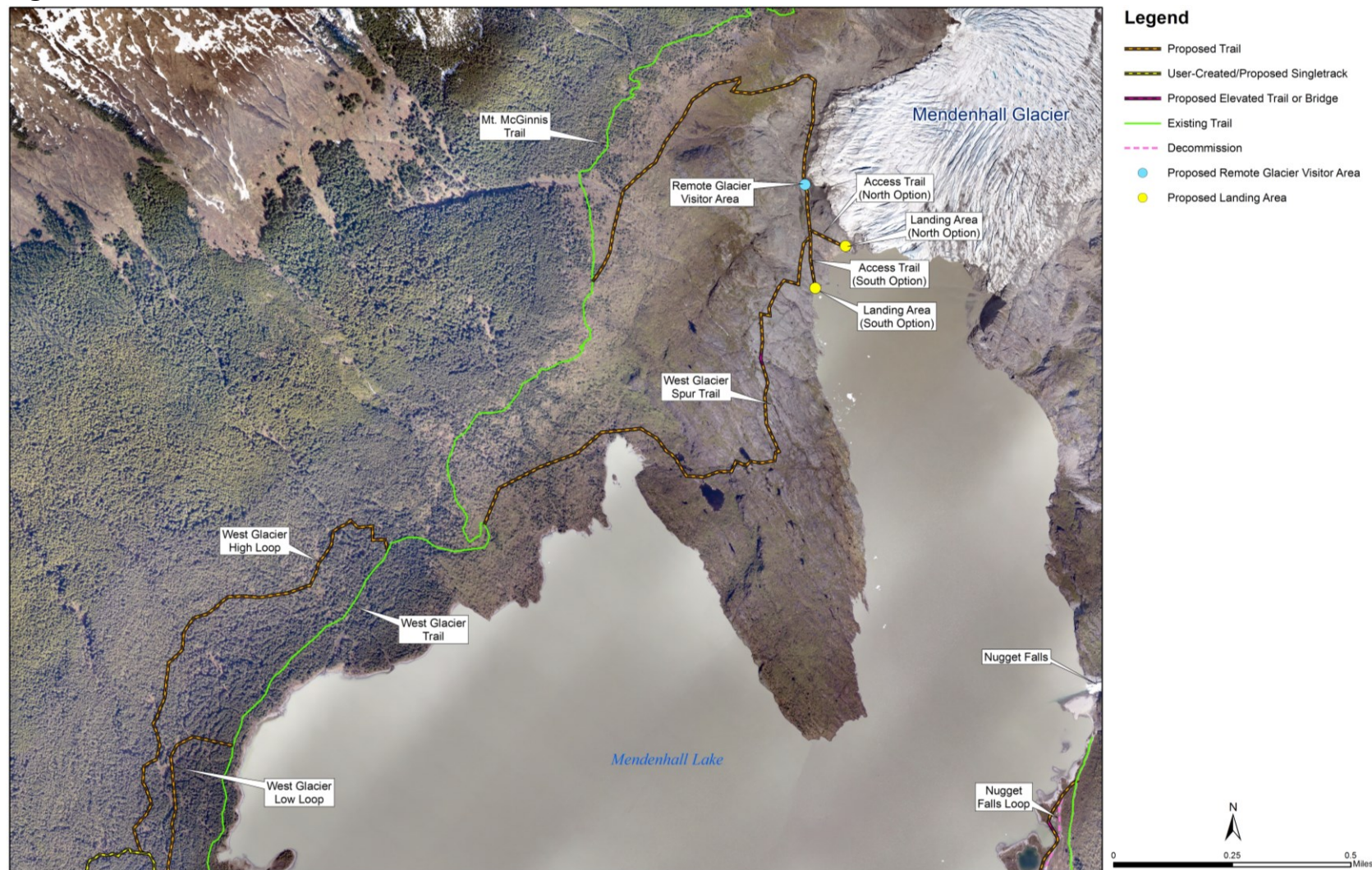


Figure 2-17. MGRA North – Alternative 4

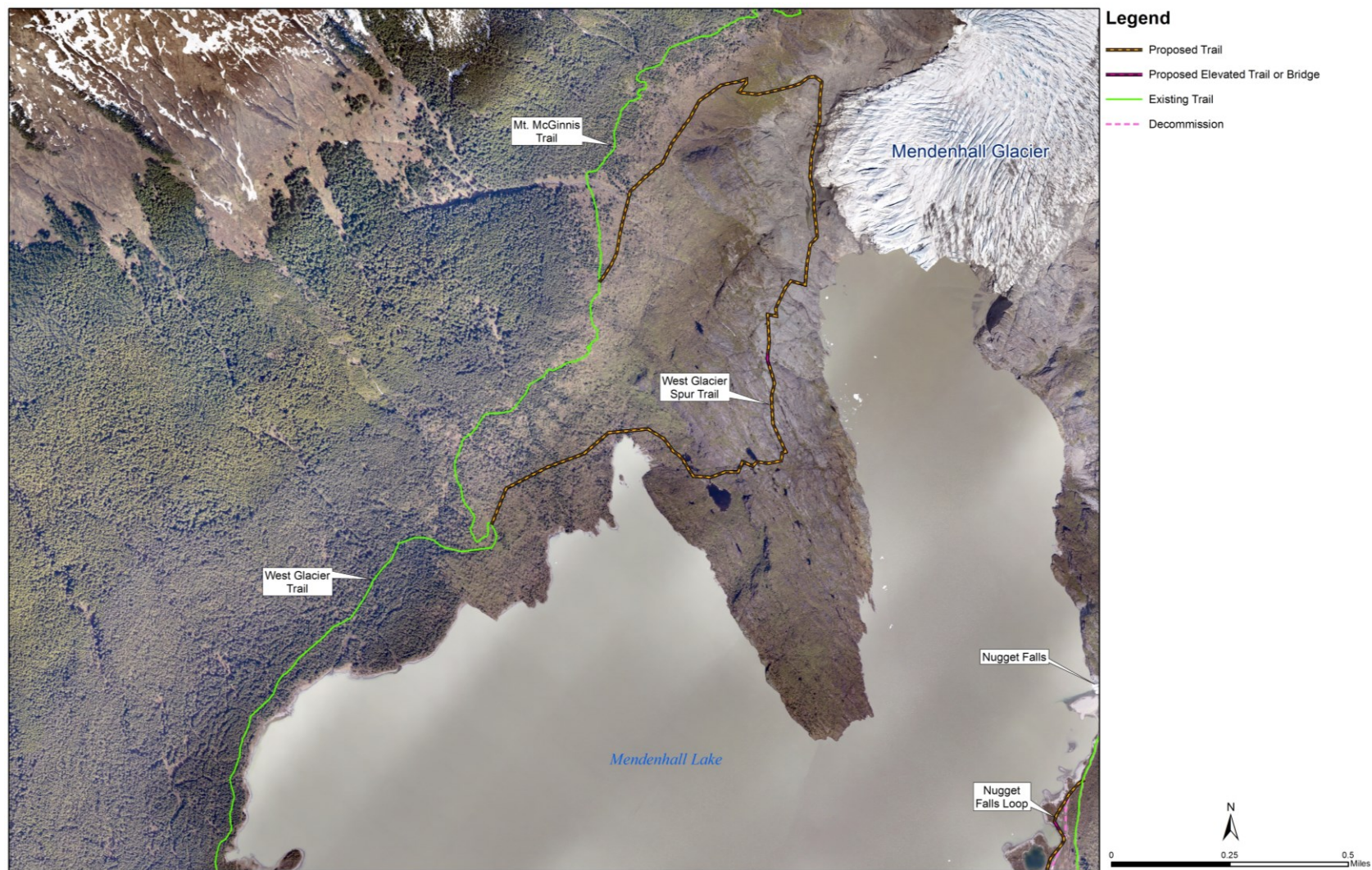


Figure 2-18. Management Unit Boundaries – Alternatives 2 and 3

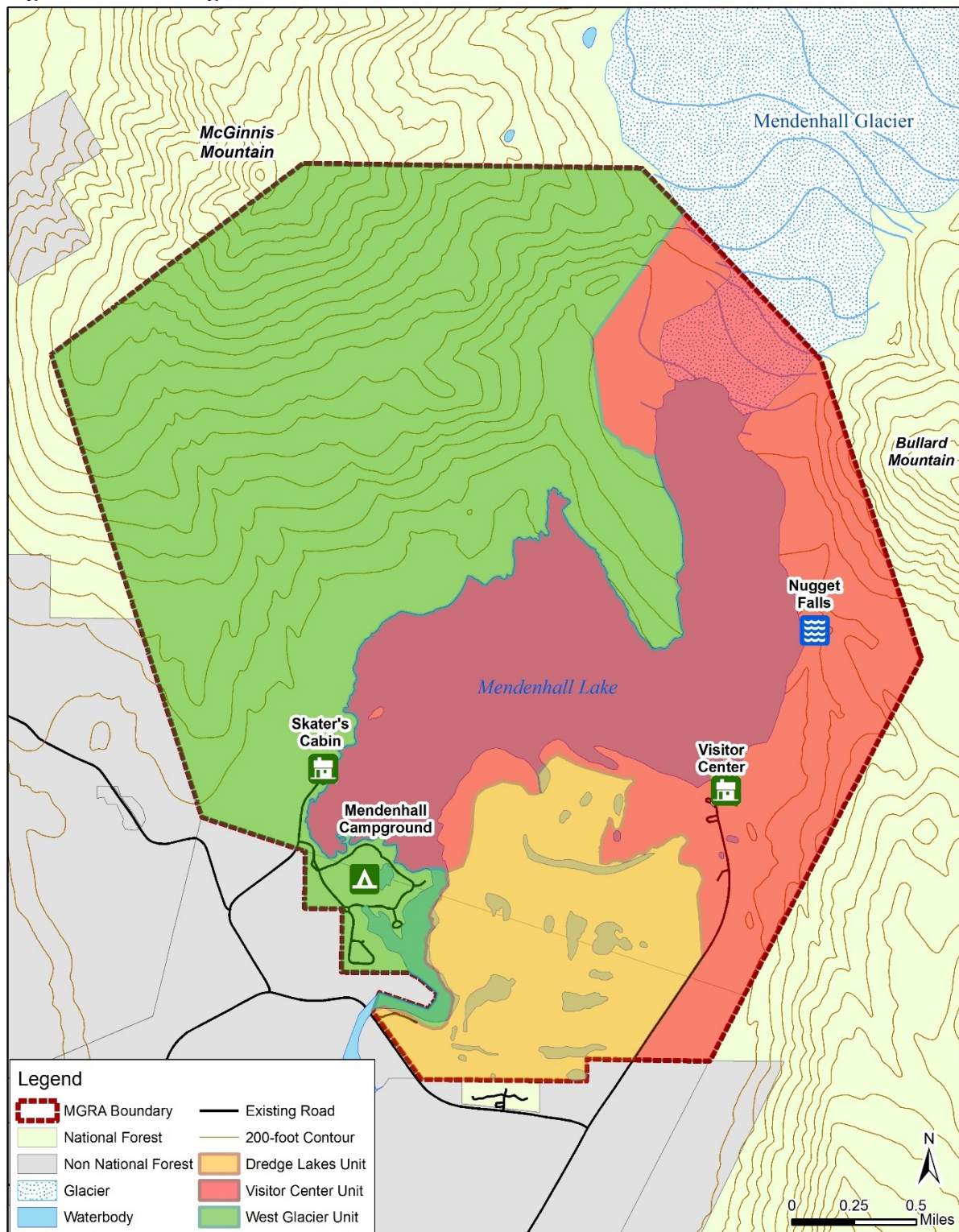
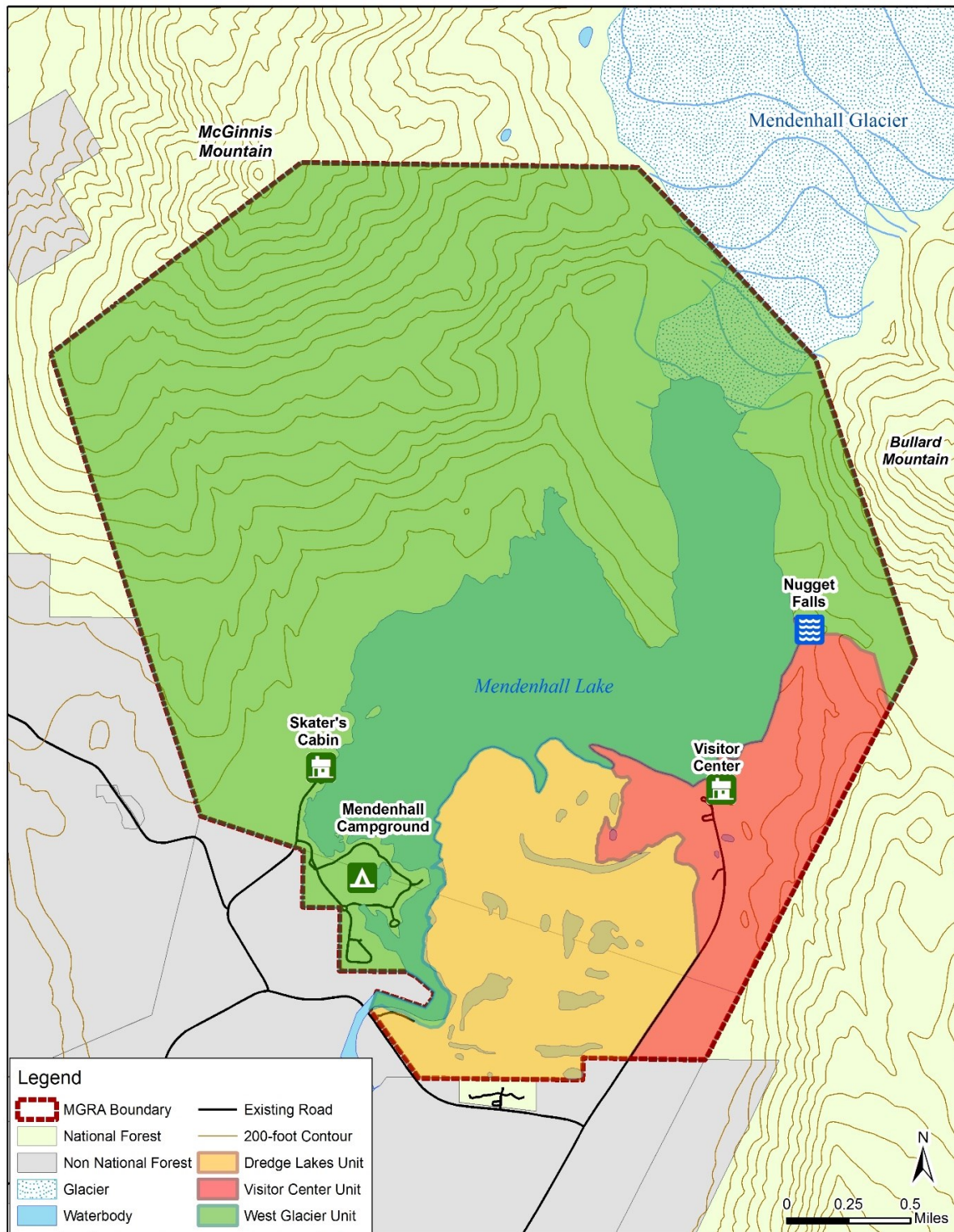


Figure 2-19. Management Unit Boundaries – Alternative 4



2.4 Mitigation Common to All Action Alternatives

In addition to complying with required consultation and coordination with Federal, State, local, and tribal entities (Chapter 1, Sections 1.6 and 1.7) and all applicable permits (Chapter 1, Section 1.9), certain measures would be incorporated into all action alternatives intended to minimize, mitigate, or avoid anticipated impacts. These measures include best management practices (BMPs), resource-specific mitigation measures, and adaptive management strategies to gradually increase commercial use. Project components would be designed to meet applicable Forest Plan direction and Forest Service Manuals and Handbooks.

2.4.1 Best Management Practices

BMPs are methods, measures, or practices to directly or indirectly protect natural resources and abate or mitigate adverse impacts to those resources while meeting other resource goals and objectives. BMPs for recreation management, watershed management, wildlife and fisheries management, access and transportation management, and other forest management activities, are described in Forest Service Handbook 2509.22, Region 10 Soil and Water Conservation Handbook. They are the result of collaboration between the Forest Service and the State of Alaska to identify practices to minimize soil erosion and protect aquatic habitat to meet the requirements of the Clean Water Act. The invasive plant BMPs provided in the 2019 Guidance for Invasive Plant Management Program Tongass National Forest would also apply to this project (Krosse 2019). In addition to the State-approved BMPs, the Forest Service implements and monitors for National Core BMPs (USDA Forest Service 2012).

2.4.2 Resource-Specific Mitigation Measures

In addition to applicable BMPs, resource-specific project mitigation measures have been incorporated into all action alternatives. Mitigation measures minimize potential adverse effects from natural or human-caused disturbances. Design features and mitigation measures common to all action alternatives are described briefly below in Table 2-6.

Table 2-6. Resource-Specific Mitigation Measures

Resource	Mitigation Measures
Wildlife and Vegetation	• A seasonal closure from March 15 to August 15 will be enforced on activities within 600 feet of an active goshawk nest that create “continuous disturbance likely to result in nest abandonment” (USDA Forest Service 2016, p 4-96). • If a Bald Eagle nest is discovered, the Forest Service will follow the U.S. Fish and Wildlife Service (USFWS) National Bald Eagle Management Plan, and avoid habitat alterations and disturbance (including repeated human activity) within 330 to 660 feet (depending on activity) of all Bald Eagle nests. • For additional migratory bird nesting areas, the project will follow USFWS guidance for Southeast Alaska and will avoid land disturbance and tree cutting/clearing during the following periods for bird nesting areas (USFWS 2021): • April 15 to July 15 within forested and woodland areas, • May 1 to July 15 for shrub and open areas, • May 1 to September 5 for known seabird colonies, and • March 1 to August 31 for goshawk and eagle nesting habitat. • All commercial uses on the lake surface will comply with restrictions near gull colonies and tern nesting areas. • “No wake” areas will be designated on Mendenhall Lake near gull colonies and tern nesting areas. • All boats will be required to follow a route that minimizes disturbances to seabird and shorebird colonies and nesting areas. • Construction in the vicinity of known or possible shorebird and seabird nesting areas will be dependent on proper surveys and precautions to minimize disruptions to active or potential nesting locations. • Glass treatments will be installed on the Welcome Center windows to reduce incidental bird strikes. • Bear management guidelines will be revised at the time of project implementation. • Beaver management practices will be revised at the time of project implementation. • A survey for undocumented sensitive plant populations will be completed in the vicinity of all project components before construction. • All project actions will be implemented and operated in compliance with measures outlined in the associated Invasive Species Risk Assessment and Guidance for Invasive Plant Management Program Tongass National Forest. • Shoe cleaning stations with interpretive signage about invasive species would be placed at trailheads.
Recreation	• New and redesigned facilities will meet accessibility standards as outlined for outdoor recreation areas in the USDA publication, Accessibility Guidebook for Outdoor Recreation and Trails (USDA Forest Service 2012a) and the Forest Service Outdoor Recreation Accessibility Guidelines. • Information regarding access to planned closures of facilities and trails will be posted at impacted areas (trailheads, parking lots, etc.) starting one month before facility or trail is closed and throughout construction activities. • Increases in commercial use will be phased in through use of an adaptive management plan (Appendix B)

Resource	Mitigation Measures
Watersheds, Wetlands, and Aquatic Habitat	• Work windows will be established through Title 16 concurrence with ADF&G. Suggested work windows (subject to change) will be as follows: ○ Ground disturbing activities will be avoided along the lakeshore from April 1 to May 31 (outmigration of salmon fry). ○ Instream work in Steep Creek will be conducted from June 1 through July 15 (period between outmigration of salmon fry and return of adult Sockeye Salmon). • Boats will be prohibited from creating wakes in designated areas. • To mitigate for impacts to Zig Zag Pond and other essential fish habitat (EFH), Backside Pond would be enlarged and connected to Steep Creek. • Culverts and other drainage features will be constructed to facilitate the natural movement of water. • Stormwater discharges would be monitored to ensure that installed controls are functioning properly • All project actions will be implemented and operated in compliance with measures outlined in the associated EFH Assessment.
Heritage	• All project actions will be implemented and operated in compliance with the measures outlined in the Programmatic Agreement developed for this project with the Alaska State Historic Preservation Office. • If a previously unidentified archaeological or historic site(s) is encountered, the contractor will discontinue work in the general area of the site(s) and notify the contracting officer immediately. The contracting officer will notify a Forest Service archeologist to determine further action. • An interpretive plan will be implemented to serve as a guide for visitor education at the MGRA and present traditional Aak’w Kwaan ecological knowledge and stories alongside western science. • The Welcome Center will be constructed with exterior and interior features consistent with the Visitor Center and the architectural style with which it was built in the 1960s. • The Welcome Center will be placed out of the historic viewshed of the Visitor Center.
Air Quality	• Bus engine idling will be prohibited while buses are parked.
Climate Change	• All proposed buildings will meet Forest Service sustainability requirements, including LEED Silver certification (representing sustainable design choices for new building elements such as lighting, heating and ventilation, materials, and construction site management) for the new Welcome Center.
Socioeconomics	• Public service announcements and other public outreach will occur prior to construction activities.

2.4.3 Adaptive Management Plan for Commercial Outfitter, Guide, and Transportation Services

An adaptive management plan, included in Appendix B, has been developed for all action alternatives to provide a strategy for adjusting commercial use at the MGRA using a system based on monitoring and desired outcomes. Adaptive management provides a structure to evaluate how to best meet the project’s short-term and long-term goals, and helps answer the basic question: are our management actions having the predicted or desired effects?

The intent of using adaptive management for changes in commercial use is to: 1) give special use permit holders (including outfitter/guide services and transportation services) an understanding

and assurance in how service days could increase or decrease over time; and 2) give the public assurance that any increases in service days would be based on monitoring information and would be phased in rather than allocated in bulk following the ROD (if an action alternative is selected) for this project. The plan describes the conditions required to initiate an increase in service days, based on proposed infrastructure completion. By incorporating an adaptive management plan for commercial use allocations into the alternatives in this EIS, service days can be increased without additional environmental analysis, if all conditions and monitoring requirements are met. Monitoring will inform if service days would remain the same, increase, or decrease to achieve desired conditions.

2.5 Alternatives Considered but Eliminated from Detailed Study

The following alternatives (or components of an alternative) were considered but dismissed from detailed consideration for reasons summarized below.

2.5.1 Parking and Access Expansion Alternatives

2.5.1.1 Circulator Shuttle System from Remote Parking Area

The Forest Service considered a proposal with a circulator shuttle that would pick up visitors from a remote parking area located at the edge of the MGRA. Tour buses would transport passengers from their arrival port at the Juneau docks to a shuttle loading location nearer the MGRA, and a circulator vehicle would deliver them directly to the Visitor Center area.

This component was dismissed from further consideration because it would not adequately meet the project need to continue to provide quality opportunities for all visitors to enjoy the recreation area. Visitors from outside Alaska, which make up the bulk of the visitors to the MGRA in the summer, generally have less than one day to spend experiencing Juneau (McDowell 2017). With the addition of a second mode of transportation to the Visitor Center, increased loading, unloading, and waiting would add time and potentially confusion to and from the MGRA. For some limited-mobility visitors, this also introduces a potential safety concern during loading and unloading.

Additionally, a shuttle system would still require a comparable number of vehicle trips to deliver all visitors to the Visitor Center, since expected capacity of the vehicle would not be greater than existing vehicle capacities (tour bus). Traffic on Juneau roads would not be reduced since tour buses would still need to deliver people to the Mendenhall Valley to the shuttle pick up location. It would also not meet the stated need to meet the demand of the visitor industry and support the economy of Southeast Alaska, as many commercial transporter and guides offer convenient, streamlined tour packages that include additional destinations prior to or immediately following their visit at the MGRA.

The Forest Service supports development of an electric circulator shuttle and may incentivize those vendors proposing use of electric shuttles within the special use permitting approval process as outlined in the adaptive management plan (Appendix B). As circulator/shuttle modes of transportation evolve and become more available in Juneau, the decision to not include a circulator shuttle system may change and be revisited or could arise independently of a Forest Service action.

2.5.1.2 Circulator Shuttle System from Downtown Juneau

The public suggested a similar circulator shuttle that would originate in downtown Juneau nearer to the cruise ship docking area and deliver people to the Visitor Center, via either an electric shuttle bus or a light rail system. The public requested that the Forest Service partner with the CBJ to build infrastructure for a light rail or provide shuttle buses to operate on a loop.

This alternative was dismissed from consideration because it does not meet the need to provide quality opportunities for all visitors to enjoy the recreation area because it faces considerable technical, design, and economic challenges, requiring the Forest Service to dictate operations to private companies. It is considered outside the scope of the proposal. The Forest Service currently permits two locally owned and independent tour companies to provide shuttle service from downtown to the MGRA.

Similar to the circulator shuttle from a remote parking area, the Forest Service would support development of an electric circulator shuttle from downtown and may incentivize those vendors proposing use of electric shuttles within the special use permitting approval process as outlined in the adaptive management plan (Appendix B) and a shuttle system may be revisited or could arise independently of a Forest Service action.

2.5.2 Steep Creek Trail Alternatives

2.5.2.1 Steep Creek Fish Viewing Window

This concept, included in the Master Plan (USDA Forest Service 2019), was introduced early in the planning process. It included a below-grade fish viewing facility installed in the realigned portion of Steep Creek west of Glacier Spur Road to provide an underwater view of the stream and fish moving through the area. The viewing room would have been accessible by ramps and stairs from the Steep Creek Trail.

While this concept meets the to provide quality opportunities for all visitors to enjoy the recreation area and to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view, public comments were received indicating this type of experience is available elsewhere in Juneau and that the facility would cause impacts to fish and lead to increased encroachment into bear habitat. After consideration of the design feasibility, high level of maintenance needed, potential for wildlife impacts, and practicality, this alternative was dismissed.

2.5.3 Dredge Lakes Multi-Use Trails Alternatives

2.5.3.1 Dredge Lakes Area Nordic Ski Loop

Comments were received regarding trail additions and improvements throughout the MGRA for skiers, mountain bikers, and dog walkers. Many of the requested improvements have been incorporated.

A Nordic ski loop within the Dredge Lakes Unit was not included in the proposed trail improvements because trail widening to accommodate grooming equipment would disrupt the intent for the trails to be walking interpretive trails. The Forest Service aims to keep these trails with as much vegetative screen and forest canopy cover as possible, contributing to the natural, secluded feeling of the trail even near the parking area and other trails.

2.5.4 Boat Docks and Related Support Facilities Alternatives

2.5.4.1 Additional Docks on Mendenhall Lake

The 2019 Master Plan contained a proposal for five docks on Mendenhall Lake; the three included in the proposed action and two additional floating docks: one located at Nugget Falls and one on the south shore between the Welcome Center dock and Mendenhall River.

Upon further investigation and study into lake bathymetry, these two additional dock locations do not have the required water depth for docks without significant dredging. The three docks satisfy the purpose and need with fewer environmental impacts and these additional docks were dropped from further consideration.

2.5.5 Alternatives Related to Infrastructure Expansion

2.5.5.1 East Side Development Only

Public comment was received suggesting an alternative to limit all new facilities to the east side of the MGRA, or the existing Visitor Center Unit, which currently experiences the highest user demand from April through October.

This alternative was excluded from consideration because it does not meet the purpose and need to provide quality opportunities for all visitors to enjoy the recreation area and to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center. Crowding in the Visitor Center area is expected to increase. Even with added facilities, this concept would impact all users' experience if visitors cannot disperse over the MGRA. In addition, limiting facility improvements to the east side only would not enhance the recreational experiences on the west side for other user groups, including local mountain bike and Nordic ski groups, since no improvements would be made to the west side.

Furthermore, with the anticipated increase in visitation over the next 10 to 20 years and the likelihood that the glacier will not be visible from the Visitor Center in 30 years, unintentional visitor-created environmental impacts (erosion due to users stepping off trails, disturbances to bears and nesting birds) would likely increase. Spreading visitors out to designated locations over a greater area of the MGRA will allow greater control of these and other overflow impacts.

2.5.5.2 No Capacity Increase

Some commenters expressed a desire for the Forest Service to limit the number of visitors to current levels, especially with regard to imposing a limitation on allowed commercial services.

This alternative was dismissed from further consideration because it does not meet the stated purpose and need for the project. The MGRA and associated infrastructure was developed using federal dollars. The Forest Service does not meter entry into the MGRA but does allocate a portion of the total capacity for commercial use. Two of the Forest Plan goals focus on emphasizing locally popular recreation places and those important to the tourism industry and supporting use of resources that contribute to the Southeast Alaska economy (USDA Forest Service 2016, pp. 2-3 and 2-4).

2.6 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Table 2-7 is structured around the issues and indicators presented in Chapter 1, Section 1.5.1 that are more fully analyzed in Chapter 3.

Table 2-7. Summary Comparison of Effects

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Wildlife and Vegetation	Sensitive and Special Status Species	Negligible Effect - Intermittent disturbances to foraging or nesting Queen Charlotte Goshawks - No impacts to the viability of species populations at the MGRA or within Tongass National Forest, or a population trend toward a federal listing	Minor Effect - Permanent impacts to some moderate and high value habitat for Queen Charlotte Goshawks - Intermittent disturbances to foraging and nesting goshawks - No impacts to the viability of species populations at the MGRA or within Tongass National Forest, or a population trend toward a federal listing	Minor Effect Similar to Alternative 2	Minor Effect Similar to Alternative 2
Wildlife and Vegetation	Migratory Birds	Minor Effect - Wildlife predation - Nest failure from glacial outburst floods - Visitors disturbing nesting and foraging birds - Some individuals would be affected - Ample habitat to support migratory birds	Moderate Effect - New infrastructure, increases in trail and facility use, and additional visitor operations in areas with nesting and foraging bird habitat - Intermittent impacts to individual foraging and nesting birds - Potential for temporary impacts to local bird populations	Moderate Effect Similar to Alternative 2	Minor Effect - Fewer impacts to birds and bird habitat from new infrastructure and anticipated visitor use - Occasional impacts to individuals - No anticipated effect on populations within the MGRA or Tongass National Forest

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Wildlife and Vegetation	Bears	Moderate Effect - Problematic bear interactions with visitors and residents' dogs in the Visitor Center Unit and on trails in the Dredge Lakes Unit - Persistent risk of bear-vehicle collisions in the Visitor Center Unit - Impacts expected to individual bears and the localized population in the MGRA - No impacts expected to affect the Forest-level population	Moderate Effect - Increases in habitat fragmentation and human use of bear habitat in the MGRA - More adverse bear-human interactions and blocking bears' access to important habitat - Impacts to individuals and the localized population - Wildlife underpass and Steep Creek Habitat Restoration would improve bear habitat and conditions for salmon - No impacts expected to affect the Forest-level population	Moderate Effect Similar to Alternative 2	Minor Effect - Fewer increases in habitat fragmentation and anticipated visitation - Some habitat improvements - Impacts to individuals possible - No impacts to the local or Forest-level bear populations expected
Wildlife and Vegetation	Other Wildlife	Minor Effect - Wildlife individuals disturbed by social trails and off-trail traffic - Rare conflicts possible with mountain goats and wolves near the glacier terminus - No impacts anticipated for local or Forest-level populations	Moderate Effect - Impacts to wildlife individuals and habitat from new infrastructure and visitor use - Increased visitor use and infrastructure in the West Glacier Unit near high value habitat for wolves and mountain goats - Potential for short-term impacts to localized populations	Moderate Effect Similar to Alternative 2	Minor Effect - Reduced scale of new infrastructure and trail and facility capacities - Occasional impacts to individuals - No anticipated interference with local or Forest-level wildlife populations or their habitat

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Wildlife and Vegetation	Vegetation and Habitat	Negligible Effect - Most well-trafficked areas are appropriate for ongoing levels of visitor use - Some user-created trail use would continue and impact wildlife habitat and vegetation - No impacts to habitat viability or ongoing natural processes	Minor Effect - Permanent and temporary impacts total 30.7 acres of vegetation and sensitive plant habitat - No impacts to habitat viability or ongoing natural processes - Perceptible, localized effects to local vegetation	Minor Effect - Permanent and temporary impacts total 27.1 acres of vegetation and sensitive plant habitat - No impacts to habitat viability or ongoing natural processes - Perceptible, localized effects to local vegetation	Minor Effect - Smaller proposed infrastructure footprints - Permanent and temporary impacts total 16.1 acres of vegetation and sensitive plant habitat - Perceptible, localized effects without affecting the integrity of available habitat types
Wildlife and Vegetation	Invasive Species	Minor Effect - Trail use creates a vector for the spreading of invasive plants - Increased off-trail activity from increased unguided use of the MGRA would continue to spread invasive species	Moderate Effect - The highest risk of spreading invasive species would be associated with construction of project components - Disturbance, clearing, new tools, and human activity would create seed beds for invasive species introduction - There would be minimal additional invasive species impacts following construction of infrastructure	Moderate Effect Similar to Alternative 2	Moderate Effect - Less construction of new infrastructure, a smaller risk of spreading invasive species - Use of user-created trails in the Dredge Lakes Unit would continue, and conditions of the trails would likely degrade

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Wildlife and Vegetation	Early Successional Vegetation	Negligible Effect - Existing conditions would persist within early successional vegetation close to the glacier terminus and along the lakeshore - Occasional off-trail use expected within early successional vegetation in the West Glacier Unit	Moderate Effect - Construction and new infrastructure to impact 11.3 acres of early successional plant communities - Some early successional vegetation would be permanently removed by the placement of project components or damaged by off-trail visitor traffic	Moderate Effect - Construction and new infrastructure to impact 9.4 acres of early successional plant communities - Some early successional vegetation would be permanently removed by the placement of project components or damaged by off-trail visitor traffic	Minor Effect - Construction and new infrastructure to impact 7.9 acres of early successional plant communities - Minimal early successional vegetation would be permanently removed by the placement of project components or damaged by off-trail visitor traffic
Recreation	Social Encounters	Moderate Effect - Crowding would become prevalent over more of the primary use season (May 1 – September 30) - Locals would avoid the crowded Visitor Center Unit, leading to more encounters on lesser used trails - More encounters would be experienced in multiple locations over 15% and less than 80% of the primary use season	Moderate Effect - Local users displaced from Visitor Center Unit in response to more social encounters - New facilities to add interest in popular or local high-value areas - ROS changes from Roded Natural to Rural for the East Glacier Trail, Powerline Trail, Moraine Ecology Trail, and Trail of Time - Encounters would increase in multiple areas for more than 15% and less than 80% of the primary use season	Moderate Effect Similar to Alternative 2	Minor Effect - Number of encounters would increase in a few areas - Additional facilities would allow visitors to spread out from high traffic areas - More encounters experienced less than 15% of the primary use season

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Recreation	Scenic Resources	Negligible Effect - No altering of the native environment - Unsubstantial scenic impacts from crowds	Major Effect - Infrastructure proposals would decrease scenic integrity from high to low in portions of the MGRA to accommodate recreation and interpretive developments. - Noticeable impacts to the viewshed from various locations as a result of infrastructure development along the Lakeshore, such as the Welcome Center, Lakeshore Trail, boats and boat docks, and overtime the Remote Glacier Visitor Area	Major Effect Similar to Alternative 2	Moderate Effect Some new infrastructure would be visible from a few areas within the MGRA that have a high existing scenic integrity and scenic integrity objectives
Recreation	Operational Noise	Minor Effect - Gradual increases in operational noise (buses, vehicles, crowds) - Traffic and congestion along Glacier Spur Road likely during primary use season - Peak noise around the Visitor Center parking area and adjacent trails	Moderate Effect - Seasonal construction noise possible for 5 to 10 years - Substantial increases in noise from more buses, vehicles, and visitors - More noise with bus loading oriented close to Steep Creek - As many as 30 buses loading an hour during peak use - Noise expected from boat motors and propellers	Minor Effect - Seasonal construction noise possible for 5 to 10 years - Some increases in noise from more buses, vehicles, and visitors - Less noise near Steep Creek with bus loading situated farther east - Minimal noise from electric boat engines	Minor Effect - Seasonal construction noise possible for 5 to 10 years - Some increases in noise from more buses, vehicles, and visitors - Less noise near Steep Creek with bus loading situated farther east

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Watersheds, Wetlands, and Aquatic Habitat	Wetlands and Waterbodies	Minor Effect Ongoing disturbances in wetlands from visitors going off established or user-created trails	Moderate Effect - Permanent impacts to approximately 15.7 acres of wetlands and waters - Additional temporary disturbances from construction - Zig Zag Pond filled entirely (20,000 sq ft)	Moderate Effect - Permanent impacts to approximately 13.8 acres of wetlands and waters - Additional temporary disturbances from construction - Part of Zig Zag Pond filled (2,500 sq ft)	Minor Effect - Permanent impacts to approximately 4.6 acres of wetlands and waters - Additional temporary disturbances from construction - Part of Zig Zag Pond filled (2,500 sq ft)
Watersheds, Wetlands, and Aquatic Habitat	Essential Fish Habitat (EFH)	Salmon spawning and rearing conditions in Steep Creek may continue declining from limited spawning gravels	- EFH Assessment determination: permanent and adverse effects to EFH - Zig Zag Pond filled entirely (20,000 sq ft) - Restoration of fish habitat in Steep Creek and connection to Backside Pond established	- EFH Assessment determination: permanent and adverse effects to EFH - Part of Zig Zag Pond filled (2,500 sq ft) - Restoration of fish habitat in Steep Creek and connection to Backside Pond established	- EFH Assessment determination: permanent and adverse effects to EFH - Part of Zig Zag Pond filled (2,500 sq ft) - Restoration of fish habitat in Steep Creek and connection to Backside Pond established
Watersheds, Wetlands, and Aquatic Habitat	Riparian Management Areas (RMAs)	Negligible Effect - No measurable impacts to RMAs - Ongoing disturbances to riparian areas from visitors going off established or user-created trails	Minor Effect Permanent impacts to approximately 12 acres of RMAs	Minor Effect Permanent impacts to approximately 9 acres of RMAs	Minor Effect Permanent impacts to approximately 6 acres of RMAs

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Watersheds, Wetlands, and Aquatic Habitat	Stream/Water Crossings	Ongoing disturbances to streams from visitors going off established or user-created trails	19 stream crossings over Class I or II streams 15 stream crossings over Class III or IV streams 12 crossings over existing ponds or sections of Mendenhall Lake	20 stream crossings over Class I or II streams 15 stream crossings over Class III or IV streams 7 crossings over existing ponds or sections of Mendenhall Lake	6 stream crossings over Class I or II streams 14 stream crossings over Class III or IV streams 8 crossings over existing ponds or sections of Mendenhall Lake
Watersheds, Wetlands, and Aquatic Habitat	Water Quality	Negligible Effect - Water quality throughout most of the MGRA likely to remain high - Water quality could gradually degrade adjacent to Glacier Spur Road and Visitor Center Unit parking areas from increased traffic and visitor use	Minor Effect - Approximately 9 acres of new impervious surfaces, potentially impacting nearby several Class I, II, and III streams - Additional traffic could contribute to adverse water quality conditions - Stormwater management would limit water quality impacts from parking area - Water quality could be impacted from the addition of motorized boats, and initial and periodic maintenance dredging on Mendenhall Lake	Minor Effect - Approximately 6.7 acres of new impervious surfaces, potentially impacting nearby several Class I, II, and III streams - Additional traffic could contribute to adverse water quality conditions - Stormwater management would limit water quality impacts from parking area - Minimal risks of impacts to water quality from operating electric boats - Water quality could be impacted by initial and periodic maintenance dredging on Mendenhall Lake	Negligible Effect - Approximately 3.4 acres of new impervious surfaces, potentially impacting nearby several Class I, II, and III streams - Stormwater management would limit water quality impacts from parking area - Additional traffic could contribute to adverse water quality conditions

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Watersheds, Wetlands, and Aquatic Habitat	Flood Events and Floodplains	Glacial outburst flooding continuing to cause periodic trail closures	- Alteration of Steep Creek’s existing floodplain - Short (400-foot-long) trail segment located in FEMA-designated floodplain - Estimated 3 miles of new trails susceptible to flooding during heavy rain events and/or glacial outburst flooding causing periodic trail closures	- Similar to Alternative 2 2.8 miles of trails susceptible to flooding	- Similar to Alternative 2 2.3 miles of trails susceptible to flooding
Heritage^a	Historic and/or Cultural Resources	- No ground-disturbing activities or change in management and capacity and has the least potential to affect existing heritage resources - Historic properties within the APE would continue to be affected by natural processes and existing (and increasing) visitation and recreation use	- Impacts to heritage resources, including visual and setting impacts at historic sites, from increased capacity, visitation, and accessibility in the Visitor Center Unit - Greatest increase in capacity and commercial use allocations and would have the greatest potential for visitor-induced damage to historic properties	- Impacts to the viewshed of historic properties would be slightly reduced in this alternative from changes to the Welcome Center Complex area and shift of the Lakeshore Trail - Welcome Center Dock and West Glacier Dock would be more visually impactful to historic sites	Visual and setting impacts at historic properties would be reduced without the amphitheater, boats, boat docks, and the Remote Glacier Visitor Area

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Air Quality	Local Air Quality	Negligible Effect - Air quality would generally be within the “good” air quality indicator (AQI) category for criteria pollutants - Traffic congestion would continue on high-volume days, with vehicles waiting along Glacier Spur Road	Minor Effect - On the busiest days, the MGRA would see an additional 150 round trip bus trips - On the busiest days, particulate matter (PM₁₀) levels could rise another to 29 micrograms per cubic meter (µg/m³) on busy days, maintaining a “good” AQI - No measurable air quality impacts expected from boats powered by alternative fuel	Minor Effect - On the busiest days, the MGRA would see an additional 60 round trip bus trips - On the busiest days, daily PM₁₀ levels could rise to 24 µg/m³ on busy days, maintaining a “good” AQI - No measurable air quality impacts expected from boats powered by electricity	Minor Effect - On the busiest days, the MGRA would see an additional 45 round trip bus trips - On the busiest days, 24-hour PM₁₀ levels would rise to an estimated 23 µg/m³, maintaining a “good” AQI

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Climate Change^b	Flooding	• Potential for glacial flood outburst events for the next 10 to 20 years to scour salmon fry, cause shorebird and seabird nest failures, damage to historic resources, and inundation and damage to trail and facilities near the lakeshore • Increased precipitation, predominantly in the form of rainfall • Mendenhall Glacier is receding and will become land terminating, eventually retreating out of view of MGRA infrastructure	• Similar to Alternative 1; but greater potential for facility damage from flooding along the lakeshore	• Similar to Alternative 2	• Similar to Alternative 2
Climate Change^b	Greenhouse Gas Emissions	• Heating the Visitor Center would be expected to produce 59 tons of carbon dioxide (CO₂) • Annual visitor transportation emissions would be approximately 1,334 tons of CO₂	• LEED Silver rating for the Welcome Center • Annual visitor transportation emissions would be approximately 2,244 tons of CO₂ • Annual emissions alternative fuel powered boats would be less than 500 tons of CO₂	• LEED Silver rating for the Welcome Center • Annual visitor transportation emissions would be approximately 1,927 tons of CO₂ • Annual emissions electric powered boats would be less than 1 ton of CO₂	• LEED Silver rating for the Welcome Center • Annual visitor transportation emissions would be approximately 1,777 tons of CO₂

Resource	Impact	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3	Alternative 4
Socioeconomics	Traffic	Negligible Effect - Glacier Spur Road averages 80 buses daily during the summer - Consistent levels of traffic and subsequent wear on Mendenhall Valley roadways	Moderate Effect - Glacier Spur Road may average 120 buses daily during the summer - Less than 1% increase in total vehicles on Mendenhall Loop Road	Moderate Effect - Glacier Spur Road may average 96 buses daily during the summer - Less than 1% increase in total vehicles on Mendenhall Loop Road	Minor Effect - Glacier Spur Road may average 92 buses daily during the summer - Less than 1% increase in total vehicles on Mendenhall Loop Road
Socioeconomics	Local Economy	Moderate Effect - Short-term potential for economic support from increased local use and independent travelers - Long-term potential decline in economic support as the glacier recedes out of view	Moderate Effect - Potential for short-term job growth from construction - Long-term increased commercial and guiding opportunities from added food service, boat docks, and trail infrastructure	Moderate Effect - Potential for short-term job growth from construction - Long-term increased commercial and guiding opportunities from added food service, boat docks, and trail infrastructure	Minor Effect - Potential for short-term job growth from construction - Long-term increased commercial and guiding opportunities from added food service and trail infrastructure

^a An estimation of general effects to historic properties for each alternative shown here. Actual formal findings of effects would be undertaken through consultation and coordination with the State Historic Preservation Officer, Advisory Council of Historic Preservation, and tribal entities prior to implementation of any project component and use the Programmatic Agreement. See Section 3.9 for details.

^b As per CEQ final guidance on consideration of greenhouse gas emissions and climate change in NEPA reviews, conclusions are not provided as to whether an effect or impact is negligible, minor, moderate, or major in this analysis (CEQ 2016). See Section 3.11 for details.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter provides the relevant baseline of the physical, biological, social, and economic environment within the project area and the potential effects to the existing environmental conditions by the implementation of project alternatives. Information presented in this chapter is the scientific and analytical basis for the comparison of alternatives. This chapter is organized by resource-based issues, as identified in Chapter 1.

3.2 Analyzing Effects

Chapter 3 describes each resource-based issue, beginning with an overview of that resource, description of the current conditions, and finally, a description of the environmental consequences that would result from each alternative. Current conditions serve as the baseline against which environmental impacts from the alternatives will be compared. Where applicable, the environmental consequences sections describe effects that are common to all alternatives followed by descriptions of effects that are unique to each alternative. The discussions include descriptions of measures that could be implemented to avoid, minimize, or mitigate impacts.

The issues presented were used to inform development of alternatives. Because it is important to compare the effects of the different alternatives in the context of these issues, measurement indicators were developed for each issue and are described in each resource section. Measurement indicators were chosen that are quantitative (where possible), predictable, responsive to the issue, and linked to cause-and-effect relationships.

3.2.1 Direct, Indirect, and Cumulative Effects

Environmental effects, impacts, or consequences include any modifications of, or changes in, the existing environment as a result of the action taken by the project. Effects disclosed in this chapter vary in degree and belong to multiple different categories. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and occur within the reasonably foreseeable future. Cumulative effects are caused by the incremental impact of the action in conjunction with other past, present, and reasonably foreseeable future actions. Past, present, and reasonably foreseeable future actions considered within the cumulative effects analysis include:

- A.J. Dock Cruise Ship Berth Expansion
- Back Loop Bridge and Dredge Lakes Trailhead Parking Area Improvements
- City and Borough of Juneau (CBJ) Dock Electrification
- Franklin Dock Floating Berth Improvements
- Juneau Commission on Sustainability (JCOS) Climate Action and Implementation Plan

- Juneau Trails Master Plan
- Helicopter Landing Tours on the Juneau Icefield
- Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements
- Mendenhall Campground Repaving
- Mendenhall Glacier Mineral Withdrawal
- Mendenhall Glacier Recreation Area (MGRA) East and West Glacier Trails Maintenance
- MGRA Hydropower
- MGRA Management Plan Revision – Commercial Guide, Outfitter, and Transport Services
- MGRA Point-to-Point Transport Special Use Permitting
- MGRA Visitor Center Maintenance
- Mendenhall Loop Road Capacity Improvements
- Mendenhall Loop Road Resurfacing: Egan Drive to Stephen Richards
- Montana Creek Master Plan
- Norwegian Cruise Ship Berth (Aak’w [Auke] Landing) Construction
- Nugget Creek Dam Removal
- Small Cruise Ship Dock Construction

3.3 Short-term Uses and Long-term Productivity

The National Environmental Policy Act (NEPA; 40 Code of Federal Regulations [CFR] 1502.16) requires the consideration of the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity. This involves the consideration of whether the Mendenhall Glacier Visitor Facility Improvements Project would sacrifice a resource value that might benefit the environment in the long-term for some short-term value to the public. In general, “short-term” is used here to refer to the construction period, while “long-term” refers to the operational life of the project and beyond.

Implementation of the action alternatives would result in short-term construction related uses and impacts that are described in detail in this chapter. Potential short-term impacts include ground disturbance and vegetation removal for construction access and safety of operations, disturbance to wildlife, temporary limitations to recreation access in some areas, increased air emissions, transport and use of hazardous materials (e.g., fuels and lubricants), water quality impacts, and increased ambient noise levels. Short-term impacts would be minimized through implementation of best management practices (BMPs) and mitigation measures intended to reduce environmental effects. Over the long term, these resources are expected to recover from any adverse short-term effects without a loss in productivity.

The short-term effects identified in this draft environmental impact statement would be offset by the improved recreational experience provided at the MGRA. Standards and guidelines provided

in Forest Service Manuals (FSM) and Handbooks (FSH), BMPs, project-specific design and mitigation measures, and adaptive management will be implemented to maintain the long-term productivity of natural resources.

3.4 Unavoidable Adverse Effects

Implementation of an action alternative may cause some adverse environmental effects that cannot be comprehensively mitigated or avoided. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of one of several other resources. Many adverse effects can be reduced, mitigated, or avoided by limiting the extent or duration of effects. The application of action alternatives and the outlined standards and guidelines, BMPs, project-specific design and mitigation measures, and adaptive management are all intended to limit the extent, severity, and duration of potential adverse effects. These unavoidable effects and applicable avoidance measures are discussed throughout the analysis provided in this chapter.

3.5 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as removal of iron ore or the extinction of a species. Irretrievable commitments are those that are lost for a period of time, such as the sustained loss of wetlands habitat from placement of fill for infrastructure or timber productivity in forested areas that are kept clear for use as a powerline right-of-way or road. Irretrievable commitments have the potential to be reinstated and reversed, whereas irreversible commitments cannot be reversed, except perhaps in the extreme long term (on a scale of hundreds of years).

Discussion and consideration of the environmental consequences for each alternative includes analysis of any irreversible or irretrievable effects that may result from the various project components. Some irretrievable losses may be expected from the project, such as losses of wetland productivity and aquatic habitat as a result of construction and expansion of paved parking areas, facilities, and trails proposed in the action alternatives. As described in the analysis of Watersheds, Wetlands, and Aquatic Habitat, Alternatives 2, 3, and 4 would permanently impact 15.7, 13.8, and 4.6 acres of wetlands, respectfully. Alternatives 2, 3, and 4 would also create 9.0, 8.3, and 4.2 acres, respectfully, of impervious surface, which is considered an irretrievable commitment of the soil resource. Further, implementation of the action alternatives would result in the consumption of energy and materials. Fossil fuels would be required for construction, operation, and maintenance of the project. Some of the materials used for the project, such as glass, concrete, asphalt, or metals, may be able to be recycled in the future if dismantled. However, some materials, like treated wood, would not be recyclable if the project were decommissioned. The raw materials and energy required for the manufacture of the non-recyclable materials would result in an irretrievable commitment of natural resources. No irreversible commitments are expected if design features, mitigation measures, and adaptive management are implemented as outlined.

3.6 Wildlife and Vegetation

3.6.1 Scope of the Analysis

This section includes a description of existing terrestrial wildlife and vegetation conditions within the MGRA, with a focus on species of interest. Species of interest include threatened, endangered, sensitive, and special status species; migratory birds and raptors; USDA Forest Service (Forest Service) management indicator species (MIS)¹; and other land mammals. Vegetation includes wildlife-specific habitat types, rare and sensitive plants, invasive species, and early successional species. A discussion of existing aquatic habitat, including fish species, is provided in Section 3.8. The spatial scope of this analysis encompasses all 5,800 acres of the MGRA. Cumulative analysis also includes the Forest Service Wildlife Analysis Area (WAA) 2515, which includes the Eagle River/Herbert River Valley and the Mendenhall Valley, and incorporates Value Comparison Units 270 and 290 (Tuttle 2014). The analysis extends 30 years into the future to encompass projected design capacity.

A Biological Evaluation (BE) was prepared for the proposed project to analyze potential effects on Federally-listed threatened and endangered species and Forest Service Region 10 (R10) sensitive species in the project area (Dunn 2022). ABR, Inc. – Environmental Research and Services (ABR) conducted a review of existing information regarding biological resources for the project to analyze species of interest or concern and habitat availability within the MGRA (ABR 2021). An Invasive Species Risk Assessment was prepared to analyze potential effects on invasive species infestations (Turner 2022). The following analysis includes a summary of these reports, which are also included in the project record.

3.6.2 Regulatory Setting

3.6.2.1 Federal Regulations

For activities that are Federally funded or that take place on Federal lands, there are laws, regulations, guidelines, and executive orders (EOs) that apply to wildlife and vegetation management. A partial list of applicable regulations is included below and summarized in Chapter 1.

- Endangered Species Act (ESA)
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- Alaska National Interest Lands Conservation Act (ANILCA)
- EO 13112 National Invasive Species Management Plan
- EO 13186 Responsibilities of Federal Agencies to Protect Migratory Birds

¹ MIS are a representative group of species whose population changes are believed to indicate the effects of land management activities. The health of an indicator species is used to gauge function of the habitat on which it depends.

3.6.2.2 Consistency with the 2016 Tongass Forest Plan

The 2016 Forest Plan outlines laws, regulations, and Forest Service policies to provide specific information on how threatened, endangered and sensitive species, MIS, and other wildlife and fish species will be managed on National Forest System (NFS) lands. Forest-wide desired conditions and objectives are included in Chapter 2 of the Forest Plan. The Forest is organized by land use designations (LUD) for management purposes. Each LUD has specific goals, objectives, desired conditions, and management prescriptions that are discussed in Chapter 3 of the Forest Plan. Forest Plan standards and guidelines in Chapter 4 provide direction for species and habitat management (USDA Forest Service 2016, pp. 4-15, 4-85 to 4-97). The 2016 Forest Plan final environmental impact statement (EIS) provides in-depth information on MIS, threatened, and endangered species (USDA Forest Service 2016a, pp. 3-118, 3-221 to 3-242, 3-257 to 3-292), migratory birds, and other species of concern (USDA Forest Service 2016a, pp. 3-242 to 3-250, 3-280 to 3-281).

3.6.2.3 Consistency with the MGRA Management Plan

The 1996 MGRA Management Plan, revised in 2015, establishes a desired future condition and management direction specific to the MGRA. The MGRA Management Plan states that the overall management direction for the MGRA is “to manage the area principally for recreation use while retaining the area substantially in its natural condition” (USDA Forest Service 1996).

The 1996 MGRA Management Plan final EIS emphasizes the importance of providing visitor opportunities for wildlife viewing while implementing additional protective measures if negative wildlife impacts are detected. The plan also directs Forest Service staff to consider new wildlife enhancement projects when planning for the future of the MGRA. Specific wildlife concerns mentioned in the MGRA Management Plan final EIS include the gull colony on the rock outcrop west of the glacial terminus and the shorebird and Arctic Tern nests along the Mendenhall Lake shoreline (USDA Forest Service 1996a).

3.6.3 Issues and Indicators

Issue Statement: *Proposed facility developments, increased visitor use, and changes in visitor distribution could adversely impact wildlife (particularly bears and migratory birds), reduce or alter habitat, and increase the potential for wildlife-human interactions.*

Issue Statement: *Proposed activities could introduce or spread invasive species such as reed canarygrass, impacting native plants and watershed condition, particularly within riparian areas and around the Dredge Lakes Unit.*

Issue Statement: *The proposed improvements could damage successional plant life near the glacier, thereby reducing diversity and slowing the natural succession pathways.*

Measurement Indicators:

- Evaluation of proposed facility development, increased visitor traffic, and associated disturbances within documented bear movements, migratory bird nesting areas, and other areas known to have significance for vulnerable life stages of wildlife populations
- Estimation of acres and location of lost or altered wildlife habitat and vegetation from proposed facilities and increased commercial use

- Evaluation of increased visitor traffic and acres of new facilities in proximity to known invasive species infestations
- Estimation of increase in visitor traffic and acres of facility development within high value early successional vegetation in the MGRA

3.6.4 Affected Environment

The analysis area is the MGRA which is located in Juneau’s Mendenhall Valley. Although located adjacent to suburban Juneau, the MGRA contains a diverse range of Southeast Alaskan habitats, from old-growth hemlock/spruce forest to muskeg, alder scrub, recently deglaciated terrain, and icefields. As the Mendenhall Glacier recedes, terrestrial habitats in the MGRA are gradually experiencing ecological succession. The changing habitat is primarily evident in areas exposed by the retreating glacier that are undergoing primary succession.

3.6.4.1 Threatened, Endangered, Sensitive, and Special Status Wildlife Species

The Forest Service conducted a BE for the MGRA in April 2020 to assess the presence of threatened or endangered species or their designated critical habitat listed under the ESA and R10 sensitive species designated by the Forest Service. There are no threatened or endangered species occurring within the MGRA. The only R10 sensitive animal species known or suspected to occur within the project area is the Queen Charlotte Goshawk (*Accipiter gentilis laingi*) (Dunn 2022). Bald Eagles (*Haliaeetus leucocephalus*) are a special status species (protected by the Bald and Golden Eagle Protection Act) that can be found year-round in the MGRA.

Queen Charlotte Goshawk

The Queen Charlotte Goshawk is an accipiter found year-round in Southeast Alaska. The United States (U.S.) Fish and Wildlife Service (USFWS) evaluated the distinct population segment found in Southeast Alaska in 2007 and 2012 and deemed a listing under the ESA unwarranted (72 Federal Register [FR] 216:63123 and 77 FR 148:45870; ABR 2021).

Queen Charlotte Goshawks use productive old-growth forests as primary habitat for nesting and foraging and non-productive forest types and young-growth forests secondarily. These types of habitats are gradually increasing within the MGRA through forest succession. Specifically, goshawks use wet needleleaf forest, Sitka spruce forest, western hemlock forest, and western hemlock Sitka spruce forest habitat types, and foraging habitat such as broadleaf shrub-spruce scrub forest and mesic Sitka spruce woodland habitat types within the MGRA (ABR 2021). Based on the habitat evaluation discussed below in Section 3.6.4.4, there are approximately 2,600 acres of existing moderate and high value goshawk habitat in the MGRA.

The MGRA is within an active goshawk nesting territory, which has been occupied regularly for the last 20 years (ABR 2021). In recent years, goshawks have been regularly seen by birders in multiple places including the Dredge Lakes Unit, near the Visitor Center, and around Skater’s Cabin. Multiple nests have been found during the past 20 years, including 2 in the Dredge Lakes Unit, 3 in the West Glacier Unit, and 2 along Nugget Creek adjacent to the MGRA (Figure 3-1; Dunn 2022). Nest location varies annually, and no nest has been known to be reused in consecutive years (Tuttell 2014). Goshawk fledglings have recently been observed using the West Glacier Unit.

Bald Eagles

Federally-protected Bald Eagles are common in Southeast Alaska and can be found foraging and nesting in coastal areas, including the MGRA and surrounding vicinity. In addition to Federal protection, Bald Eagles are a Forest Service R10 MIS. Bald Eagles primarily forage on fish and are attracted to the MGRA in July and August during the Sockeye Salmon run and in late October during the Coho Salmon run. Although not common, eagles have been observed hunting seabird nests within the MGRA and at Sheep Creek Falls southeast of downtown Juneau (ABR 2021).

There are roughly 4,000 acres of existing moderate and high value habitat (including Mendenhall Lake) available to Bald Eagles in the MGRA (ABR 2021). These raptors prefer riparian and shoreline areas and typically nest in large trees in the overstory of coastal spruce-hemlock forests. Although no Bald Eagle nests have been discovered within the MGRA, suitable nesting habitat is present. Nests have been found south of the MGRA near Montana Creek (ABR 2021). Bald Eagle nesting begins in February, and egg laying occurs from April to June followed by hatching and rearing until fledging takes place in the early fall (Tuttell 2014).

Impacts to Bald Eagles are discussed throughout the migratory bird effects section.

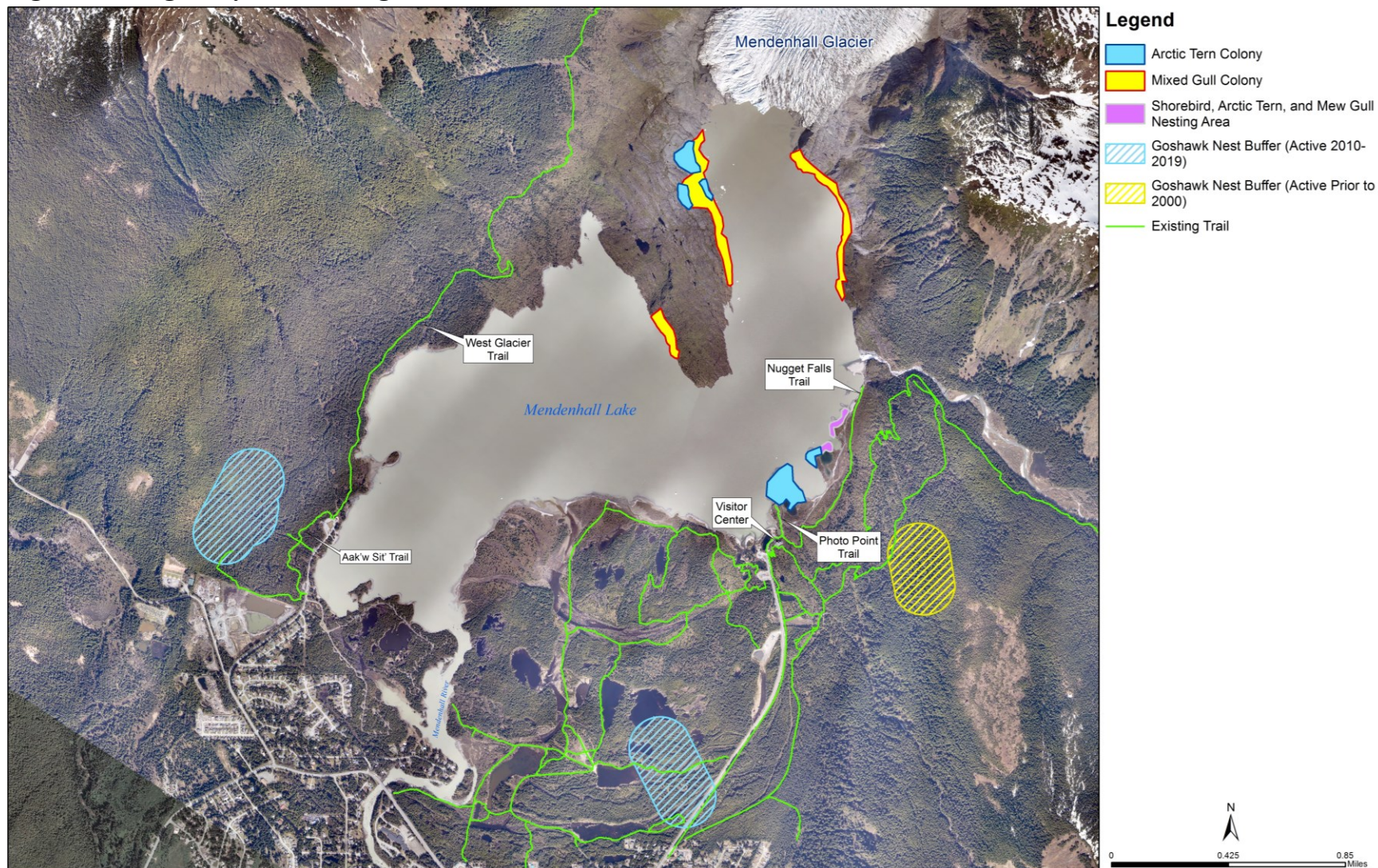
3.6.4.2 Migratory Birds

Migratory waterfowl, seabirds, shorebirds, and landbirds use several aquatic habitats in the MGRA for nesting, foraging, and as a migratory stopover. Within the MGRA approximately 160 bird species have been recorded on an annual basis, excluding vagrants and very rare species. This includes 2 special status bird species, 10 species of seabirds, 37 species of waterbirds (waterfowl, loons, grebes, cranes, and herons), 14 species of shorebirds, 15 species of raptors, and 82 species of landbirds (ABR 2021).

Concentrations of nesting migratory seabirds and shorebirds are found along the shores of Mendenhall Lake, near the Visitor Center Unit and in the Dredge Lakes Unit. Queen Charlotte Goshawks and Bald Eagles are discussed in Section 3.6.4.1. Migratory birds currently experience disturbances from humans and predation while using the MGRA, and are at risk of additional disruptions from contamination and climate change which are described in detail in ABR 2021.

A map of common migratory bird nesting areas in the MGRA is provided below (Figure 3-1).

Figure 3-1. Migratory Bird Nesting Areas Within the MGRA



Seabirds

Seabirds, including Arctic Terns (*Sterna paradisaea*), Herring Gulls (*Larus argentatus*), Glaucous-winged Gulls (*L. glaucescens*), and Mew Gulls (*L. canus*), have been observed returning to the MGRA during nesting season for many years. Tern nesting season is late April through mid-July; gull nesting season is longer and overlaps with tern nesting, typically from late March until late September. Seabird nesting sites within the MGRA include the shoreline of Mendenhall Lake and close to the glacier face (USDA Forest Service 2018). Historic colonies, including Tern Island near Skater's Cabin, have increasingly dense vegetation growth, and nesting has relocated to other locations within the MGRA to follow glacial recession (ABR 2021).



Nesting Arctic Terns at Photo Point

Based on the habitat evaluation discussed below in Section 3.6.4.4, there are approximately 1,600 acres of existing moderate and high value habitat available to Arctic Terns in the MGRA. Two main tern colony locations exist in the MGRA: one near Photo Point Trail by the Visitor Center and the other downslope from the West Glacier Trail (ABR 2021). From 2003 to 2019, high counts of adult terns on Mendenhall Lake ranged from 40 to 100 birds, which includes many non-breeding birds. Returns of Arctic Terns in 2018 were lower than the 15-year average, likely from a growing predation from wolves and incidental human disturbance at the recreation area (Baluss 2018).

The total annual number of nesting gulls (all species) at Mendenhall Lake ranges from 600 to 700 individuals (ABR 2021). Large numbers of Glaucous-winged and Herring Gulls nest in mixed colonies along cliff habitats above the shore of Mendenhall Lake. Populations of these two species have been stable to increasing from 2008 to 2018, likely due to an adequate nearby food source (salmon runs), large colony population, and relative lack of human disturbance

(ABR 2021). Mew Gulls are present in smaller numbers. In 2018, 5 to 6 Mew Gull nests and around 12 gull adults were observed close to Arctic Tern nests near the West Glacier Spur Trail. Similar to terns, Mew Gulls appear to be facing challenges from wolf predation (ABR 2021).

Waterbirds

Waterbirds are found in Mendenhall Lake, in ponds and lakes within forested habitats, in newly exposed rock ponds near the glacier's terminus, and in fast-moving, perennial clearwater streams during breeding and nesting. Mallards often nest in the West Glacier Unit near ponds in newly exposed rock near the face of Mendenhall Glacier and in wetlands and over water within the MGRA. Barrow's Goldeneyes (*Bucephala islandica*) typically nest in cavities within 1.2 miles of freshwater. Common Mergansers (*Mergus merganser*) are often found in larger ponds, Steep Creek, and Mendenhall Lake. Harlequin Ducks (*Histrionicus histrionicus*) likely nest along fast-moving clearwater streams in the recreation area, such as Steep Creek and Dredge Creek, and Wesley Creek in the West Glacier Unit. Great Blue Herons (*Ardea Herodias*) are relatively uncommon overall and are not known to breed in the MGRA but have been observed in Steep Creek (Meadow Pond) and Kettle and Zig Zag Ponds. Although Vancouver Canada Geese (*Branta canadensis*) would not be expected to overwinter in the MGRA, there is suitable available habitat for nesting and foraging within dense forests and forest openings. Based on representative waterbird species, Great Blue Herons and Vancouver Canada Geese, there are approximately 4,000 acres of existing moderate and high value habitat available to waterbirds in the MGRA. Various species of waterfowl use the MGRA during spring and fall migration, but do not nest in the area (ABR 2021).

Shorebirds

Shorebird species observed regularly in the MGRA include Killdeer (*Charadrius vociferus*), Semipalmated Plover (*Charadrius semipalmatus*), Wilson's Snipe (*Gallinago delicata*), Spotted Sandpiper (*Actitis macularius*), and Solitary Sandpiper (*Tringa solitaria*) (ABR 2021). The shorebird breeding season typically lasts from early May through mid-August and nests are most common near the Visitor Center, but are also observed along the Mendenhall Lake shoreline and wetlands in the Dredge Lakes and West Glacier Units.

Landbirds

Many landbirds are found in the MGRA. Landbirds that could be impacted by the proposed project include Belted Kingfisher (*Megaceryle alcyon*), American Dipper (*Cinclus mexicanus*), and Rusty Blackbird (*Euphagus carolinus*). Belted Kingfishers regularly forage for fish in glacial moraine ponds, at the mouth of Steep Creek, and in the Mendenhall River at the lake outlet and have been observed in the Dredge Lakes Unit on Moose and Loon lakes; however, they are not known to breed in the MGRA. American Dippers are commonly observed foraging along Steep Creek and nests have been observed along Steep and Nugget Creeks and an unnamed creek south of the Mendenhall Glacier face. Although Rusty Blackbirds are known breeders in the MGRA and are present annually in the MGRA during the breeding season, there are no recent records of nests in the area. Historical blackbird nesting sites have centered around the Dredge Lakes Unit, particularly at Loon Lake. Based on representative landbird species known to regularly occur in old growth type forests (Red-breasted Sapsucker [*Sphyrapicus ruber*], Hairy Woodpecker [*Dryobates villosus*], and Brown Creeper [*Certhia americana*]), there are at least 2,600 acres of existing moderate and high value habitat available to landbirds in the MGRA (ABR 2021).

3.6.4.3 Management Indicator Species and Other Wildlife

Under the 2008 Tongass Land and Resource Management Plan Amendment, the Forest Service considered 13 terrestrial MIS for analysis within the Tongass National Forest. All terrestrial MIS could occur within the project area (USDA Forest Service 2016a, p. 3-320). MIS and habitat descriptions are provided below in Table 3-1.

Certain MIS were selected for additional analysis within this draft EIS. Black bears, mountain goats, and wolves were selected due to their reliance on habitat around the proposed facilities and importance for wildlife viewing within the MGRA, and Bald Eagles were considered given that they are a special status species. Black bears, mountain goats, and wolves are discussed below. Bald Eagles are discussed above in Section 3.6.4.1.

Table 3-1. Management Indicator Species with Potential to Occur in the Analysis Area

Species	Potential Occurrence in Analysis Area	MGRA Habitat Use
Black Bear <i>Ursus americanus</i>	Often in spring, summer and fall	Wide range of habitats; prefer estuarine, riparian, and forested habitats in coastal areas; found foraging on salmon and berries at lower elevations during late summer and early fall
Mountain Goat <i>Oreamnos americanus</i>	Present year-round	Prefer alpine and subalpine areas; often found on rocky outcrops and at higher elevations, and forage in alpine meadows and in the winter, old growth forests
Bald Eagle <i>Haliaeetus leucocephalus</i>	Present year-round	Key habitats include riparian and shoreline areas, in proximity of areas to forage on fish; nests are typically in large trees in coastal spruce-hemlock forests
Brown Bear <i>Ursus arctos</i>	Rare in spring, fall and summer	Habitat generalists, found from the coastline to alpine areas; concentrated around low elevation valleys and salmon streams in the later summer and early fall
Sitka Black-tailed Deer <i>Odocoileus hemionus sitkensis</i>	Occasional, present year-round	Wide range of habitats; prefer lower elevation productive old-growth forests in the winter, and young growth stands (<25 years-old) and other non-forested habitats for foraging during non-winter months
American Marten <i>Martes americana</i>	Present year-round	Prefer coastal areas, riparian habitat, and upland forests below 1,500 feet; old-growth forests provide denning habitat and scavenging opportunities and young-growth forests provide supplemental habitat
River Otter <i>Lutra canadensis</i>	Year round	Associated with coastal and freshwater aquatic environments and adjacent uplands; values old-growth forests for canopy cover, large diameters trees and snags, borrows, and den sites
Alexander Archipelago Wolf <i>Canis lupus ligoni</i>	Occasional, present year-round	Generally observed in remote areas of the MGRA, often in the West Glacier Unit and near the glacier terminus; typically occupy old-growth forests at low elevations, habitat dependent on prey availability
Red Squirrel <i>Tamiasciurus hudsonicus</i>	Present year-round	Prefer productive old growth forests and young-growth stands capable of cone production; nest and den in tree cavities and snags
Red-breasted Sapsucker <i>Sphyrapicus ruber</i>	Most common in spring and summer	Landbird; nest and breed in old growth forests, likely within the MGRA possibly year-round; prefer habitat with large diameter old growth trees and snags
Hairy Woodpecker <i>Dryobates villosus</i>	Most common in spring and summer	Landbird; nest and breed in old growth forests, likely within the MGRA possibly year-round; prefer habitat with large diameter old growth trees and snags
Brown Creeper <i>Certhia americana</i>	Present year-round	Landbird; nest and breed in old growth forests, likely within the MGRA possibly year-round; prefer habitat with large diameter old growth trees and snags
Vancouver Canada Goose <i>Branta canadensis</i>	Most common in spring and summer	Waterbird; nest and forage in dense forest habitat in the MGRA; overwinter in marine intertidal habitats outside the MGRA

Source: USDA Forest Service 2016a, pp. 3-230 to 3-242

Black Bears

Black bears are common at the MGRA. The estimated density of black bears is approximately 1.5 bears/square mile within the Alaska Department of Fish and Game (ADF&G) Game Management Unit (GMU) 1C², which encompasses the MGRA; however, bear density near the recreation area is likely higher because of available nearby human food sources. Based on the habitat evaluation discussed below in Section 3.6.4.4, there are approximately 3,500 acres of moderate and high value black bear habitat in the MGRA. Most bears observed in the MGRA have ranges extending beyond the recreation area boundaries, and the bear population has the potential to expand as the glacier recedes and more foraging habitat emerges.

Based on bear surveys in 2009, 2011, and 2019, bear use within the MGRA likely ranges between 9 and 15 individual bears. According to these surveys, most bears in the area are females, often with cubs, who have likely become somewhat habituated to the consistent human presence. Male bears are scarce within the MGRA, typically visiting the recreation area during periods of lower visitor use and in areas with less visitor traffic (i.e., in the proximity of Dipper Falls). Female bears are attracted to the area in part because of the scarcity of male bears (ABR 2021).

Bear congregation areas within the MGRA change seasonally. Bears are often observed foraging for black cottonwood catkins along Nugget Falls Trail and the lakeshore in the spring. Bears concentrate along Steep Creek in mid-summer and early fall, fishing on spawning salmon along the length of the creek upstream to Dipper Falls. Other bear attractants include northern ground cones in forested parts of the Visitor Center and Dredge Lakes Units and grasses and sedges along the lakeshore and area wetlands throughout the summer.

An important black bear travel corridor exists between Nugget Falls and Steep Creek (on both sides of Glacier Spur Road). Bears often follow Steep Creek north or enter the Visitor Center parking area from the Nugget Falls Trail and exit south along the Powerline Trail. Bears have also been observed transiting the Visitor Center facilities from the East Glacier Trail or Powerline Trail and exiting along the Moraine Ecology Trail, and vice versa. Bear movements through the Steep Creek and Visitor Center areas include frequent crossings of Glacier Spur Road, most often near Steep Creek (ABR 2021).

Some high use bear areas conflict with highly popular visitor locations, including: the pavilion, the Visitor Center access ramp, the metal stairs to Steep Creek Trail from the main parking lot north of Zig Zag Pond, the beach access by the Visitor Center, the intersection of Photo Point and Nugget Falls Trails, the gates to the seasonal Steep Creek Trail closure by Zig Zag Pond, the road crossing by Zig Zag Pond, and the Dipper Bridge on the Trail of Time (Figure 3-2; USDA Forest Service 2020). Visitor use of these areas can impede bear movements and safe access to seasonal food resources in areas of the Visitor Center Unit with high value foods (cottonwoods along the lakeshore and salmon runs in Steep Creek). Overlapping bear and human use areas can also create safety issues for both bears and humans and have led to recent adverse bear-human interactions within the MGRA (ABR 2021).

² ADF&G GMU 1C encompasses nearly all of the City and Borough of Juneau (with the exception of Hawk Inlet on Admiralty Island), most of the Chilkat Range, and most of Glacier Bay National Park.

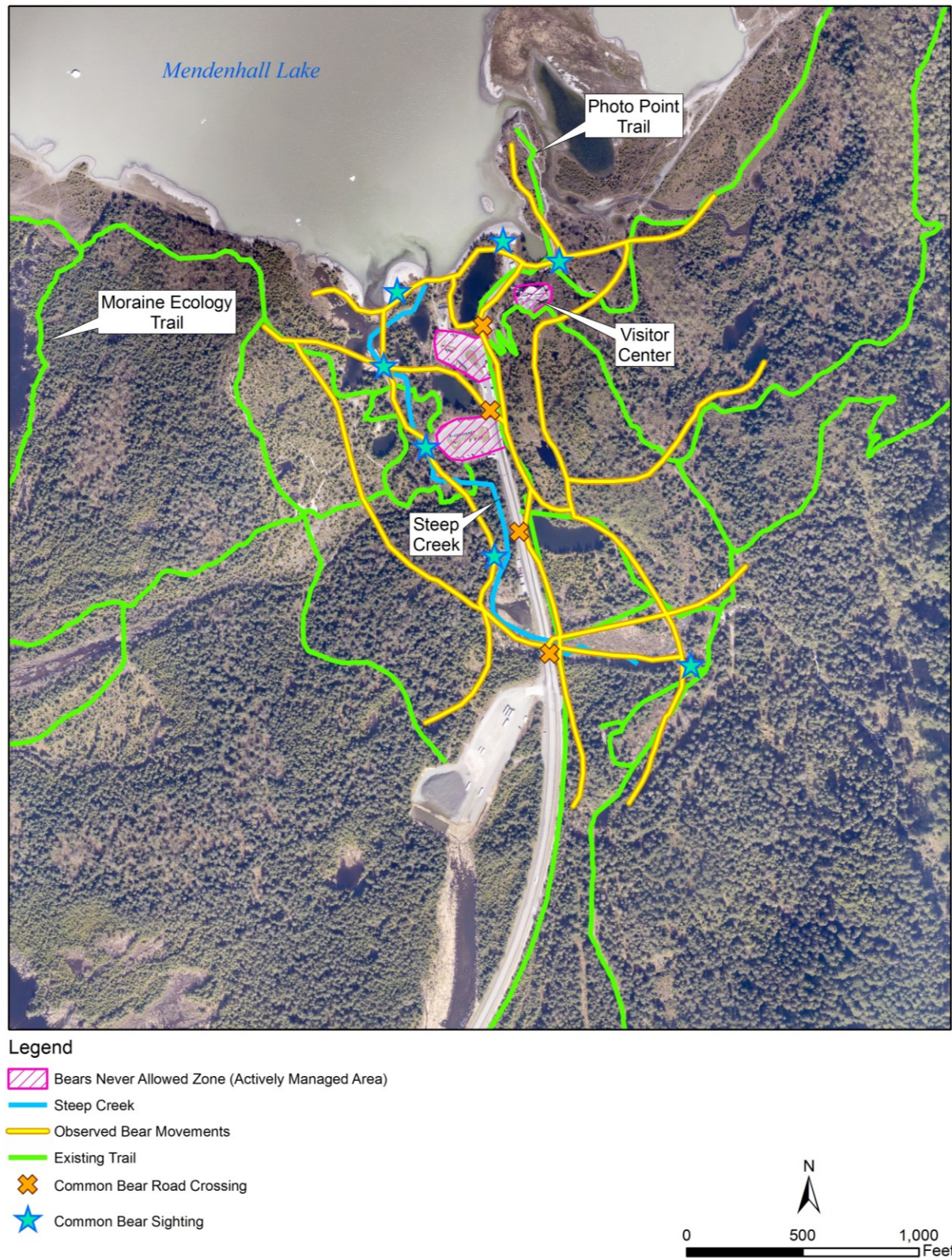


Sow and cub using an active visitor area, adjacent to the Visitor Center. USDA Forest Service photo by Amber DeBardelaben

Active management of bear-human interactions occurs within the MGRA to reduce adverse interactions. The Forest Service maintains no-bear zones at the parking lots, around the Visitor Center, and other places where bears are hazed away by Forest Service Rangers. Some trail areas are closed during periods of high bear use in the summer. Bear-vehicle collisions have occurred along Glacier Spur Road. In an effort to reduce vehicle speeds and improve safety, speed humps were added to Glacier Spur Road in 2014. The Forest Service also enforces a no-food zone for the Visitor Center Unit, with the exception of designated food areas at the pavilion and inside the Visitor Center. However, bears are attracted to these food-designated areas in the Visitor Center Unit and to campsite attractants such as food and trash within the Mendenhall Campground (ABR 2021).

Additional analysis of bears within the MGRA can be found in the Biological Resources Review available on the project website (ABR 2021).

Figure 3-2. Bear Movements near Visitor Center^a



^a Information used to prepare this figure may be subjective since it is influenced by most data being collected in high visitor use and Forest Service staff activity areas.

Mountain Goats

Mountain goats (*Oreamnos americanus*) are common in the MGRA, but generally frequent areas with low visitor use directly adjacent to the Mendenhall Glacier. Their selected habitat changes seasonally. Mountain goats prefer alpine areas to avoid predators such as wolves and bears during kidding season and in the summer, and are often seen on high cliffs and near steep slopes on Mount McGinnis and Mount Bullard (USDA Forest Service 2018). During the winter months, goats prefer forested habitat at lower elevations (1,000 to 1,500 feet) with large tree canopies capable of intercepting snowfall and providing shallower snow depths (USDA Forest Service 2017). Goats are known to eat lichens and other early successional species and have been seen more frequently in recent years foraging within successional forest habitat north of Nugget Falls.

ADF&G reports that goat populations are at medium to high densities in GMU 1C and populations appear healthy (Scott 2014). Goats will likely become more prevalent in the lower portions of the MGRA as the glacier recedes.

Wolves

Alexander Archipelago wolves (*Canis lupus ligoni*) inhabit remote parts of the MGRA. Although rarely observed in person by visitors or staff, evidence of wolves suggest they are most common in the West Glacier Unit, near the glacier terminus, and Nugget Creek. There are no known wolf den sites within the MGRA, but wolves have been documented in the West Glacier Unit preying on seabird nests (Tuttell 2014). Wolf habitat is prey dependent. Other wolf prey includes deer and moose and occasionally mountain goats and salmon. ADF&G reports that the wolf population in GMU 1C is secure but fluctuates based on prey abundance (Churchwell 2021).

Other Land Mammals

Beavers (*Castor canadensis*) are common in the MGRA and influence the area by using riparian habitats, blocking man-made structures, affecting salmon spawning habitat, and building natural dams that contribute to unpredictable flooding (USDA Forest Service 2018). There are about a dozen beaver ponds connected to the south shore of Mendenhall Lake (ABR 2021). Currently, most beaver activity is within the Dredge Lakes Unit. Some beaver dams have disrupted the flow of Steep Creek and have been removed by the Forest Service to improve fish passage (Schneider 2012).

Other land mammals that occur in the MGRA include lynx, ermine, porcupine, marten, otter, snowshoe hare, little brown bat, and several species of voles.

3.6.4.4 Vegetation

Generally, the MGRA is located on coarse, flat outwash and alluvial sediments from the Mendenhall Glacier. As the Mendenhall Glacier recedes, leaving behind recently-deglaciated terrain, early successional plants become established near the glacier terminus. Early successional communities gradually transition from pioneer species (such as lichen, moss, fireweed, and yellow dryas) to willow and alder shrub dominant before becoming a young forest supporting broadleaf trees and spruce saplings (20 to 100 years). Eventually, succession progresses to mature and then climax or old-growth forest conditions (more than 100 years) dominated by Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*) trees (ADF&G 2001). Currently, approximately 14 percent of the MGRA, approximately 750 acres, is early successional vegetation, of which 10 percent is willow and alder shrub dominant.

Additionally, 46 percent of the MGRA consists of more mature forest vegetation, approximately 3,800 acres (ABR 2021). The rate of glacial recession has increased in the past 20 years, rapidly increasing the area of newly-exposed soils and pioneer plant communities (USDA Forest Service 2018).

The following general plant communities occur in the project area: conifer forest, mixed conifer/hardwood forest, open forest, forest edge, alder and willow scrub, areas dominated with mosses and lichens, rocky areas, rock outcrops, ridge tops, cliffs, riparian areas, and lakes and ponds (USDA Forest Service 2010). Slopes of the western side of the MGRA are covered with alder, sapling trees, and scattered herbs and moss (USDA Forest Service 2010). The recreational trails in the MGRA are primarily located in mixed coniferous/deciduous forests and cross riparian and lake margin areas. Elements of the southern Visitor Center Unit and most of the Dredge Lakes Unit are dominated by riparian vegetation.

Threatened, Endangered, Rare, and Sensitive Plants

There are no Federally listed or proposed threatened or endangered plants under the ESA known to occur on the Tongass National Forest (USDA Forest Service 2016, p. 4-39). There are no known colonies of rare or sensitive plants recognized by the Forest Service's R10 Sensitive Species list within the MGRA. However, the MGRA contains suitable habitat for the following R10 sensitive species: moosewort fern (*Botrychium tunux*), spatulate moonwort fern (*Botrychium spathulatum*), and mountain lady's slipper orchid (*Cypripedium montanum*). These species are suspected to occur within the project area (Dunn 2022).

These species could be found in various parts of the MGRA. Suitable habitat for moosewort fern includes well drained sandy, gravelly open areas and alpine areas. Habitat for spatulate moonwort fern includes well-drained open areas and roadsides, and subalpine and alpine areas. Mountain lady's slipper orchid habitat includes open forest and areas with calcareous soils or substrate (Dunn 2022).

Invasive Species

Invasive species in Alaska are ranked based on the level of threat each poses to existing habitat and native plant species in order to prioritize control efforts and resources. The ranking system, developed by the Alaska Center for Conservation Science's Alaska Natural Heritage Program in cooperation with the Forest Service and others, is based on ecological impacts, biological characteristics, distribution, and feasibility of control to give each species a score out of 100, with 100 being the most invasive (Carlson et al. 2008). Invasiveness ranks were updated in 2011 (Nawrocki et al. 2011). Invasive species were grouped into six leveled categories. Species with scores greater than 80 were considered "extremely invasive" and scores 70 to 79 are "highly invasive", both of which are estimated to be threatening to Alaskan ecosystems. Species with scores 60 to 69 and 50 to 59 are labeled "moderately invasive" and "modestly invasive", respectively. These pose threats to natural ecosystems but are not as likely to successfully invade or cause major impacts. Scores below 50 are labeled "weakly invasive" and are generally not considered to have much potential to invade or pose a threat to ecosystems or habitats.

Based on invasive plant surveys conducted throughout the MGRA, there are 24 invasive species found in the MGRA (Table 3-2). Many of these have been identified in all units of the MGRA. A majority (19) of the invasive species identified in the MGRA have invasiveness ranks below 60 (moderately invasive), and 9 of those ranked below 50 (weakly invasive). Only one species in the MGRA, reed canarygrass (*Phalaris arundinacea*), has an invasiveness ranking above 80 and

is considered to be extremely invasive. Reed canarygrass has been found within riparian areas in all three units of the MGRA and is most prevalent in the Dredge Lakes Unit (Turner 2022).

The Forest Service has been managing multiple invasive species infestations within the MGRA. Approximately 2.7 acres of reed canarygrass throughout the Dredge Lakes Unit have been identified for herbicide (glyphosate) treatment. This treatment program is in alignment with the Northern Tongass Integrated Weed Management decision and is being conducted as part of a multi-year cooperative agreement with the Southeast Alaska Watershed Coalition. The infestation is most concentrated around Moose Lake, Crystal Lake, Moraine Lake, and the snow storage facility at the south end of the overflow parking lot (USDA Forest Service 2021).

Since 2016, a half-acre infestation of oxeye daisy (*Leucanthemum vulgare*) at two sites near the Visitor Center has undergone treatment annually using hand pulling. The infestation appears to be isolated and there has been no evidence that it is spreading over the duration of treatment (USDA Forest Service 2022a). Since 2018, the Forest Service has been conducting an ongoing treatment of a 0.2-acre infestation of orange hawkweed (*Pilosella aurantiaca*) also near the Visitor Center, by hand pulling (USDA Forest Service 2021b). However, the infestation appears to be spreading from the initial contamination site. Less than 0.1 acres of purple foxglove (*Digitalis purpurea*) at the Nugget Falls Trail was treated in 2016 (Turner 2022).

Possible vectors for spread of invasive species in the MGRA include past facility projects, existing visitor use, and ongoing maintenance operations. Development of user-created trails and off-leash dogs also can introduce and spread invasive plants.

Table 3-2. Invasive Species Found in the MGRA^a

Common Name	Scientific Name	Invasiveness Rank ^b	Infested Acres
Reed Canarygrass	<i>Phalaris arundinacea</i>	83	2.7
Orange Hawkweed	<i>Hieracium aurantiacum</i>	79	0.2
Creeping Buttercup	<i>Ranunculus repens</i>	72	<0.1
Oxeye Daisy	<i>Leucanthemum vulgare</i>	61	0.5
Tall Buttercup	<i>Ranunculus acris</i>	60	<0.1
White Clover	<i>Trifolium repens</i>	59	<0.1
Common Dandelion	<i>Taraxacum officinale</i>	58	<0.1
Alsike Clover	<i>Trifolium hybridum</i>	57	<0.1
Timothy	<i>Phleum pratense</i>	54	<0.1
True Forget-Me-Not	<i>Myosotis scorpioides</i>	54	<0.1
Orchardgrass	<i>Dactylis glomerata</i>	53	<0.1
Kentucky Bluegrass	<i>Poa pratensis</i>	52	<0.1
Italian Ryegrass	<i>Lolium perenne ssp. multiflorum</i>	52	<0.1
Meadow Foxtail	<i>Alopecurus pratensis</i>	52	<0.1
Purple Foxglove	<i>Digitalis purpurea</i>	51	<0.1

Common Name	Scientific Name	Invasiveness Rank ^b	Infested Acres
Curly Dock	<i>Rumex crispus</i>	48	<0.1
Annual Bluegrass	<i>Poa annua</i>	46	<0.1
Common Plantain	<i>Plantago major</i>	44	<0.1
Common Chickweed	<i>Stellaria media</i>	42	<0.1
Old-Man-In-The-Spring	<i>Senecio vulgaris</i>	36	<0.1
Sticky Chickweed	<i>Cerastium glomeratum</i>	36	<0.1
Big Chickweed	<i>Cerastium fontanum ssp. vulgare</i>	36	<0.1
Disc Mayweed	<i>Matricaria discoidea</i>	32	<0.1
Creeping Bentgrass	<i>Agrostis stolonifera</i>	NR	<0.1

^a Turner 2022

^b Alaska Center for Conservation Science 2021; invasiveness ranks range from 0 to 100, with higher numbers reflecting increasing invasiveness

Early Successional Vegetation

There are approximately 750 acres of early successional vegetation within the MGRA (ABR 2021). Areas close to the glacier's terminus are at a relatively early stage of plant succession (less than 80 years since deglaciation), featuring early successional species adapted to disturbance, including lichen, scattered shrubs and herbs, and a moss carpet. Areas along the lakeshore and areas farther from the current glacier terminus are dominated by alder and willow scrub that are gradually transitioning to support secondary plant communities (such as mature cottonwood and young Sitka spruce forests).

Some areas in the MGRA with early successional vegetation also provide important habitat for nesting shorebirds, seabirds, and waterbirds. Pioneering shrub alders, willows, and cottonwoods all provide food for migratory birds. Early successional vegetation like ground cones are important food sources for bears, and alder and willow shrubs are winter food sources for mountain goats and small mammals.

Vegetation as Wildlife Habitat

ABR's Biological Resources Review evaluated available habitat within the MGRA and habitat use by wildlife in the area. Determination of existing habitat types was based on extrapolation from 2020 Forest Service cover type mapping for the Tongass National Forest, broad-scale raster mapping of vegetation of Southeast Alaska from the Alaska Center for Conservation Science, and 1978 aerial photography of the MGRA (ABR 2021). Additional discussion of wetland and aquatic habitats is found in Section 3.8.

The habitat analysis of the MGRA identified 22 habitat types and estimated current coverage for each type. The MGRA is dominated by the glacial lake and larger swaths of needleleaf conifer forests occupying the mountains and hillsides northwest of Mendenhall Lake. Vegetation succession in the MGRA is evidenced by changes in habitat coverage over the past 50 years, as seen with the expansion of Sitka spruce forests into areas with historic scrub coverage. The most

significant change in habitat type since the 1970s has been reduced coverage of Mendenhall Glacier and as a result, Mendenhall Lake has expanded substantially (ABR 2021).

Each of the habitat types were evaluated for their respective breeding and foraging value for nine species found in the MGRA. The species considered were species of concern and interest to the Forest Service, and included two special status species (Queen Charlotte Goshawk and Bald Eagle), one MIS (black bear), and six additional migratory birds (Vancouver Canada Goose, Red-breasted Sapsucker, Hairy Woodpecker, Brown Creeper, Arctic Tern, and Great Blue Heron). Habitats were ranked as negligible, low, moderate, or high value, based on habitat preferences of the nine species. Habitat preference was evaluated using data collected during field studies, scientific literature, and professional judgement of ABR biologists and Forest Service staff. The habitat use value reflects how frequently habitat types are used for nesting and/or foraging during the breeding season or during migration (ABR 2021). Results are summarized in Table 3-3.

Analysis conducted by ABR identified six habitat types that are common in the areas proposed for recreational facilities in the MGRA: tall willow scrub (seasonally flooded), clearwater lakes and ponds, glacial river (upper perennial), clearwater streams (upper perennial), clearwater streams (lower perennial), and moist graminoid-forb meadow. These habitat types each encompass approximately 53 acres (about 1 percent) of the MGRA (ABR 2021). The habitat use value for the six habitat types that would be common in areas for proposed project components are as follows:

- Tall willow scrub (seasonally flooded): moderate value for Great Blue Heron and black bear
- Clearwater lakes and ponds: high value for Vancouver Canada Goose and Great Blue Heron and moderate value for Arctic Tern and Bald Eagle
- Glacial river (upper perennial): high value for Great Blue Heron and Bald Eagle, and moderate value for Vancouver Canada Goose, Arctic Tern, and black bear
- Clearwater streams (upper perennial): high value for Bald Eagle and black bear
- Clearwater streams (lower perennial): high value for Great Blue Heron, Bald Eagle, black bear and moderate value for Vancouver Canada Goose and Arctic Tern
- Moist graminoid-forb meadow: moderate value for Arctic Tern, Bald Eagle, Vancouver Canada Goose, and Great Blue Heron

Table 3-3. Habitat Coverage and Wildlife Habitat Use Summary for the MGRA

Habitat Type	Estimated Areaa (acres)	Percent Coverage	Species Using as Moderate (M) and High Value (HV) Habitat
Ice-Snow Field	<158	3	None
Rock	<158	3	Arctic Tern (HV)
Dwarf Scrub and Meadow	<105	2	None
Low and Tall Alder Scrub	<264	5	Black Bear (M)
Hemlock Forest (high elevation)	>105	2	Queen Charlotte Goshawk (M), Hairy Woodpecker (M), Black Bear (M)
Low And Tall Alder-Willow Scrub	<264	5	Black Bear (M)
Tall Willow Scrub (seasonally flooded)	<53	1	Great Blue Heron (M), Black Bear (M)
Glacial Lake	>1,213	23	Arctic Tern (HV), Bald Eagle (HV), Vancouver Canada Goose (M), Great Blue Heron (M)
Clearwater Lakes and Ponds	>53	1	Vancouver Canada Goose (HV), Great Blue Heron (HV), Arctic Tern (M), Bald Eagle (M)
Glacial River (upper perennial)	>53	1	Great Blue Heron (HV), Bald Eagle (HV), Vancouver Canada Goose (M), Arctic Tern (M), Black Bear (M)
Clearwater Streams (upper perennial)	<53	1	Bald Eagle (M), Black Bear (M)
Clearwater Streams (lower perennial)	<53	1	Great Blue Heron (HV), Bald Eagle (HV), Black Bear (HV), Vancouver Canada Goose (M), Arctic Tern (M)

Habitat Type	Estimated Area ^a (acres)	Percent Coverage	Species Using as Moderate (M) and High Value (HV) Habitat
Moist Graminoid-Forb Meadow	<53	1	Vancouver Canada Goose (M), Arctic Tern (M), Great Blue Heron (M), Black Bear (M)
Wet Sedge Meadow	<5	0.1	Vancouver Canada Goose (HV), Arctic Tern (M), Great Blue Heron (M), Black Bear (M)
Fresh Sedge-Forb Marsh	<5	0.1	Vancouver Canada Goose (HV), Arctic Tern (M), Great Blue Heron (M), Black Bear (M)
Broadleaf Shrub-Spruce Scrub Forest	>158	3	Great Blue Heron (HV), Queen Charlotte Goshawk (M), Black Bear (M)
Needleleaf Forest (wet)	<475	9	Vancouver Canada Goose (HV), Great Blue Heron (HV), Queen Charlotte Goshawk (HV), Bald Eagle (HV), Red-breasted Sapsucker (HV), Hairy Woodpecker (HV), Brown Creeper (HV); Black Bear (M)
Sitka Spruce Woodland (mesic)	>105	2	Vancouver Canada Goose (M), Great Blue Heron (M), Queen Charlotte Goshawk (M), Bald Eagle (M), Hairy Woodpecker (M)
Sitka Spruce Forest	>422	8	Vancouver Canada Goose (HV), Queen Charlotte Goshawk (HV), Great Blue Heron (M), Bald Eagle (M), Red-breasted Sapsucker (M), Hairy Woodpecker (M), Brown Creeper (M), Black Bear (M)
Western Hemlock Forest	<738	14	Vancouver Canada Goose (HV), Queen Charlotte Goshawk (HV), Bald Eagle (HV), Red-breasted Sapsucker (HV), Hairy Woodpecker (HV), Brown Creeper (HV), Great Blue Heron (M), Black Bear (M)
Western Hemlock-Sitka Spruce Forest	>791	15	Vancouver Canada Goose (HV), Queen Charlotte Goshawk (HV), Bald Eagle (HV), Red-breasted Sapsucker (HV), Hairy Woodpecker (HV), Brown Creeper (HV); Great Blue Heron (M), Black Bear (M)
Artificial Fill	>16	0.3	None

^a Present-day acreage derived from very rough visual approximations of the proportional coverage of each habitat type in the MGRA, as identified on the 2018 aerial photography for the area
Source: ABR 2021; Table 5-3

Other habitat types that occur in areas proposed for recreational facilities include two uncommon wetland types, wet sedge meadow and fresh sedge-forb marsh, and each constitute about 5 acres (less than 0.1 percent) of the MGRA. Existing artificial fill, representing areas that have previously been excavated and/or filled to support recreational activities, covers approximately 16 acres (approximately 0.3 percent) of the MGRA.

3.6.4.5 Subsistence

Subsistence use is defined by ANILCA (Section 803) as “the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal, or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.” Section 804 of ANILCA prioritizes the taking on public lands of fish and wildlife for non-wasteful subsistence uses over taking fish and wildlife for other purposes.

Subsistence use in Alaska is regulated both by State and Federal agencies, including the Alaska Boards of Fisheries and Game, USFWS, BLM, and the Forest Service. Juneau, as a nonrural community, is classified as a State nonsubsistence-use area (ADF&G 2022). The Tongass National Forest is a Federal subsistence area, but the Mendenhall Valley, MGRA, and Mendenhall Lake are closed to subsistence uses (U.S. Department of the Interior 2021).

3.6.5 Analysis Methods

3.6.5.1 Effects Analysis and Significance Criteria

The Forest Plan directs the use of standards and guidelines for wildlife and associated habitat (USDA Forest Service 2016, p. 4-41). For this analysis, indicators and levels of effect have been set for the key issues identified in Chapter 1 (see Section 1.5.1, Issue 1). Certain components may also have a beneficial effect on a particular issue or resource. Specific issue statements and indicators for this resource are listed in Section 3.6.3 and levels of effect for each indicator are outlined in Table 3-4 below.

Conclusions, such as whether an effect or impact is negligible, minor, moderate, or major are based upon the professional’s judgment of the magnitude of the change, the context and extent of the impact, and the timing and nature of activities taking place.

Table 3-4. Indicator Units of Measure and Level of Effect for Issue 1: Wildlife and Vegetation

Indicator	Negligible	Minor	Moderate	Major
Sensitive Special Status Species	No measurable effect on individuals or populations.	May impact individuals, but not likely to cause a loss of population viability within the MGRA or cause a trend toward a Federal listing.	May impact individuals and may result in a loss of population viability within the MGRA, but not likely to cause a trend toward a Federal listing.	May adversely impact individuals, potentially cause a loss of population viability within the MGRA and the Tongass National Forest, and a trend toward a Federal listing.
Migratory Birds	No measurable effect on individuals or populations.	Minor increase in acres of facility development, including in-water development, and anticipated visitor traffic within documented migratory bird nesting areas. Likely to adversely impact individuals but not expected to affect population viability within the MGRA.	Moderate increase in acres of facility development and anticipated visitor traffic within or near documented migratory bird nesting areas. Likely to adversely impact individuals and may result in a loss of population viability within the MGRA.	Major increase in acres of facility development and anticipated visitor traffic within documented migratory bird nesting areas. Expected to adversely impact individuals and potentially cause a loss of population viability within the MGRA and the Tongass National Forest.
Bears	No measurable effect on individuals or populations.	Minor increases in anticipated visitation and new facilities within areas with observed bear movements and near areas critical to activities necessary for individual survival and population health. Likely to adversely impact individual bears but not expected to affect population viability within the MGRA.	Moderate increase in anticipated visitation and new facilities within areas with observed bear movements and near areas critical to activities necessary for survival and long-term population health. Likely to adversely impact individual bears and may result in a loss of population viability within the MGRA.	Major increase in anticipated visitation and new facilities within areas with observed bear movements and near areas critical to activities necessary for survival and long-term population health. Expected to adversely impact individual bears and potentially cause a loss of population viability within the MGRA and the Tongass National Forest.

Indicator	Negligible	Minor	Moderate	Major
Wildlife	No measurable effect on individuals or populations.	Proposed anticipated visitors and facilities would be likely to adversely impact individuals present during more vulnerable life stages, such as breeding, migration, or juvenile life stages but not expected to affect population viability within the MGRA. Impacts on species, their habitats, or the natural processes sustaining them would not be detectable. Population numbers, stability, and other demographic factors for species would not be impacted.	Proposed anticipated visitors and facilities could adversely impact individuals present during more vulnerable life stages, such as breeding, migration, or juvenile life stages and interfere with activities necessary for survival on an occasional basis, and potentially result in a loss of population viability within the MGRA. Impacts on species, their habitats, or the natural processes sustaining them would be detectable.	Proposed anticipated visitors and facilities could adversely impact individuals and potentially cause a loss of population viability within the MGRA and the Tongass National Forest. Impacts on species, their habitats, or the natural processes sustaining them would be detectable. Population numbers, stability, and other demographic factors for species could have large, short-term declines with long-term population numbers significantly depressed.
Vegetation and Sensitive Plant Habitat	No measurable (in acres) or perceptible changes in vegetation types, including sensitive plant habitat, continuity, integrity, or native plant community size.	Minimal measurable (in acres) or perceptible effects on vegetation types from anticipated visitation and new facilities that would not be expected to affect those habitats' natural processes and available sensitive plant habitat.	Measurable (in acres) and perceptible changes to vegetation types (size, continuity, or integrity) from anticipated visitation and new facilities would have localized impacts on those habitats' natural processes and available sensitive plant habitat.	Substantial (in acres) and highly noticeable changes to vegetation types (diversity, continuity or integrity) from anticipated visitation and new facilities could have permanent impacts on those habitats' natural processes and available sensitive plant habitat.
Invasive Species	No measurable (in acres) or perceptible changes in facilities or anticipated visitation in proximity to known invasive species infestations.	Measurable (in acres) or perceptible change in facilities or anticipated visitation in proximity to known invasive species infestations, but not anticipated to spread existing invasive species.	Measurable (in acres) or perceptible change in facilities or anticipated visitation in proximity to known invasive species infestations; expected to contribute to spread of existing invasive species, limited to the MGRA.	Substantial (in acres) and highly noticeable changes as a result of anticipated visitation and new facilities in proximity to known invasive species infestations; expected to spread existing invasive species into new areas, within and outside of the MGRA.
Early Successional Vegetation	No measurable increase in number of visitors or acres of development within high value early successional vegetation.	Minor changes to number of visitors and acres of development within high value early successional vegetation.	Moderate changes to the number of visitors or acres of development within high value early successional vegetation.	Major changes to the number of visitors or acres of development within high value successional vegetation.

3.6.6 Direct and Indirect Effects

Direct and indirect effects to various types of wildlife and vegetation were analyzed for impacts to individuals, the localized population within the MGRA, and the population within the Tongass National Forest.

3.6.6.1 Alternative 1 – No Action

Sensitive and Special Status Wildlife Species

The No Action Alternative would not involve new construction within moderate and high value Queen Charlotte Goshawk habitat within the MGRA. Ongoing disruptions to foraging activities from intensive visitor use in the Visitor Center Unit would persist. A gradual increase in the frequency of recreational activities within the Dredge Lakes and West Glacier Units near Tolch Rock would be expected and would continue to affect nesting and foraging goshawk. It is unknown to what extent the existing conditions impact individual goshawks beyond displacement or harassment (Dunn 2022). Some individuals could be disturbed under the No Action Alternative; however, it is not likely that the No Action Alternative would affect the viability of the Queen Charlotte Goshawk population at the MGRA or throughout Tongass National Forest, or contribute to a trend toward a Federal listing. As a result, the No Action Alternative would be expected to have a **negligible effect** on sensitive and special status species.

Migratory Birds

Migratory birds nesting and foraging in the MGRA could continue to be affected by occasional visitors and dogs going off trail and disturbing individual nests or eggs. Existing threats that Arctic Terns and Mew Gulls face from predation from raptors and wolves would persist and some human disturbances could gradually increase from local and independent visitors under the No Action Alternative. Development of user-created trails would be expected to gradually increase along the Mendenhall Lake shoreline that could disturb shorebird and seabird nesting. Glacier outburst flooding (see Section 3.8.4.7) and other high water event risks to nesting colonies would continue and be expected to persist for the next 10 to 20 years (Kienholz et al. 2020). Existing conditions for other migratory birds will continue under current management, including wildlife predation and increased visitor crowding disrupting nesting and foraging birds during critical life stages. The No Action Alternative would have a **minor effect**, as some individuals would be disturbed but habitat would remain within the MGRA, supporting local migratory bird populations.

Bears

Visitor traffic, visitor crowding, and ongoing bear habituation can increase bear-human interactions and create unsafe conditions for bears and visitors within high traffic areas in the MGRA. Under the No Action Alternative, the potential for bear encounters and stress on bears would likely follow current trends and the number of bear-human interactions would gradually increase over time. Traffic from local and independent visitors could gradually increase, and without expanded visitor facilities to disperse visitors, overcrowded conditions could worsen over time. More unguided visitors could lead to a higher potential of negative bear-human encounters throughout the MGRA.

Under the No Action Alternative, bear interactions with visitors and dogs would continue to be a problem in the Visitor Center Unit and on trails in the Dredge Lakes Unit, particularly during the salmon run season. Vehicle traffic along Glacier Spur Road and in the existing Visitor Center

parking area would pose a persistent risk of bear-vehicle collisions. Additionally, current facilities and visitor use would impede bear movements and access to seasonal food resources, similar to existing conditions. Bears would likely habituate to increases in unguided visitors or seek out other habitats and food sources outside of the MGRA as crowding worsens. As a result of existing and anticipated visitor crowding and bear-human interactions, the No Action Alternative would impact individual bears, likely while using travel corridors and would have the potential to impact the localized population in the MGRA. However, these impacts would not be expected to affect the forest-level population, resulting in a **moderate effect** to bears from the No Action Alternative.

Wildlife

The No Action Alternative would reflect ongoing trends and existing conditions for wildlife populations. User-created trails and off-trail traffic would continue to have the potential to disturb area wildlife throughout the MGRA. Unpredictable user-created trails have the potential to create conflicts with mountain goats and wolves near the glacier terminus. The Forest Service would continue monitoring and managing beaver activity as needed within the Dredge Lakes Unit and along Steep Creek. It is anticipated that there would be a **minor effect** on wildlife from the No Action Alternative.

Vegetation and Sensitive Plant Habitat

Under the No Action Alternative, there would be no immediate change to the existing condition and availability of vegetation and sensitive plant habitat. Most well-trafficked areas are hardened appropriately for ongoing levels of visitor use. Visitors occasionally stray from hardened facilities and marked trails, resulting in minor adverse effects on lakeshore and trailside vegetation. If the number of visitors to the MGRA continues to increase, existing vegetation that provides wildlife habitat and sensitive plant habitat could be affected by an increasing amount of user-created trails forming off of designated trails. As a result, the No Action Alternative would have a **negligible effect** overall on vegetation.

Invasive Species

Visitors and their dogs on marked trails and user-created trails create a vector for the spreading of invasive plants, posing a risk to existing vegetation. Increased unguided use of the MGRA and subsequent increased off-trail use will continue to spread invasive species throughout the area under this alternative. Existing infestations near the Visitor Center would be expected to stay contained. The ongoing reed canarygrass infestations within the Dredge Lakes Unit would potentially spread as a result of continued development of user-created trails. The No Action Alternative would be expected to have a **minor effect** on invasive species.

Early Successional Vegetation

Under the No Action Alternative, existing conditions would persist within early successional vegetation close to the glacier terminus and along the lakeshore. Occasional off-trail use and development of user-created trails would be expected within early successional vegetation in the West Glacier Unit, thus indirectly affecting wildlife populations with high value food resources in those areas. No facilities development or permitted commercial use within early successional vegetation would occur under this alternative; thus, the No Action Alternative would have a **negligible effect** overall on early successional vegetation.

3.6.6.2 Effects Common to All Action Alternatives

Temporary Impacts During Construction

During construction of the proposed facilities, there would be temporary impacts to wildlife and habitat from all action alternatives. Construction, visitor use of new facilities, and increases in commercial use would occur over a 15 to 30-year period. Construction activities and concentrated visitor use would occur primarily in the spring, summer, and fall when wildlife is more prevalent in the recreation area. Prior to construction of any project components, the final location, structure type, design criteria, and construction plan would be designed to meet all applicable Forest Plan Standards and Guidelines, FSM and FSH, BMPs, and memoranda of understanding with applicable Federal and State agencies. For all action alternatives, project components and increased commercial use would be implemented gradually, as outlined in the adaptive management plan (Appendix B).

Potentially disruptive construction activities would include use of ground-based heavy equipment or machinery, pile driving hammers, excavation machinery, timber clearing and removal, and paving operations. Wildlife would be affected by vegetation clearing and construction activities. The most likely behavioral response would be avoidance of the immediate area during the most disruptive activities. Depending on the frequency, timing (e.g., during nesting), and magnitude (noise) of construction, individuals may avoid the immediate area for a prolonged period. Construction activities would be conducted in accordance with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which would minimize impacts to birds (see Chapter 2, Section 2.4). However, ground disturbance would have the potential to affect foraging migratory birds, causing flushing and intensive energy expenditures.

For many wildlife species in the MGRA, individual behavior would likely be altered during construction. Construction impacts could temporarily disturb bears foraging or traversing in the area. Bears and other mammals would avoid areas during construction due to noise and habitat disturbance; however, unless construction activity was in the immediate vicinity of preferred seasonal food resources, within areas used active nesting or denning, or during other critical time periods, construction of project components would not be likely to impact populations. Following construction of most project components, wildlife individuals and populations would likely return to the area and adjust use based on available habitat and visitor activity.

Vegetative clearing for construction buffer areas or machinery access would be temporary and could include sensitive plant habitat. Remaining disturbed vegetation would be restored following construction, consistent with applicable mitigation measures and the FSM and FSH. Habitat fragmentation and alterations to sensitive plant habitat would be localized and limited to the immediate area surrounding each project component. A survey for undocumented sensitive plant populations would be completed in the vicinity of all project components before construction (see Chapter 2, Section 2.4.2). Temporary localized disruption to wildlife from construction noise would also occur during implementation of the action alternatives. Some species are more susceptible to disturbance, especially during critical periods of the year such as during breeding, nesting, or denning.

The highest risk of spreading invasive species across all alternatives would be associated with construction of project components. Equipment, tools, and materials used in construction of proposed facilities have the potential to unintentionally introduce or spread invasive plants into

new areas (Turner 2022). Additional soil disturbance and vegetation clearing would create seed beds for invasive species introduction, and the increase in human presence and movement of tools and machinery through the area would increase the chance to spread these species. Proposed facilities or improvements in areas with existing hardscape and established trails without known infestations would have less of a risk of spreading invasive species. Most invasive species present in the MGRA are considered to be weakly to moderately invasive and pose less of a threat to existing ecosystems.

Existing infestations of reed canarygrass (extremely invasive), orange hawkweed (highly invasive), and oxeye daisy (moderately invasive) could be exacerbated by construction. However, these infestations are actively managed and would continue to be treated annually in compliance with the North Tongass Integrated Weed Management project. Proper implementation of project mitigation measures and intended compliance with Forest Service BMPs as outlined in the Guidance for Invasive Plant Management Program Tongass National Forest (Krosse 2019) would lower the risk of spreading invasive species as a result of ground disturbance and vector distribution during the construction phase of the action alternatives (Turner 2022).

The level of effects provided below for the wildlife and vegetation indicators under each action alternative take into consideration the relative impact of construction when identifying overall impacts (negligible, minor, moderate, or major). Refer to Chapter 2, Section 2.4 for mitigation measures for impacts to wildlife and vegetation.

Subsistence

Because subsistence use is prohibited within the Mendenhall Valley, Mendenhall Lake, and the MGRA, and because there is no known subsistence use of the MGRA, none of the action alternatives would eliminate potential subsistence resources. The Forest Service concludes that the Mendenhall Glacier Facility Improvements Project would not impact subsistence opportunities in the area.

Forest Orders

Management of the MGRA would undergo changes via new rules (Forest Orders) that would delineate areas where visitors could consume food, smoke, walk leashed dogs, and use non-motorized wheeled devices (e.g., bicycles, scooters, roller skates). Limiting food consumption and dogs would reduce the potential for negative wildlife interactions and vegetation disturbances within sensitive habitats. Limiting the areas where people can walk leashed dogs and forbidding walking dog off leash would restrict a vector for spreading invasive species.

Interpretive Plan Elements

The interpretive plan would involve installing small features such as wayfinding signage and benches and shelters for visitor use (AldrichPears Associates 2022). These additions would be within proposed hardscape or would create minimal disturbances that would be outside of sensitive habitats.

3.6.6.3 Alternative 2 – Proposed Action

Sensitive and Special Status Wildlife Species

The BE determined the new trails and associated anticipated trail visitation increases under Alternative 2 may affect individual Queen Charlotte Goshawks. Specifically, increased use on trails in the Dredge Lakes Unit and West Glacier Unit near Tolch Rock would increase

displacement of foraging individuals and could eventually affect nesting ability, leading to goshawks leaving the area or failed nesting attempts. However, studies suggest that if goshawks have adapted to an urban environment, brood size increases compared to wilderness areas (Solonen et al. 2019). In addition, goshawks are showing an ability to adapt to an urban environment by changing diet, nesting, and feeding behaviors; therefore, the extent to which recreationists increase effects to goshawks is unknown. Habitat fragmentation poses the greatest threat to Queen Charlotte Goshawk populations (McClaren 2004). Approximately 24 acres, less than 1 percent of the available moderate and high value habitat for goshawks, would be permanently impacted by new construction (ABR 2021). As determined by the BE, Alternative 2 would be expected to have a **minor effect** on goshawks, as a result of minor disruptions to foraging goshawks and discountable effects to nesting goshawks (Dunn 2022). There would be no anticipated goshawk population effects within the MGRA or Tongass National Forest.

Migratory Birds

Implementing Alternative 2 could impact individual migratory birds by removing, filling, or otherwise altering nesting and foraging habitat and by introducing higher numbers of visitors near known suitable nesting and foraging habitat. Table 3-5 summarizes the following: existing suitable migratory bird nesting areas, Alternative 2's proposed project components within or in the vicinity of nesting bird habitat, associated facilities footprints within nesting habitat, and associated anticipated visitation increases near or within nesting habitat (Figure 3-3).

Bird habitat along Mendenhall Lake's edge important to shorebirds, seabirds, waterbirds, and some raptors could be impacted by Alternative 2. The Welcome Center Complex would fill about 1.2 acres of bird habitat along Mendenhall Lake's shoreline important to shorebirds, seabirds, and raptors, including Bald Eagles. Although the Welcome Center's windows would be treated with glaze to minimize this risk, there is the potential for migratory birds to strike the facility's window resulting in bird injury or mortality. In addition to Welcome Center Complex, Nugget Falls Trail Expansion, Lakeshore Trail, the Boat Docks, and portions of the West Glacier Spur Trail and the Remote Glacier Visitor Area would directly impact some areas along the lakeshore edge.

Associated increased visitor levels around the edges of Mendenhall Lake may disrupt wetlands along Mendenhall Lake shoreline important for nesting and foraging seabird and shorebird colonies, including the Photo Point nesting colony (near the Welcome Center Complex) and the mixed gull and Arctic Tern colony on the West Glacier rock peninsula. The Photo Point Loop, Nugget Falls Loop, and West Glacier Spur Trail would be within 820 feet (250 meters) of seabird colonies and shorebird nesting areas. Adding motorized boat tours on the lake would increase the number of people that have access to seabird colonies on the West Glacier rock peninsula exponentially. It is anticipated that at maximum there could be a boat departing every 30 minutes for 10 hours per day from the Visitor Center dock across the lake to the glacier, equating to approximately 20 round trips daily.

Assuming 214 service days per year and boat capacity of 50 passengers, the vessels would deliver around 214,000 visitors annually to the base of the glacier. This would be in addition to those visitors hiking West Glacier Trail and those who take a non-motorized boat across the lake. Trails and facilities would be located as far as feasible from known colonies and nesting areas (USDA Forest Service 2016, p. 4-89 and 4-90). Education, interpretation, fencing, and signage would be used to protect these areas and mitigate visitor disturbances, meeting the purpose of Forest Plan guidelines for regulating human use and minimizing disturbance (USDA Forest

Service 2016, p. 4-89 Section XI.A.1.b, p. 4-90 Section XII.A.3 and A.6). These methods have been successful at maintaining the Arctic tern nesting colony at Photo Point. However, the potential remains for uninformed visitors and loose dogs to disturb individual nesting and foraging birds along the shoreline.

Under Alternative 2, the Parking and Access Expansion, Glacier Spur Road Trailheads, Steep Creek Habitat Restoration, and Steep Creek Trail would directly impact forested bird habitat important for raptors, landbirds, and waterbirds. Dredge Lakes Outer Loop, Dredge Lakes Multi-Use Trails, and West Glacier Unit Trails would directly impact old growth forest habitat important for raptors nesting and hunting. Forested bird habitat would be further disrupted by additional visitor use in these areas, including bus movement, idling and loading/offloading, vehicle parking, and visitors gathering and walking. Additional use of forest trails, including use by faster moving mountain bikes and loose dogs, could result in abandonment of adjacent habitat and disruptions to raptors, landbirds, and waterbirds. There is also the potential that additional traffic on the road through forested bird habitat would increase birds strikes; however, the potential for strikes would decrease as posted vehicle speeds slow from 40 miles per hour near the entrance of the MGRA to 20 miles per hour between Steep Creek and the parking lot.

As proposed in Alternative 2, Parking and Access Expansion, Steep Creek Habitat Restoration, Steep Creek Trail, and Lakeshore Trail would fill and bring more visitors near wetland, pond, and riverine areas valued for raptor, waterbird, and landbird bird habitat. These include Zig Zag Pond and adjacent wetlands important for waterbirds, and Steep Creek and Mendenhall River important for eagles, ducks, and dippers.

Proposed commercial motorized boat operations could have direct and indirect impacts to nesting and foraging birds within and along the shoreline of Mendenhall Lake. There is a small potential for boat operations, including elevated noise and accidental discharges or spills, to decrease bird nesting and foraging along the lake. There is the potential for waves caused by motorized watercraft to swamp or destroy nests and lead to their abandonment or failure. To avoid these risks, measures and procedures to avoid impacts to high value nesting areas would be implemented.

To the extent feasible, motorized boats would maintain an 820-foot (250-meter) no-disturbance buffer from seabird colonies, as directed by Forest Plan guidelines (see Chapter 2, Section 2.4.2; USDA Forest Service 2016, p. 4-89). Careful route planning for accessing the Welcome Center Dock would avoid the Photo Point bird colony no-disturbance area. Under the South Option, the Remote Glacier Dock and on-shore restroom facilities would be within the no-disturbance area for the mixed gull and Arctic Tern colony on the West Glacier rock peninsula. Boats at the dock could be as close as 100 feet from the colony. However, implementation of mitigation measures, including no-wake speeds within 820 feet of the colony and onshore closure signage, would meet the purpose of Forest Plan guidelines for regulating human use and minimizing disturbance (USDA Forest Service 2016, p. 4-89 Section XI.A.1.b, p. 4-90 Section XII.A.3 and A.6). The North Option dock location, travel route, and on-shore restroom facilities would be more than 820 feet from the current colony location. Under both options, dock locations would move as needed as the glacier retreats. Bird colonies may also move and shift in response to glacial recession.

Under Alternative 2, there would be new facilities, proposed increases in trail capacities, and additional visitor operations in areas with nesting and foraging bird habitat. As a result,

Alternative 2 would be anticipated to intermittently impact individual foraging and nesting birds and potentially cause temporary impacts to local bird populations. Alternative 2 would have a **moderate effect** on migratory birds.

Table 3-5. Project Components Within Suitable Habitat for Migratory Birds – Alternative 2

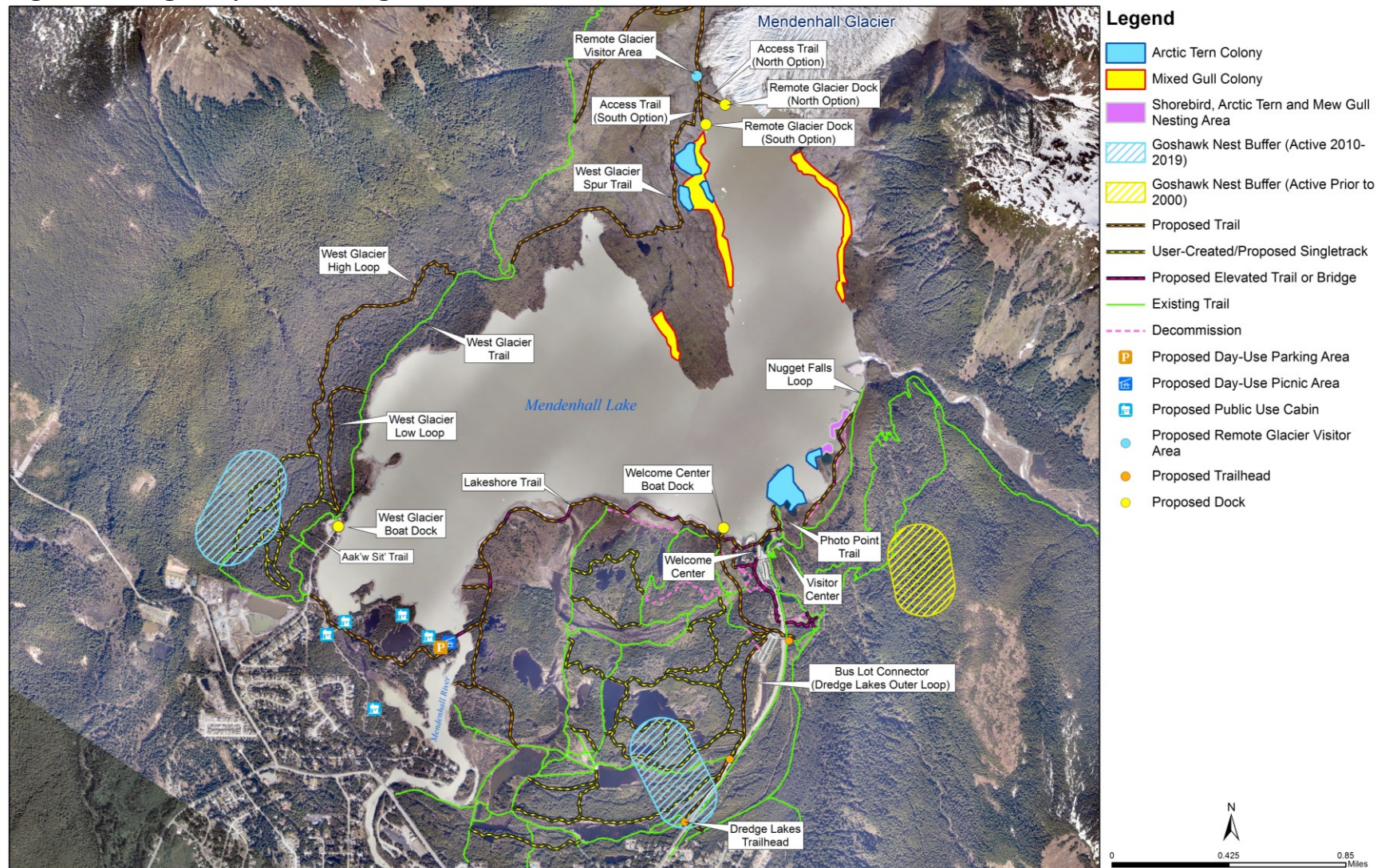
Project Component	Permanent Vegetation Disturbance (Acres) Within Suitable Habitat	Estimated Visitor Use (% Increase)^a	Bird Type	Nesting and Use Areas
Parking and Access Expansion	1.3	999,000 (84)	• Raptors: Bald Eagle • Waterbirds: Great Blue Heron	• Raptors: Forested areas adjacent to existing parking • Waterbirds: Zig Zag Pond and area wetlands
Welcome Center Complex (includes Photo Point Trail)	1.0	N/A	• Raptors: Bald Eagle • Seabirds: Arctic Tern, Mew Gull • Shorebirds: Semipalmated Plover, Spotted Sandpiper, Least Sandpiper, Greater Yellowlegs, Dunlin	• Raptors: Moraine Ecology Trail • Seabirds: Photo Point colony • Shorebirds: Photo Point colony and wetlands along shoreline
Visitor Center Improvements	0.01	N/A	• Raptors: Bald Eagle • Landbirds: Rusty Blackbird	• All species: Visitor Center
Glacier Spur Road Trailheads	0.6	N/A	• Raptors: Queen Charlotte Goshawk, Bald Eagle • Waterbirds: Harlequin Duck, Great Blue Heron • Landbirds: Belted Kingfisher, Rusty Blackbird (historically)	• All species: Forested areas adjacent to proposed parking
Lakeshore Trail	4.7	321,000 (new)	• Shorebirds: Least Sandpiper, Greater Yellowlegs, Dunlin • Waterbirds: Red-throated Loon (historically), Trumpeter Swan, Tundra Swan, Canada Goose	• All species: Wetlands along the lakeshore and Mendenhall Campground

Project Component	Permanent Vegetation Disturbance (Acres) Within Suitable Habitat	Estimated Visitor Use (% Increase) ^a	Bird Type	Nesting and Use Areas
Dredge Lakes Outer Loop	6.7	77,040 (new)	• Raptors: Queen Charlotte Goshawk, Bald Eagle • Waterbirds: Harlequin Duck, Great Blue Heron • Landbirds: Belted Kingfishers, Rusty Blackbirds (historically)	• Raptors: Old growth forested areas • Waterbirds: Forested wetlands and stream buffers • Landbirds: Old growth forested areas
Public Use Cabins	0.1	N/A	• Waterbirds: Red-throated Loon (historically), Trumpeter Swan, Tundra Swan, Canada Goose	• Waterbirds: Wetlands within Mendenhall Campground
Nugget Falls Trail Expansion	1.0	321,000 (110)	• Seabirds: Arctic Tern, Mew Gull, Glaucous-Winged Gull, Herring Gull • Waterbirds: Common Merganser	• Seabirds: Colony north of Nugget Falls • Waterbirds: Above Nugget Falls
Steep Creek Habitat Restoration	0.9	N/A	• Raptors: Queen Charlotte Goshawk, Bald Eagle • Waterbirds: Harlequin Duck, Great Blue Heron • Landbirds: American Dipper	• Raptors: Foraging in Steep Creek • Waterbirds/Landbirds: Forested wetlands and stream buffers
Steep Creek Trail Expansion	1.1	321,000 (110)	• Raptors: Queen Charlotte Goshawk, Bald Eagle • Waterbirds: Harlequin Duck, Great Blue Heron • Landbirds: American Dipper	• Raptors: Foraging in Steep Creek • Waterbirds/Landbirds: Forested wetlands

Project Component	Permanent Vegetation Disturbance (Acres) Within Suitable Habitat	Estimated Visitor Use (% Increase) ^a	Bird Type	Nesting and Use Areas
Dredge Lakes Multi-Use Trails	0.6	N/A	• Raptors: Queen Charlotte Goshawk, Bald Eagle • Waterbirds: Harlequin Duck, Great Blue Heron • Landbirds: Belted Kingfishers, Rusty Blackbirds (historically)	• Raptors: Old growth forested areas • Waterbirds: Forested wetlands and stream buffers • Landbirds: Old growth forested areas
Boat Docks	1.0	214,000 (new)	• Seabirds: Arctic Tern, Mew Gull, Glaucous-Winged Gull, Herring Gull • Shorebirds: Least Sandpiper, Greater Yellowlegs, Dunlin • Waterbirds: Red-throated Loon (historically); Trumpeter Swan, Tundra Swan, Canada Goose	• Seabirds/Shorebirds: Shoreline nesting colonies • Waterbirds: Wetlands along shoreline
Remote Glacier Visitor Area	0.6	265,000 (new)	• Seabirds: Arctic Tern, Mew Gull, Glaucous-Winged Gull, Herring Gull • Waterbirds: Mallard	• Seabirds: Shoreline nesting colonies • Waterbirds: Ponds found on exposed rock by the glacier
West Glacier Unit Trails	4.3	N/A	• Raptors: Queen Charlotte Goshawk, Bald Eagle • Seabirds: Arctic Tern, Mew Gull, Glaucous-Winged Gull, Herring Gull • Waterbirds: Harlequin Duck • Landbirds: American Dipper	• Raptors: Old growth forested areas • Seabirds: Shoreline nesting colonies • Waterbirds: Along Wesley Creek • Landbirds: Old growth forested areas

Source: ABR 2021 *Wildlife Report*; ^a Appendix A

Figure 3-3. Migratory Bird Nesting Areas – Alternative 2



Bears

Under Alternative 2, there would be impacts to bears and bear habitat from the placement of visitor facilities. Approximately 24 acres, less than 1 percent of the available moderate and high value bear habitat, would be permanently impacted by placement of new facilities associated with Alternative 2 (ABR 2021). The new facilities and trails would cause localized habitat fragmentation within high value areas with observed bear movements between the Nugget Falls area to Steep Creek and the Powerline Trail (Figure 3-4). In particular, the portion of the Lakeshore Trail that crosses in front of the Welcome Center would directly impact an area with active bear movement between the Nugget Falls area and Steep Creek. Collectively, Alternative 2's project components would block or limit access to undeveloped shoreline habitat in the area. Table 3-6 summarizes proposed facility impacts to and gathering areas under Alternative 2.

Under Alternative 2, new trails and facilities in the Visitor Center Unit would lead to more visitors within bear habitat and a human presence in new areas, and potentially more bear-human interactions. In addition, food service proposed in the Welcome Center could attract bears and lead to increased interactions. An increase in bear-human interactions could lead to more trail and area closures and bear hazing. Mitigation measures and effective implementation of ongoing management techniques including enforcement of no food areas, seasonal closures, and visitor education could reduce impacts to bear movements. The existing bear management guidelines would be updated at the time of project implementation to reflect new facilities and changes to operational management (see Chapter 2, Section 2.4.2).

Alternative 2's project components proposed in the currently less-developed outer areas of the Visitor Center Unit and within the Dredge Lakes Unit and West Glacier Unit would have the potential to directly impact bear habitat, disrupt bears, and lead to more negative bear-human interactions. Lakeshore Trail and the Welcome Center Dock would introduce new facilities and visitors near the mouth of Steep Creek could block bears' access to the lakeshore or lead to an increase in bear-human interactions at this location. Development-spurred visitor use in more remote portions of MGRA, including Remote Glacier Visitor Area, Remote Glacier Dock, and West Glacier Unit Trails could disturb bears that are less habituated to humans. However, more remote areas are not documented high value bear habitat and the likelihood of bear-human interactions may be low. In addition, it is expected that some new visitors would be managed by guides which could reduce unpredictable visitor behavior during bear encounters and the potential for adverse encounters that increase stress on bears.

Some Alternative 2 project components would improve conditions for bear movement and reduce the risk of adverse interactions. The proposed Steep Creek Trail Expansion would realign the boardwalk to reduce human crowding near Steep Creek, providing bears more open access to salmon. The associated Steep Creek Habitat Restoration and improvements to the Pond of Time and Backside Pond would create more favorable conditions for salmon rearing and overwintering, potentially increasing bears' food supply. The proposed Dipper Falls Viewing Area would provide a designated access path and wildlife viewing blind to offer safe wildlife viewing in an area frequented by bears.

Under Alternative 2, more tour buses and vehicles on Glacier Spur Road would potentially increase the risk of bear-vehicle collisions. However, the proposed Glacier Spur Road Bridge and wildlife and pedestrian underpass could reduce the number of bears attempting to cross the road near the parking lots and the existing Visitor Center. The underpass would be built at or above minimum standards for joint wildlife and human pedestrian traffic to encourage bear use,

and it is expected that bears could habituate to using the underpass in about 2 years (see ABR 2021 for details regarding wildlife underpasses). Given the gradual nature of increased visitation under Alternative 2, bears would likely be using the underpass before the vehicle numbers reach high levels. Additionally, providing parking at the Glacier Spur Road Trailheads could reduce traffic, congestion, and blind spots along Glacier Spur Road from vehicles parking along the roadway, further decreasing the potential for collisions with bears. An elevated risk of collisions could be possible farther from the underpass near the entrance to the MGRA where posted speeds are currently 40 miles per hour and where bears may frequent due to known attractants in neighboring residential areas.

Project components would cause overall increases in habitat fragmentation and human use of bear habitat throughout the recreation area, leading to more negative bear-human interactions and blocking bears' access to important habitat. However, given available bear habitat within the MGRA, the size of bears' home ranges, and anticipated behavioral adaptations, bear populations would not be expected to experience any long-term declines as a result of this alternative. Facilities along Steep Creek and the implementation of a wildlife underpass along Glacier Spur Road would improve bear habitat and access, decrease negative wildlife interactions, and improve conditions for salmon, an important food source.

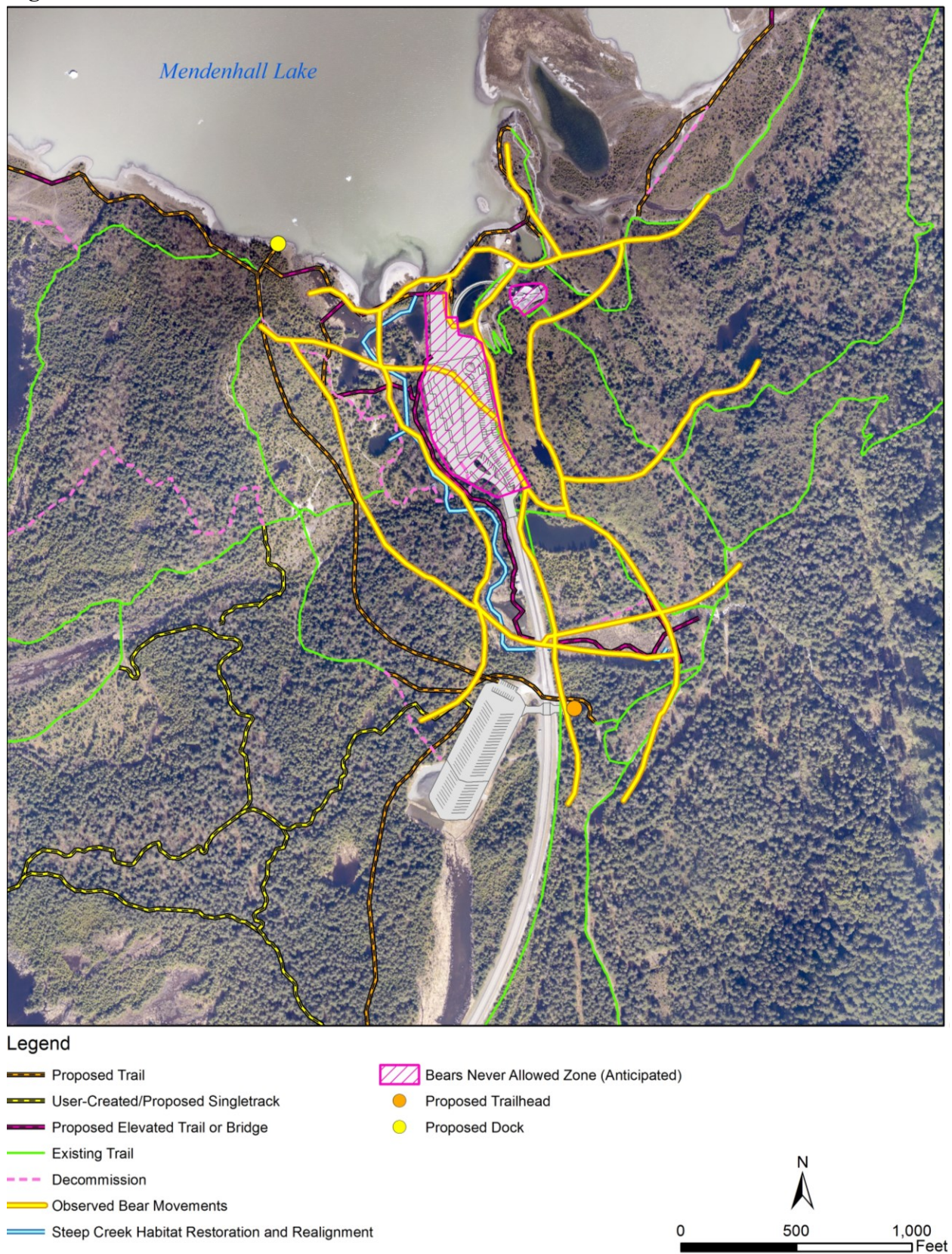
Alternative 2 would be expected to impact individual bears and potentially have short-term impacts on the population within the MGRA as bears habituate to changes. However, since these impacts would not be expected to affect the forest-level population, there would be a **moderate effect** overall on bears.

Table 3-6. Project Components Within Areas With Observed Bear Movements

Project Component	Permanent Vegetation Disturbance (Acres)	Estimated Visitor Use (% Increase) ^a	Observed Bear Movement
Main Parking Lot	1.3	999,000 (84)	Road crossing by Zig Zag Pond
Welcome Center Plaza	1.0	N/A	Main Visitor Center Path/Accessible Ramp
Photo Point Trail	0.2	N/A	Intersection of Photo Point and Nugget Falls Trail
Lakeshore Trail (along Welcome Center)	0.3	321,000 (110)	Base of pavilion steps
Nugget Falls Trail Expansions	1.0	321,000 (110)	Intersection of Photo Point and Nugget Falls Trail
Steep Creek Trail Expansion	1.1	321,000 (110)	Access to Steep Creek Trail from main parking lot and commercial overflow parking lot
Glacier Spur Road Bridge	0.2	N/A	Crossing Glacier Spur Road
Dipper Falls Viewing Platform	0.01	77,040 (110)	Dipper Bridge on Trail of Time
Welcome Center Dock	0.8	214,000 (new)	Visitor Center Beach

^a Appendix A

Figure 3-4. Bear Movements Near the Visitor Center – Alternative 2



Wildlife

In general, Alternative 2 would disturb other wildlife populations similarly to birds and black bears—by directly impacting habitat and increasing visitor traffic at existing and new use areas in the MGRA. Off-trail foot traffic would indirectly impact wildlife through noise and disturbance. Crowds may be temporarily dispersed for the first few years of the project. Gradually, increased visitor use and an overall increase in visitor infrastructure would cause levels of wildlife avoidance and habituation similar to existing conditions in high traffic areas of the MGRA. Given the overall available wildlife habitat in the MGRA and relative size of the proposed facilities, Alternative 2 would not contribute to substantial impacts to wildlife. As explained below, mountain goats, wolves, and beavers would have some impacts not previously detailed in the sections above.

Mountain goat winter habitat would be impacted by Alternative 2's proposed Nugget Falls Trail Expansion, Remote Glacier Dock, Remote Glacier Visitor Area, and the West Glacier Spur Trail. However, concentrated human use near mountain goat winter habitat is not expected during winter months. Summer and kidding habitat is at higher elevations near the MGRA boundary more than 1 mile from new facilities and is unlikely to be affected by high use during the primary use season. Given the reclusive nature of goats and that available habitat for this species would continue to increase as the glacier recedes, visitor interactions with individuals would continue to be limited.

Under Alternative 2, impacts to wolves would be similar to impacts to mountain goats. Some facilities located outside of Visitor Center Unit would occupy wolf habitat, although negative visitor interactions would not be expected. Wolves would continue to avoid humans and would likely have additional areas to inhabit as the glacier recedes.

Beavers were historically active along Steep Creek and are currently active within Dredge Lakes Unit. Beaver habitat would be impacted by proposed development of Lakeshore Trail, Welcome Center Dock, Steep Creek Habitat Restoration, Steep Creek Trail, and other development around open water within the Visitor Center Unit. Conflicts with existing beaver dams would be limited to the Lakeshore Trail and Dredge Lakes Outer Loop, as the Dredge Lakes Multi-Use Trails would occur on existing trails. The Forest Service would continue to mitigate beaver dam development, including incorporation of revised beaver management guidelines at the time of project implementation, to reduce the risk of flooding or destroying proposed facilities (see Chapter 2, Section 2.4.2).

Wildlife would be expected to continue using MGRA habitat as it is used now while avoiding new areas with high visitor use. Given available habitat beyond the MGRA, Alternative 2 would not be anticipated to affect forest-level populations of wildlife species in the MGRA. However, there would be occasional visitor disturbances, possibly interfering with individuals during critical life stages as individuals become habituated or seek out alternative habitat with possible implications for the local population. As a result, the overall negative impact to wildlife is anticipated to be **moderate**.

Vegetation and Sensitive Plant Habitat

Alternative 2's impacts on vegetation would primarily be from increased visitor facilities. Impacts to vegetation would include permanent ground disturbance from facility footprints and buffers and additional vegetation removal, such as overstory thinning for trail development and viewpoints. Although there are no documented sensitive or rare plants in the MGRA, proposed

facilities would affect suitable habitat for the following R10 Sensitive Species: Moosewort fern, spatulate moonwort fern, and mountain lady's slipper orchid (Turner 2022). Sensitive plant surveys would be completed ahead of facility construction.

As shown in Table 3-7, the largest permanent and temporary impact to vegetation would be from the Dredge Lakes Outer Loop, Lakeshore Trail, and West Glacier Unit Trails. The Steep Creek Habitat Restoration would have extensive temporary ground disturbances; however, there would be fewer permanent impacts.

Table 3-7. Summary of Vegetation Disturbance – Alternative 2^a

Project Component	Short-Term Vegetation Disturbance (Acres)	Permanent Vegetation Disturbance (Acres)
Parking and Access Expansion	1.4	1.3
Welcome Center Complex	1.1	1.0
Photo Point Trail	0.2	0.2
Visitor Center Improvements	0.0	0.0
Glacier Spur Road Trailheads	0.6	0.6
Lakeshore Trail	5.3	4.7
Dredge Lakes Outer Loop	7.4	6.7
Public Use Cabins	0.1	0.1
Nugget Falls Trail Expansion	1.1	1.0
Steep Creek Habitat Restoration	4.3	0.9
Steep Creek Trail Expansion	1.2	1.1
Dredge Lakes Multi-Use Trails	1.2	0.6
Welcome Center Dock	0.9	0.8
West Glacier Dock	0.1	0.1
Remote Glacier Bock	0.1	0.1
Remote Glacier Visitor Area	0.6	0.5
West Glacier Unit Trails	4.8	4.3
Total	30.7	24.1

^a Totals may not add up because of independent rounding

The proposed increase in facilities could disperse more people onto trails throughout the MGRA, but would mostly increase trail use in existing high use areas. By introducing increased visitor volume onto an expanded MGRA trails network, Alternative 2 would potentially cause the creation of new user-created trails into previously undisturbed areas of the MGRA. However, Alternative 2 would also disperse visitors and provide additional trail options, potentially reducing the frequency of visitors making new user-created trails and disturbing vegetation.

Alternative 2 would not be anticipated to affect habitat viability or ongoing natural processes in the MGRA; the permanent vegetation disturbance would be 24 acres, less than 1 percent of available vegetation in the MGRA, approximately 3,800 acres (ABR 2021). This alternative

would be anticipated to have a **minor effect** on vegetation and sensitive plant habitat as there would be perceptible, localized effects without affecting the integrity of available habitat types (Dunn 2022).

Invasive Species

Following construction, visitor use and facility maintenance would have the potential to damage vegetation and spread invasive species, resulting in an increased risk of invasive plant infestation in the MGRA. Visitors on established trails and wandering off trails could transport invasive species into new areas by seeds picked up on their clothing and shoes (Turner 2022).

Alternative 2 proposes to improve the existing user-created mountain bike trails in the Dredge Lakes Unit and formally incorporate these as NFS trails. By sanctioning these trails, they would undergo more consistent maintenance which could detect and treat additional reed canarygrass (or other invasive species) infestation sites. However, formally incorporating these trails could also increase visitor use, a common vector for spreading invasive species. Other facilities in that vicinity, such as the Glacier Spur Road Trailheads, Lakeshore Trail, and Dredge Lakes Outer Loop, would be outside the known extent of reed canarygrass in the MGRA.

This alternative would be implemented in compliance with Forest Service BMPs as outlined in the Guidance for Invasive Plant Management Program Tongass National Forest (Krosse 2019) to minimize the risk of spreading invasive species. However, with 31 acres of short-term vegetation disturbances and anticipated visitor use, existing invasive species infestations may expand and new infestations could emerge within the MGRA (Turner 2022). As a result, Alternative 2 would have a **moderate effect** on invasive species.

Early Successional Vegetation

Under Alternative 2, project components would be constructed within about 11 acres of early successional plant communities and visitor use would be introduced or increased those areas. Table 3-8 summarizes the proposed facility footprints and estimated visitor use increases for project components within existing and anticipated early successional vegetation.

The proposed Parking and Access Expansion, Welcome Center Complex (including the Photo Point Trail), Lakeshore Trail, and Nugget Falls Trail Expansion would introduce new facilities into early successional vegetation areas near the lakeshore currently or anticipated to be characterized by alder and willow scrub vegetation. Facility footprints, routine maintenance, and expanded distribution of visitor use would reduce the availability of scrub habitat in this area and inhibit further forest succession. This could reduce the availability of preferred food resources such as northern groundcones for bears and alders and willows for foraging migratory birds.

The Remote Glacier Dock and Remote Glacier Visitor Area and associated operation and maintenance on the north side of Mendenhall Lake would impact early successional vegetation near the glacier terminus. Off-trail and uncontrolled foot traffic could stunt lichen growth and viability directly around the facilities and trails. Similarly, the proposed West Glacier Spur Trail would have the potential to remove and disturb early successional lichens on exposed rockfaces in the West Glacier Unit. These project components could reduce the availability of foraging species for mountain goats and other mammals in the area.

Alternative 2 would likely have a **moderate effect** on early successional vegetation. Some early successional vegetation would be permanently removed by the placement of project components or damaged by off-trail visitor traffic. When compared to existing conditions, implementing

Alternative 2 would introduce and increase visitor facilities and anticipated visitation within some remote and undisturbed successional vegetation areas.

Table 3-8. Vegetation Disturbance and Estimated Visitor Use in Early Successional Vegetation – Alternative 2^a

Project Component	Permanent Vegetation Disturbance (Acres)	Estimated Visitor Use (% Increase)^b
Main Parking Lot	1.3	999,000 (84)
Welcome Center Complex	1.0	N/A
Photo Point Trail	0.2	N/A
Lakeshore Trail	4.7	321,000 (new)
Nugget Falls Trail Expansion	1.0	321,000 (110)
Welcome Center Dock	0.8	214,000 (new)
Remote Glacier Dock	0.1	214,000 (new)
Remote Glacier Visitor Area	0.5	265,000 (new)
West Glacier Spur Trail	1.7	51,000 (40)
Total	11.3	999,000

^a Totals may not add up because of independent rounding

^b Appendix A

3.6.6.4 Alternative 3

Alternative 3 would have many of the same project elements and anticipated impacts as described for Alternative 2. Impacts to wildlife and vegetation resources from project components consistent with the discussion in Sections 3.6.6.2 and 3.6.6.3 are not presented again under this alternative. Differences in project elements and associated potential impacts are discussed below.

Sensitive and Special Status Wildlife Species

Although Alternative 3 has a reduced project footprint and expected visitor use compared to Alternative 2, it would result in comparable intermittent disturbances to foraging Queen Charlotte Goshawks from trail placement and use. Project components where goshawks are known to nest and forage, including the Dredge Lakes Multi-Use Trails, West Glacier Multi-Use Trails, and the Nugget Falls Trail Expansion, would not change from Alternative 2.

Approximately 21 acres (less than 1 percent) of available moderate and high value habitat for goshawks would be permanently impacted by Alternative 3 (ABR 2021). Alternative 3 would have a **minor effect** on goshawks and would not result in a loss of population viability in the project area or Tongass National Forest or affect the population trend toward a Federal listing (Dunn 2022).

Migratory Birds

Alternative 3 would have nominally fewer impacts on migratory birds than Alternative 2.

Under Alternative 3, the section of the Lakeshore Trail directly in front of the Welcome Center would not be constructed, reducing impacts to shoreline habitat and to shorebirds, seabirds, waterbirds, and raptors. While the Welcome Center Dock would have smaller shoreline footprint

and no inland excavation, the West Glacier Dock would have a larger footprint, require dredging during construction and maintenance resulting in more impacts to migratory bird habitat along that section of the shoreline. A 1-mile-long length of Lakeshore Trail would be set back from the bird habitat along the lake shoreline. In addition to smaller footprints within lakeshore bird habitat, the Lakeshore Trail and other Visitor Center Unit facilities would be expected to accommodate fewer visitors under Alternative 3, reducing the likelihood of visitors going off-trail or disturbances to foraging or nesting birds, such as the Photo Point nesting colony.

The West Glacier Spur Trail would be within 820 feet (250 meters) of seabird colonies and shorebird nesting areas. Adding motorized boat tours on the lake would increase the number of people that have access to seabird colonies on the West Glacier rock peninsula, but to a lesser degree than Alternative 2. It is anticipated that there could be a boat departing every 30 minutes for 10 hours per day from the Visitor Center dock across the lake to the glacier, equating to approximately 20 round trips daily. Boat tour service days would be limited to 100,000 per year under Alternative 3, with a maximum of 214 service days per year and boat capacity of 35 passengers. This would be in addition to those visitors hiking West Glacier Trail and those who take a non-motorized boat across the lake. Trails and facilities would be located as far as feasible from known colonies and nesting areas (USDA Forest Service 2016, p. 4-89 and 4-90). Education, interpretation, fencing, and signage would be used to protect these areas and mitigate visitor disturbances, meeting the purpose of forest plan guidelines for regulating human use and minimizing disturbance (USDA Forest Service 2016, p. 4-89 Section XI.A.1.b, p. 4-90 Section XII.A.3 and A.6). However, the potential remains for uninformed visitors and loose dogs to disturb individual nesting and foraging birds along the shoreline.

While the expanded parking area and the realigned Steep Creek Trail impact areas would be smaller under Alternative 3, most of the project components within forested bird habitat would be the same as Alternative 2. Therefore, impacts to birds which rely on forested habitats for nesting and foraging, including raptors, landbirds, and waterbirds, would be similar between Alternatives 2 and 3.

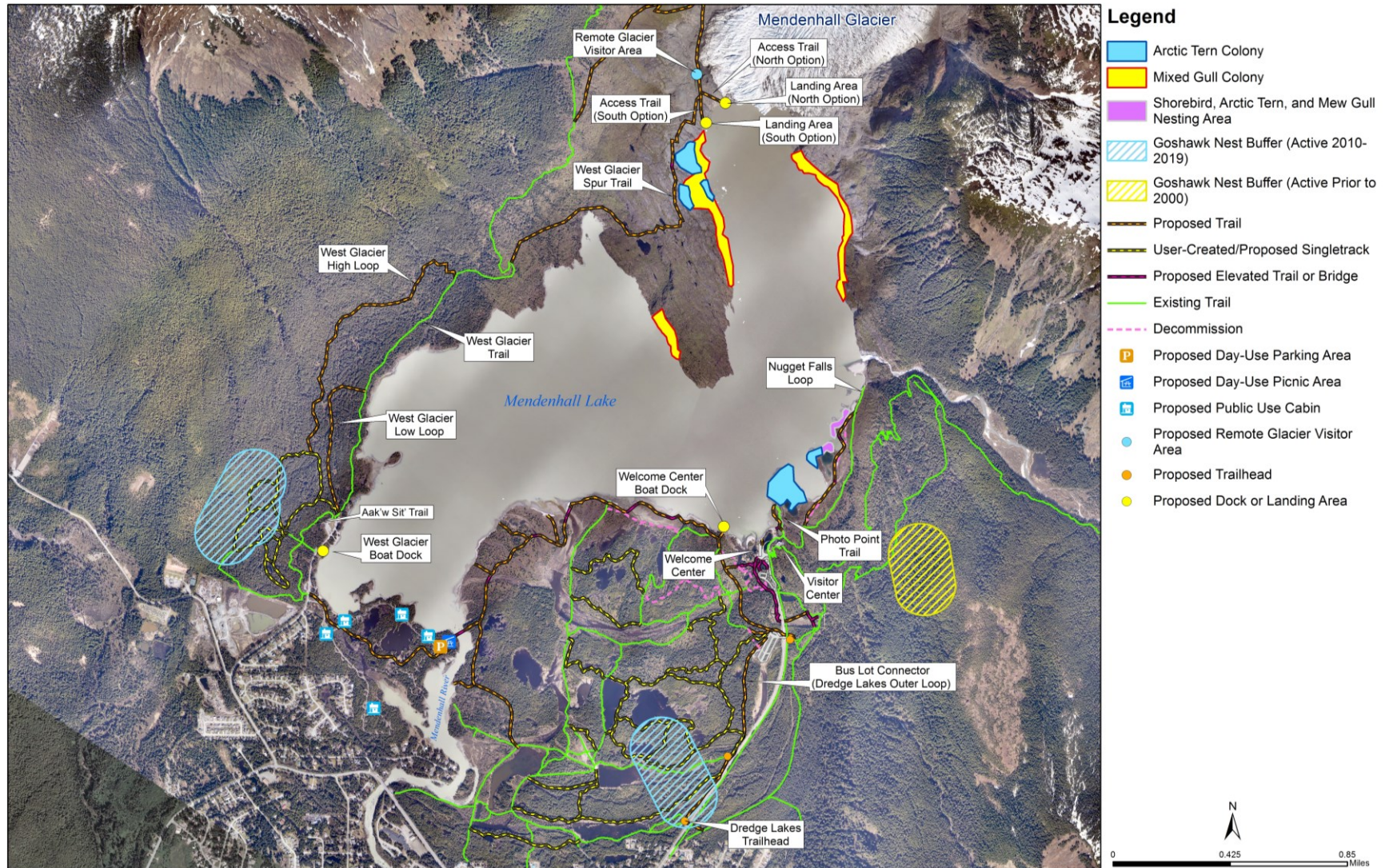
As proposed in Alternative 3, impacts to wetland bird habitat would be similar to Alternative 2. Zig Zag Pond, important for waterbirds, would not be completely filled; however, the Lakeshore Trail alignment would fill more wetland bird habitat inland from the lakeshore valued for raptors, including Bald Eagles, waterbirds, and landbirds.

The proposed boat landing areas and Remote Glacier Visitor Area would be designed to accommodate fewer visitors in Alternative 3. The smaller landing craft boats powered by electric energy combined with fewer daily boat trips would likely result in fewer human disturbances and behavioral responses from migratory birds on Mendenhall Lake and the shoreline; however, disruptions would still be likely to occur. Although there would be no dock infrastructure, the South Option for the landing area would include motorized boats operating and landing and a floating restroom facility within 820 feet (250 meters) of the mixed gull and Arctic Tern colonies on the West Glacier rock peninsula (see Chapter 2, Section 2.4.2, USDA Forest Service 2016, p. 4-89). The North option would provide a greater distance from the colonies. Education, interpretation, fencing, and signage as well as a no wake zone would be used to protect these areas and mitigate visitor disturbances from boat operations and from use of the West Glacier Spur Trail, meeting the purpose of Forest Plan guidelines for regulating human use and minimizing disturbance (USDA Forest Service 2016, p. 4-89 Section XI.A.1.b, p. 4-90 Section

XII.A.3 and A.6). Fewer visitors in the glacier area would also result in fewer disruptions to nesting birds in that area when compared to Alternative 2.

Given the extent of new facilities and proposed increases in trail and facility users in areas with nesting habitat, individual birds and localized short-term populations could be impacted (Figure 3-5). Since there would be no anticipated impacts on populations within the Tongass National Forest, Alternative 3 would be anticipated to have a **moderate effect** on migratory birds.

Figure 3-5. Migratory Bird Nesting Areas – Alternative 3



Bears

There would be somewhat fewer impacts to black bear habitat and behavior under Alternative 3 compared to Alternative 2. The permanent footprint within bear habitat would be 21 acres, which would impact less than 1 percent of available moderate and high value habitat for black bears (ABR 2021).

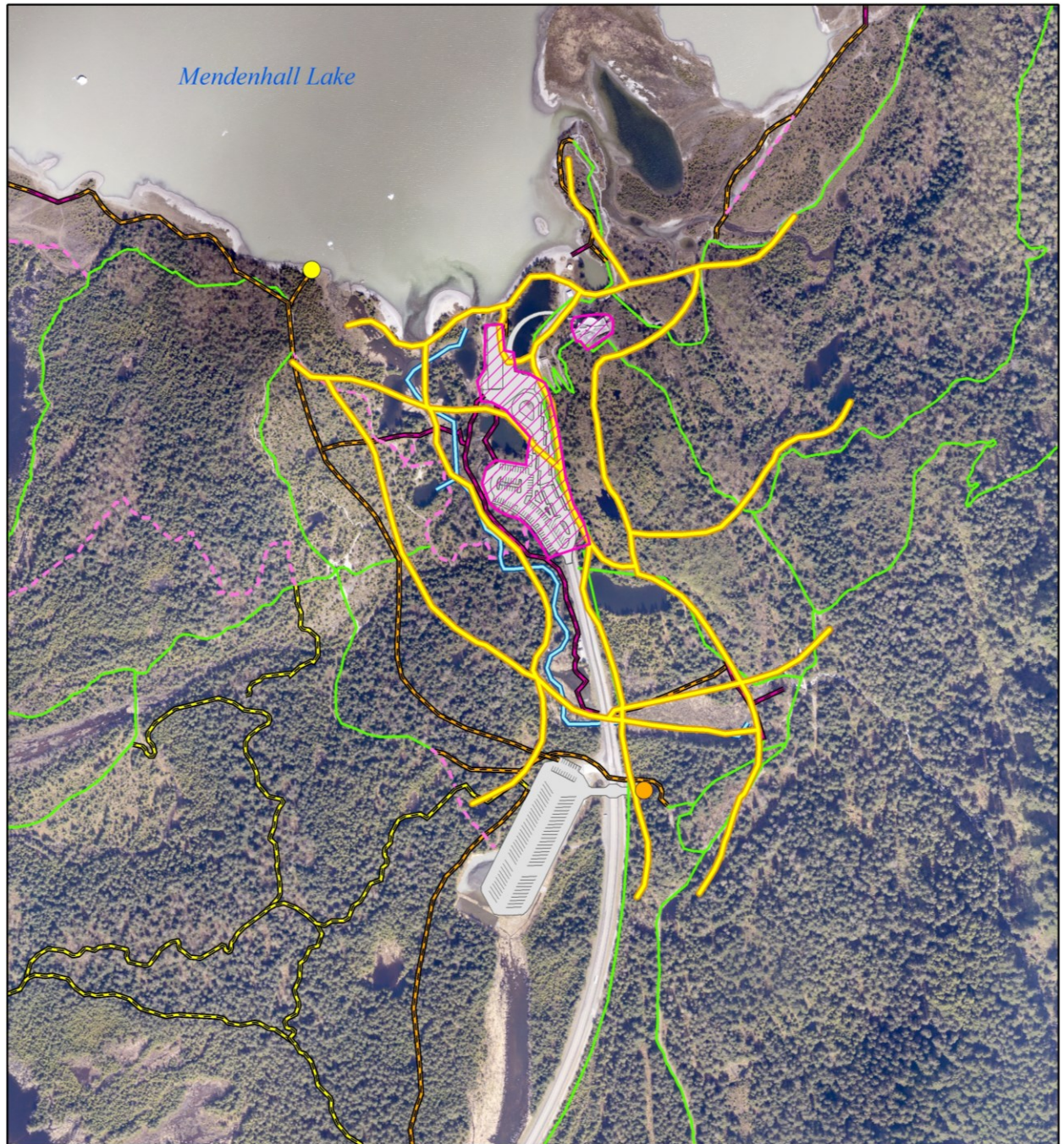
Trails and facilities proposed in Alternative 3 would allow more undeveloped space for bears to travel between Nugget Falls and Steep Creek than in Alternative 2 (Figure 3-6). By omitting the Welcome Center portion of the Lakeshore Trail, bears would have an open vegetated path along the shoreline between Photo Point Trail and the mouth of Steep Creek. Alternative 3 also includes smaller footprints for the Welcome Center Plaza, Welcome Center Dock, main parking lot, and the Steep Creek Trail.

Although some project components would have smaller footprints and fewer visitors under Alternative 3, there would be more visitors and expanded habitat disturbances within areas known for bear-human interactions and bear sightings. Similar to Alternative 2, bears would be expected to alter their behavior through habituation, avoidance, or aggression under Alternative 3 due to habitat and visitor disturbances. It would be possible that new or increased bear-visitor conflicts could emerge.

Similar to Alternative 2, implementing Alternative 3 would alleviate some existing stresses on bear activity, namely crowding and user-created trails in the Visitor Center Unit. Facilities along Steep Creek and the implementation of a wildlife underpass along Glacier Spur Road would improve bear habitat.

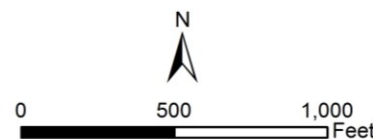
Implementing Alternative 3 would increase habitat fragmentation, anticipated visitation, and new facilities within areas of observed bear movements. As a result, Alternative 3 would be expected to have a **moderate effect** on bears, given impacts to individuals and the population within in the MGRA. Due to available habitat within the MGRA, the size of bears' home ranges, and anticipated behavioral adaptations, bear populations within the Tongass National Forest would not be expected to experience any long-term declines as a result of this project.

Figure 3-6. Observed Bear Movements Near the Visitor Center – Alternative 3



Legend

- | | |
|---|--|
| Proposed Trail | Bears Never Allowed Zone (Anticipated) |
| User-Created/Proposed Singletrack | Proposed Trailhead |
| Proposed Elevated Trail or Bridge | Proposed Dock |
| Existing Trail | |
| Decommission | |
| Observed Bear Movements | |
| Steep Creek Habitat Restoration and Realignment | |



Wildlife

Most impacts to wildlife would be the same between Alternative 2 and Alternative 3. Unique impacts of Alternative 3 to wildlife, specifically mountain goats, wolves, and beavers, are detailed below.

Like Alternative 2, Alternative 3 proposes the Remote Glacier Dock, Remote Glacier Visitor Area, and West Glacier Spur Trail in winter mountain goat and year-round wolf habitat near the Mendenhall Glacier terminus. These project components would have less capacity and fewer visitors than Alternative 2, resulting in fewer human disturbances to and behavioral responses from wildlife. The receding glacier would continue to open new habitat to mountain goats and wolves.

Beavers would be impacted by development along waterbodies within the Visitor Center Unit, including the Lakeshore Trail and Steep Creek Habitat Restoration. Although Steep Creek Trail Expansion would have a smaller footprint, the impacts to beavers under Alternative 3 would be similar to Alternative 2. The Forest Service would continue to mitigate beaver dam development in the Dredge Lakes Unit and the Visitor Center Unit to reduce the risk of flooding or destroying proposed facilities.

Given available habitat, Alternative 3 would not be anticipated to affect population levels of wildlife within the Tongass National Forest. However, there would be occasional visitor disturbances, possibly interfering with individuals and the local populations. As a result, the overall negative impact to wildlife would be anticipated to be **moderate**.

Vegetation and Sensitive Plant Habitat

Similar to Alternative 2, Alternative 3 would have impacts on vegetation and sensitive plant habitat from facility footprints. The main parking lot, Steep Creek Trail Expansion, Lakeshore Trail, and the Welcome Center Dock would all have a smaller footprint under this alternative and would have a smaller impact on vegetation. The West Glacier Dock would have a larger footprint in Alternative 3.

Project components with total and permanent ground disturbances different from those presented in Alternative 2 are summarized in Table 3-9. The permanent vegetation and habitat disturbance would be 21.4 acres of the available vegetation in the MGRA, approximately 3,800 acres (ABR 2021). This alternative would be anticipated to have a **minor effect** on vegetation and sensitive plant habitat as there would be perceptible, localized effects without affecting the integrity of available habitat types (Dunn 2022).

Table 3-9. Summary of Vegetation Disturbance – Alternative 3^a

Project Components	Short-Term Vegetation Disturbance (Acres)	Permanent Vegetation Disturbance (Acres)
Main Parking Lot	1.2	1.1
Lakeshore Trail	3.7	3.4
Steep Creek Trail Expansion	1.2	1.0
Welcome Center Dock	0.3	0.3
West Glacier Dock	0.3	0.2
Remote Glacier Landing Area	0.1	0.1
Other Components	20.4	15.3
Total	27.1	21.4

^a Totals may not add up because of independent rounding

Invasive Species

Impacts to invasive species under Alternative 3 would be comparable to Alternative 2. Alternative 3 would also include improving the existing user-created mountain bike trails in the Dredge Lakes Unit and formally designating these as NFS trails. No other facilities would be within the known reed canarygrass infestations. Ongoing management and compliance with the Forest Service’s Guidance for Invasive Plant Management Program for the Tongass National Forest would continue (Krosse 2019). However, existing invasive species infestations may expand and new infestations could emerge from 27 acres of short-term vegetation disturbances and increased visitor use (Turner 2022). Alternative 3 would have a **moderate effect** on invasive species.

Early Successional Vegetation

Similar to Alternative 2, Alternative 3 would permanently impact approximately 9.4 acres, less than 2 percent of early successional vegetation (ABR 2021). The relevant project components would not occupy a substantial portion of existing and anticipated early successional vegetation area within the MGRA. However, Alternative 3 would introduce or increase visitor facilities and anticipated visitation within some remote and undisturbed early successional vegetation areas. As a result, Alternative 3 would likely have a **moderate effect** on early successional vegetation.

3.6.6.5 Alternative 4

Alternative 3 would have many of the same project elements and anticipated impacts as described for Alternatives 2 and 3. Impacts to wildlife and vegetation resources from project components consistent with the discussion in Sections 3.6.6.2, 3.6.6.3, and 3.6.6.4 are not presented again under this alternative. Differences in project elements and associated analyses are discussed below.

Sensitive and Special Status Wildlife Species

Alternative 4 would further reduce project footprints and expected visitor use increases within Queen Charlotte Goshawk habitat compared to Alternative 2 and Alternative 3. The Dredge Lakes Multi-Use Trails and West Glacier Unit Multi-Use Trails would not be included in this alternative, reducing proposed visitor activity where goshawks are known to nest and forage. The

Dredge Lakes Outer Loop footprint would be reduced to the Lakeshore Trail and Mendenhall River Trail.

There could be continued visitor use along existing user-created trails in these areas.

Approximately 12 acres (less than 0.5 percent) of the available moderate and high value habitat for goshawks would be permanently impacted by Alternative 4. Alternative 4 would have a **minor effect** on goshawks and would not result in a loss of population viability in the MGRA or Tongass National Forest or affect the population trend toward a Federal listing (Dunn 2022).

Migratory Birds

Alternative 4 would have fewer impacts on migratory birds than Alternatives 2 and 3.

Compared to the other action alternatives, Alternative 4 would include minimal facilities within the lakeshore bird habitat and result in fewer direct impacts to nesting and foraging individuals. There would also be less human activity along the lakeshore, leading to fewer behavioral responses from migratory birds. Occasional disruptions from visitor use would be possible, similar to conditions under the No Action Alternative. There would be fewer visitors expected on the West Glacier Spur Trail and on the West Glacier rock peninsula without the Remote Glacier Visitor Area and motorized boat trips.

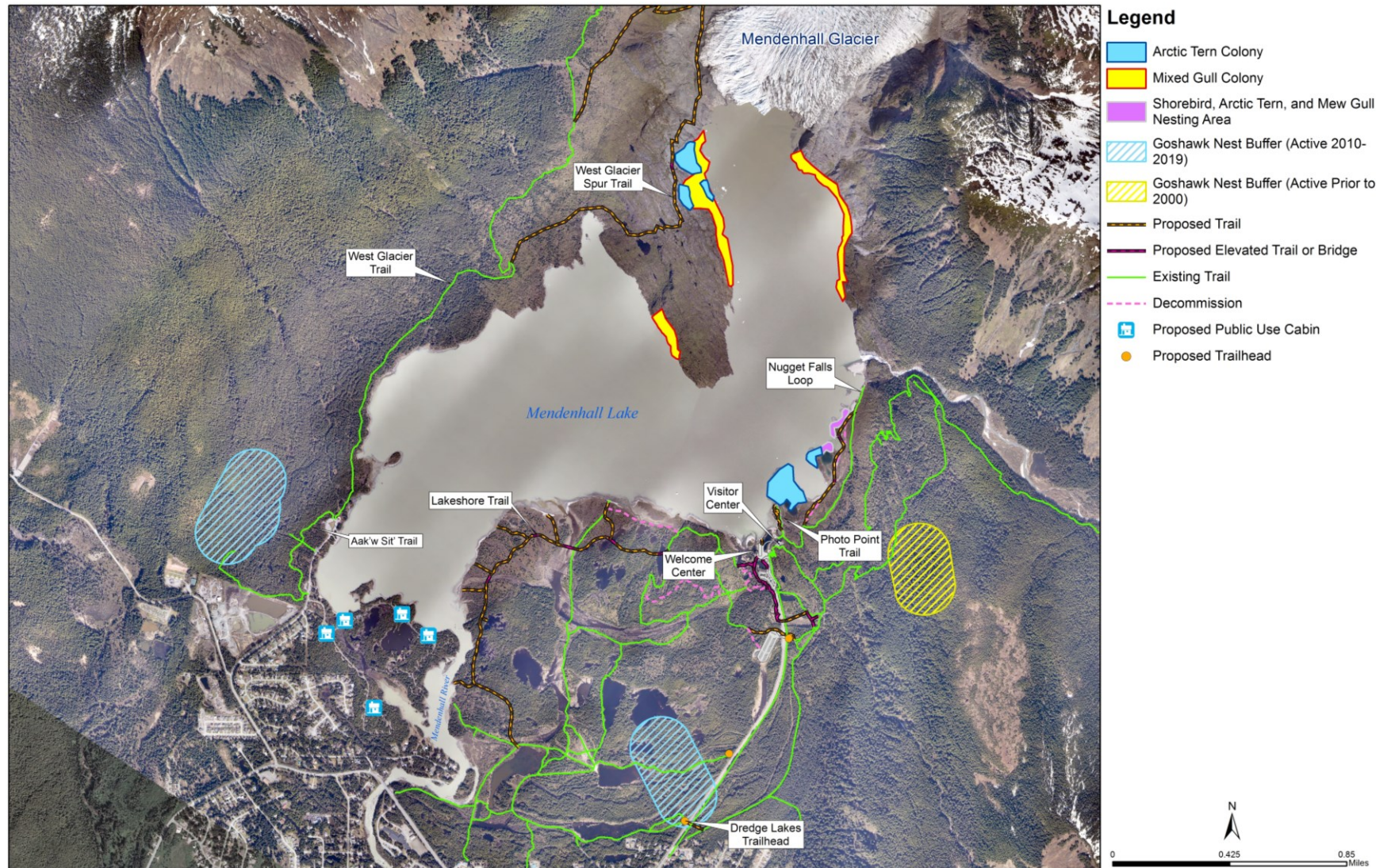
Impacts to forested bird habitat from Alternative 4 would be comparable to Alternative 3, since facilities within this habitat would be similar. The Dredge Lakes Multi-Use Trails and West Glacier Multi-Use Trail would not be constructed/improved under Alternative 4; however, the existing user-created trails would persist and informal use would likely continue to impact raptors, waterbirds, and landbirds foraging and nesting within forested habitat.

As proposed in Alternative 4, smaller footprints for the parking area, realignment of Steep Creek Trail, and Lakeshore Trail would fill less wetland habitat valued for raptors, waterbirds, and landbirds. The Dredge Lakes Outer Loop footprint would be reduced to the Mendenhall River Trail.

Because the existing informal non-motorized boat launch near the Visitor Center would be improved, but no other boat docks would be constructed and no motorized boats would be operated under Alternative 4, disturbances to nesting and foraging birds from boats would likely resemble the No Action Alternative.

Under Alternative 4, bird and bird habitat impacts would be reduced when compared to Alternative 2 and Alternative 3 (Figure 3-7). There would be occasional impacts to individuals, but no anticipated effect on populations within the MGRA or Tongass National Forest. Alternative 4 would be anticipated to have a **minor effect** on migratory birds due to the extent of new facilities and anticipated increases in visitor use.

Figure 3-7. Migratory Bird Nesting Areas – Alternative 4



Bears

Alternative 4 would permanently impact 12 acres of bear habitat, less than 0.5 percent of available moderate and high value habitat for black bears (ABR 2021). There would be about 12 fewer acres of habitat impacts than the Alternative 2 and 9 fewer acres than Alternative 3. In addition, lower anticipated visitor use in Alternative 4 would result in fewer impacts to bear habitat and behavior than other action alternatives.

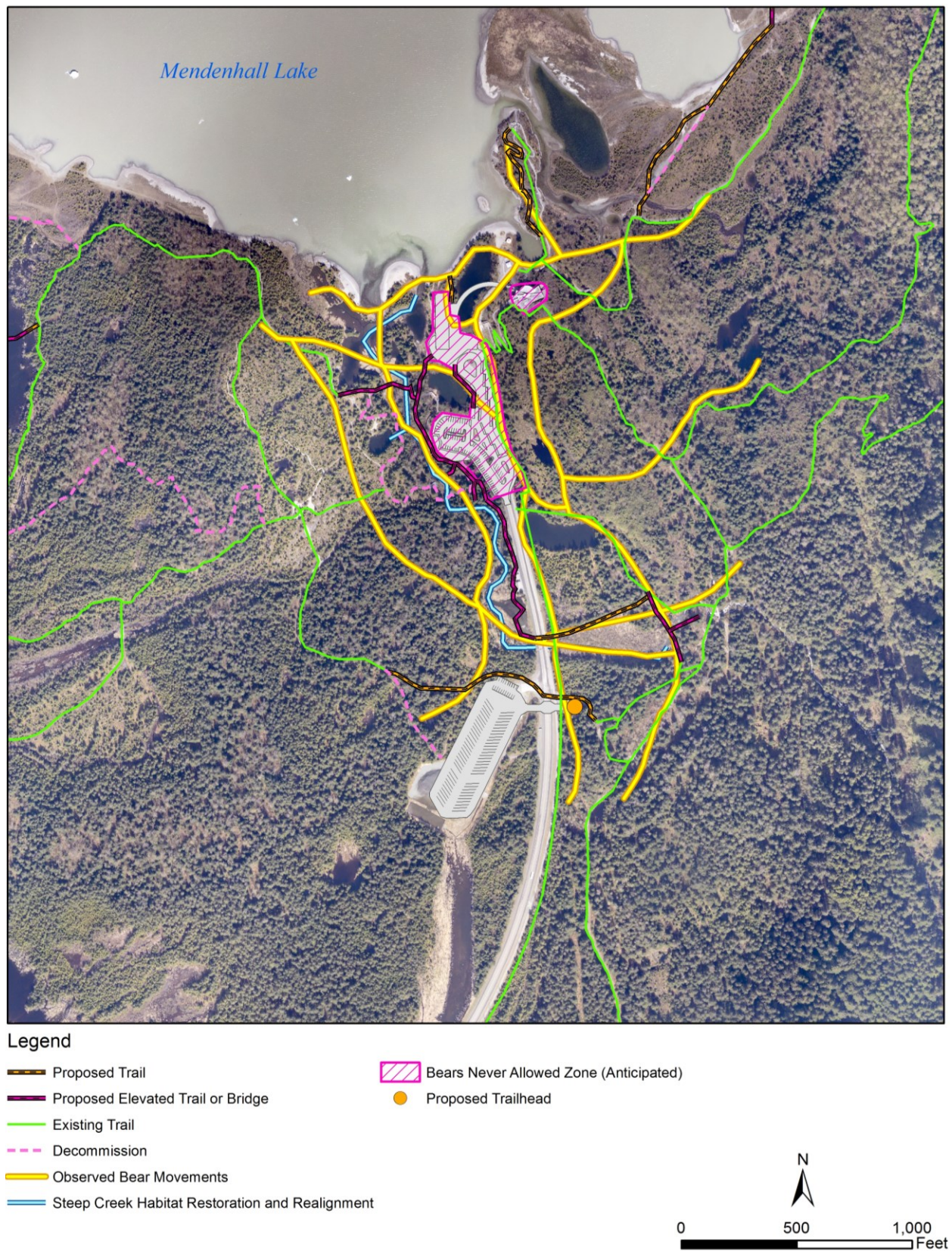
Alternative 4 leaves more undeveloped space than the other action alternatives for bears to travel between Nugget Falls and Steep Creek and to access the lakeshore near the Visitor Center than Alternatives 2 and 3 (Figure 3-8). The proposed parking lot, Welcome Center Plaza and associated trails, and Steep Creek Trail would have smaller proposed footprints within areas with observed bear movements and habitat. Omission of dock facilities and moving a portion of Lakeshore Trail away from the shoreline would also reduce impacts to bear habitat and movements.

Anticipated levels of visitation for a few trails within areas with more frequently observed bear movements, such as the Steep Creek Trail, Moraine Ecology Trail, and the Lakeshore Trail, would be reduced under this alternative when compared to the other action alternatives. With smaller increases in visitor levels, fewer disturbances to travelling and foraging bears would be expected. Similar to the other action alternatives, bears would be expected to alter their behavior through habituation, avoidance, or aggression under Alternative 4 due to habitat and visitor disturbances. Although less likely under this alternative, it would be possible that new or increased bear-visitor conflicts could emerge.

Alternative 4 would alleviate some existing stresses on bear activity. Crowding and development of user-created trails in the Visitor Center Unit would be less prominent. Similar to the other action alternatives, facilities along Steep Creek and the implementation of a wildlife underpass along Glacier Spur Road would improve bear habitat.

Due to overall increases in habitat fragmentation and anticipated visitation, implementing Alternative 4 would be expected to have a **minor effect** on bears. There would be impacts to individuals. Given available habitat within the MGRA, the size of bears' home ranges, and anticipated behavioral adaptations, no impacts to the local or forest-level bear populations would be expected.

Figure 3-8. Observed Bear Movements Near the Visitor Center – Alternative 4



Wildlife

There would be fewer direct habitat disturbances and lower levels of anticipated visitor use in areas with preferred and high value resources for wildlife under Alternative 4. Additional or different impacts to mountain goats, wolves, and beavers are described below.

There would be considerably fewer facilities within preferred winter mountain goat and year-round wolf habitat under Alternative 4 than under other action alternatives. Given that the boat docks and the Remote Glacier Visitor Area would not be developed under this alternative, habitat impacts, human disturbances, and behavioral responses from wildlife would be uncommon near the glacier terminus and other remote areas. There could be occasional impacts from hikers using the West Glacier Spur Trail near the glacier; however, mountain goats and wolves would continue to avoid humans and would likely have additional areas to inhabit to as the glacier recedes.

While beaver habitat impacts in the Visitor Center Unit would be similar to Alternative 3, because of the reduced footprints associated with Lakeshore Trail and Steep Creek Trail Expansion would result in fewer impacts to beaver habitat. Continued use of the user-created trails in the Dredge Lakes Unit would cause minimal additional impacts to beaver habitat and behavior. The Forest Service would continue to mitigate beaver dam development under Alternative 4 to reduce the risk of flooding or destroying proposed facilities.

Because the scale of facilities and trail capacities would be reduced under Alternative 4, it would not be anticipated to interfere with local or forest-level wildlife populations or their habitat. As a result, the overall impact to wildlife would be anticipated to be **minor**.

Vegetation and Sensitive Plant Habitat

Alternative 4 would have similar but fewer direct impacts on vegetation and sensitive plant habitat than Alternatives 2 and 3, primarily from smaller facility footprints.

Without proposed facilities within the Dredge Lakes and West Glacier Units, conditions of vegetation along existing user-created trails would be expected to continue to degrade from use and poor trail management (flooding, emergence of new user-created trails).

Project components with temporary and permanent ground disturbances different from those presented in Alternative 2 are summarized in Table 3-10. The permanent vegetation and habitat disturbance would be 11.5 acres, minimal relative to availability of vegetation in the MGRA. Alternative 4 would have a **minor effect** on vegetation and sensitive plant habitat as there would be perceptible, localized effects without affecting the integrity of available habitat types (Dunn 2022).

Table 3-10. Summary of Vegetation Disturbance – Alternative 4^a

Project Component	Short-Term Vegetation Disturbance (Acres)	Permanent Vegetation Disturbance (Acres)
Main Parking Lot	1.0	0.9
Photo Point Trail	0.2	0.2
Lakeshore Trail (entire alignment)	3.5	3.1
Mendenhall River Trail	1.2	1.1
Steep Creek Trail Expansion	0.9	0.9
West Glacier Spur Trail	1.9	1.7
Other Components	7.3	3.6
Total	16.1	11.5

^a Totals may not add up because of independent rounding

Invasive Species

There would be reduced ground disturbance and visitor use levels for Alternative 4 when compared to the other action alternatives. However, these activities, including 16 acres of short-term vegetation disturbances, would have the potential to spread invasive species within the MGRA. The existing user-created trails in the Dredge Lakes Unit would not be improved or formally incorporated as NFS trails. Use of these trails would be expected to continue and conditions would likely degrade without maintenance. Collectively, there would be an elevated risk of spreading reed canarygrass within the Dredge Lakes Unit. As a result, Alternative 4 would have a **moderate effect** on invasive species (Turner 2022).

Early Successional Vegetation

There would be fewer proposed facilities within early successional vegetation under Alternative 4 than under other action alternatives without boat docks and the Remote Glacier Visitor Area near the glacier terminus. Less development and fewer visitors would be anticipated for the proposed project components within early successional vegetation along the lakeshore (the main parking lot, Welcome Center and associated plaza, Photo Point Trail, and Nugget Falls Trail Expansion).

The relevant project footprints would not occupy a significant portion of existing and anticipated early successional vegetation within the MGRA, approximately 7.9 acres. When compared to existing conditions, implementing Alternative 4 would increase visitor facilities and anticipated visitation within early successional vegetation to some extent. As a result, Alternative 4 would likely have a **minor effect** on early successional vegetation.

3.6.7 Cumulative Effects

Various regional projects were considered to have potential cumulative effects to wildlife and vegetation. The impact of climate change on wildlife was also considered in the analysis of cumulative effects. The proposed project would cumulatively add to the level of wildlife and vegetation disturbances in the Mendenhall Valley and the Forest Service WAA 2515, including the Eagle River/Herbert River Valley and the Mendenhall Valley and area between, when considered with the additional actions provided in Table 3-11.

Table 3-11. Projects Considered for Analysis of Cumulative Effects to Wildlife and Vegetation

Project Name	Type	Action
MGRA Management Plan Revision – Commercial Guide, Outfitter, and Transport Services	Management	Past
MGRA Visitor Center Maintenance	Maintenance	Present
Mendenhall Glacier Mineral Withdrawal	Public Land Order Mineral Withdrawal	Present
Point-to-Point Transport Special Use Permitting	Management	Present
Mendenhall Campground Repaving	Trail & Rec Improvements	Present
Back Loop Bridge and Dredge Lakes Trailhead Parking Area Improvements	Trail & Rec Improvements	Present
Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements	Trail & Rec Improvements	Future
Montana Creek Master Plan	Trail & Rec Improvements	Future
Juneau Trails Master Plan	Trail & Rec Improvements	Future
Small Cruise Ship Dock Construction	Infrastructure	Future
A.J. Dock Cruise Ship Berth Expansion	Infrastructure	Future
Franklin Dock Floating Berth Improvements	Infrastructure	Future
Norwegian Cruise Ship Berth (Aak’w [Auke] Landing) Construction	Infrastructure	Future

The proposed project, when considered with other projects planned or currently occurring within the MGRA, is not expected to cumulatively impact wildlife or their habitat or vegetation. Activities proposed under the MGRA Management Plan Revision – Commercial Guide, Outfitter, and Transport Services have been examined and found to have little cumulative impacts. Deferred improvements on MGRA facilities, such as the Mendenhall Campground and Back Loop Bridge and Dredge Lakes Trailhead parking improvements and the Visitor Center roof repair, would not be anticipated to impact wildlife beyond possible noise disturbances during maintenance. Appropriate scheduling with construction for the proposed action would mitigate cumulative impacts from these actions.

Projects with the potential to impact wildlife and vegetation include new or expanded trails and authorized use types from the Montana Creek Master Plan and Juneau Trails Master Plan. The master plans, currently undergoing public scoping, are likely to include proposed trails within the home ranges of black bears that frequent the MGRA, and potential cumulative impacts from these trails include localized habitat disturbances, habitat fragmentation, increased bear-human interactions, and avoidance behaviors from wildlife. Motorized trail use could be considered for

lands adjacent to the MGRA, which could also disturb wildlife. In addition, construction of any master plan-proposed trails would have the potential to introduce or spread invasive species into areas adjacent to the MGRA. The relative size of the proposed trails in comparison to available habitat has yet to be determined; however, the proposed project in addition to other Juneau area trail projects in the area are not expected to cumulatively impact wildlife or their habitat or vegetation.

The proposed Mendenhall Glacier Mineral Withdrawal would prohibit possible mineral development for 20 years, subject to valid existing rights. By preventing mining adjacent to the existing MGRA boundary, this action would preserve habitat continuity and maintain ecosystem health that could otherwise be adversely impacted by mineral development. The withdrawal would protect high alpine areas and early successional areas. Additionally, there are no foreseeable changes to ADF&G game hunting regulations for GMU 1C, which includes the Mendenhall Valley (ADF&G 2021a). Together with the proposed Steep Creek Habitat Restoration, some projects listed in Table 3-11 may cumulatively improve conditions for wildlife and vegetation.

Wildlife could also be impacted by increased traffic in the Juneau area from more cruise ship tourists in Juneau. In addition to increased traffic from tour buses traveling to the MGRA if the Forest Service offered more special use permits as proposed under this project, it is likely that there would generally be more traffic and more tour buses on Juneau area roads from the anticipated increase in cruise ship traffic. Bears and other wildlife could experience further habitat fragmentation and an elevated risk of being hit by vehicles in the Juneau area from increased use.

Climate change is accelerating habitat changes in the MGRA, most notably by accelerating glacier recession and forest succession as the melting glacier exposes new primary habitat and existing early successional habitat transitions to forested habitat. Wildlife continues to adapt to these changing conditions.

Wildlife would also be affected by unseasonable weather events tied to climate change, such as late frosts and early warm weather changing the availability of key foraging resources such as wild berries (Holen 2017). These changes could put animals out of sync with critical seasonal food sources. Outside of the MGRA, migratory birds are affected by climate change-induced reduced habitat availability along migration routes (King and Finch 2013). Additionally, salmon are a key food source for bears. However, salmon stocks are impacted by increasingly adverse ocean conditions like warming and acidification (EcoAdapt 2014). Impacts linked to climate change would be expected to persist, and possibly worsen over the duration of this project.

3.7 Recreation and Visitor Experience

3.7.1 Scope of the Analysis

This section includes a description of existing recreation facilities and the range of recreational opportunities and experiences available at the MGRA. In addition, this section describes how proposed infrastructure and proposed changes to visitor capacity, allocation of use, and permitted service days would affect the recreation experience, including scenic resources and the noise/soundscape. The scope of this recreation analysis includes the recreational opportunities and experiences available within the 5,800 acres of the MGRA from now until 30 years in the future.

3.7.2 Regulatory Setting

3.7.2.1 Consistency with the 2016 Tongass Forest Plan

The recreation and visitor experience analysis contained in this EIS has been reviewed for consistency with applicable Forest Plan direction including recreation and tourism, trails, and scenery. The Forest Plan directs management of the land and resources of the Tongass National Forest. It contains forest-wide direction along with specific direction for recreation and tourism that provide for resource management across the Forest (USDA Forest Service 2016, Chapter 4). It presents goals, objectives, and desired conditions for different LUDs. The MGRA falls under the Special Interest Area LUD.

Recreation Area Use: Capacity, Allocation of Use, and Permitted Service Days

Recreation and tourism standards and guidelines address recreation use administration for Special Interest Areas (USDA Forest Service 2016, pp. 4-41 to 4-47). Under the direction, recreation use is to be based on the effect of recreation and tourism on the unique features for which the Special Interest Area is established. The standards and guidelines also call for providing interpretation of the unique characteristics of the Special Interest Area and regulating use to eliminate adverse effects on special features. Recreation Opportunity Spectrum (ROS, see below) classifications are to be adopted and use managed according to these ROS classes.

Visitor capacity is defined as the maximum amounts and types of visitor use than an area can accommodate while achieving and maintaining the desired resource conditions and visitor experiences that are consistent with the purposes for which the area was established (Interagency Visitor Use Council 2019). For recreation sites and individual recreation facilities, visitor capacity is determined by observations and judgments of Forest Service MGRA staff, recreation specialists, and special use permit administrators. In addition to observations and judgment, these professionals consider quantitative measures such as number of social encounters expected in different recreation settings (see ROS descriptions below) and occupancy limits of buildings and infrastructure, for example number of parking stalls and restroom facilities available. Use of this type of professional judgment is not uncommon in setting user capacity estimates (Cole and Carlson 2010). Considerations for visitor capacity are described in detail in Appendix A.

The Forest Service allocates a percentage of total capacity in different areas of the MGRA for commercial use. For example, the Visitor Center Unit, which sees the greatest number of visitors, has a high percentage of total use allocated to commercial use. In contrast, the Dredge

Lakes Unit, which is historically a local-use area, has a very low commercial use allocation percentage.

A service day is an allocation of use constituting a day or any part of a day on NFS lands for which an outfitter, guide, or transporter provides services to a client. Each commercial client that visits the MGRA represents one service day for that service provider. Based on the commercial allocation, special use permits with specific numbers of service days are distributed to different commercial outfitter, guide, transport, and other service providers. Commercial allocation percentages and service days are described in detail in Appendix B. The Forest Service does not limit entry into the MGRA for those that arrive without an outfitter, guide, transport, or other service provider.

Recreation Opportunity Spectrum

The ROS is a Forest Service classification system that offers a framework for analyzing and providing a range of recreation experiences in different settings across the forest. The Forest Service designates seven major ROS classes for areas ranging from highly-trafficked to remote: Urban, Rural, Roaded Modified, Roaded Natural, Semi-Primitive Motorized, Semi-Primitive Non-Motorized, and Primitive. Each ROS class provides a different setting and features (e.g., scenic quality, ease of access, remoteness, visitor management, facilities, social encounters, visitor impacts) with different experiences and opportunities based on these settings, but the ROS designation does not specify or prescribe what types of activities are allowed in an area. A broad spectrum of ROS classes and associated experiences provides people with a range of recreational choices. Refer to the Forest Plan, Appendix I, for a more complete description of the ROS classes and appropriate standards and guidelines for each. The number of social encounters expected for each ROS designation (Table 3-12) was used to estimate visitor use capacity for trails in the MGRA, and therefore influences the number of commercial service days allocated for outfitter and guide use of those trails (Appendix B).

The Forest Plan allows for changes to ROS designations, with direction to “update existing ROS inventories as a part of specific project planning and implementation, and whenever project activities cause a change in recreation setting conditions significant enough to reclassify the affected area” (USDA Forest Service 2016, p. 4-41). An amendment to the Forest Plan would not be required to update any ROS classes within the scope of this project.

Table 3-12. Forest Service ROS Designations

ROS Class Designation	Allowable Number of Social Encounters
Urban	Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the operating season.
Rural	User may meet many (more than 20) other parties per day on trails, in dispersed areas, on roads, and in developed facilities. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the operating season.
Roaded Modified	User meets less than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the operating season.

ROS Class Designation	Allowable Number of Social Encounters
Roaded Natural	User meets less than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season. Numerous other parties may be encountered on roads. Few, if any, other parties are visible at dispersed campsites.
Semi-Primitive Motorized	User meets less than 10 parties per day on trails, roads, and shorelines during 80 percent of the primary use season.
Semi-Primitive Non-Motorized	User meets less than 10 parties per day on trails and waterways during 80 percent of the primary use season.
Primitive	A very low interaction between users (generally less than 3 group encounters per day).

Scenery Management System

The Forest Service also uses the Scenery Management System, a system of analysis that addresses the amount of visible impact created by man-made activities on NFS lands. The Scenery Management System presents an objective approach for determining the relative value and importance of scenery in an area. The integrity of the existing scenery resource is described by the existing scenic integrity (ESI) level. The desired condition is represented by scenic integrity objectives (SIO).

Scenic integrity is a term used to describe the visual condition of the landscape objectively as a degree of how intact it is, rather than using value judgement statements such as “beautiful” or “interesting.” ESI is the current state of the landscape; the degree to which the view is perceived as whole, complete, or intact without visual impacts from human activities. Scenic integrity ranges from very high to unacceptably low (USDA Forest Service 2016, p. 7-19; Table 3-13).

Table 3-13. Forest Service Scenic Integrity Levels

Scenic Integrity	Description
Very High	Mostly intact landscape character with only minute deviations, if any
High	Landscape character appears intact; deviations may be present that repeat line, form, color, texture and pattern common to the landscape and are not readily apparent
Moderate	Landscape character appears slightly altered. Any deviations remain visually subordinate to the landscape
Low	Landscape character appears moderately altered; deviations begin to dominate the landscape
Very Low	Landscape character appears heavily altered; deviations may strongly dominate the landscape
Unacceptably Low	Landscape character appears extremely altered; deviations are very dominant and do not follow line, form, color, texture, or pattern from the landscape

Source: USDA Forest Service 2016, p. 7-19

The Forest Service provides direction and objectives for landscapes within each LUD through the SIO. The SIO are applied to any activity that has the potential to affect the scenic character of the landscape (USDA Forest Service 2016, p. 4-54, Table 3-14). Each SIO depicts a level of scenic integrity used to direct landscape management: very high (unaltered), high (appears unaltered), moderate (slightly altered), low (moderately altered), and very low (heavily altered). Relevant objectives for Special Interest Areas include the following: to provide opportunities for public engagement with unique natural areas without compromising the natural characteristics of the area; to develop facilities only for interpretive purposes that blend with the natural settings; and to maintain a high SIO everywhere within the Special Interest Area except for developed recreation and interpretive facilities (USDA Forest Service 2016, p. 3-39).

Table 3-14. Forest Service Scenic Integrity Objectives (SIO)

SIO Designation	SIO Guidelines
High	Activities/modifications not visually evident to the casual observer
Moderate	Activities/modifications are visually subordinate to the landscape character
Low	Activities/modifications may visually dominate landscape, but have similar characteristics to naturally-occurring features
Very Low	Activities/modifications may visually dominate landscape but should appear to be natural when viewed as background

Source: USDA Forest Service 2016, pp. 4-55 to 4-57

3.7.2.2 Consistency with the MGRA Management Plan

Management of the recreation area is provided by the MGRA Management Plan that establishes a desired future condition and management goals for the MGRA. The 1996 MGRA Management Plan, revised in 2015, states the following: “the overall vision for the Recreation Area is for the area to remain relatively undeveloped, allowing for concentrated, high levels of use at two specific sites (the Visitor Center, Mendenhall Campground), moderately concentrated use at three sites (West Glacier Trailhead, Skater’s Cabin, and Mendenhall River) and dispersed, low to moderate use on Mendenhall Lake and in the rest of the Recreation Area” (USDA Forest Service 1996a).

The MGRA Management Plan is purposely broad to provide flexibility in responding to future changing uses. The Forest Service must periodically review its management to keep pace with changing policy, use patterns, and expectations of the public. The 1996 MGRA Management Plan states that it “provides the framework for more proactive decision making for problems that may occur in the foreseeable future” (USDA Forest Service 1996). The plan allows for monitoring and evaluation of commercial and non-commercial use to determine if the number of commercial service days allocated could be increased or decreased. In 2015, the Forest Service determined, after NEPA analysis, that the number of service days allocated should be increased due to substantial changes in visitor use (USDA Forest Service 2015). Due to changes in visitor use, the Forest Service is once again reevaluating commercial and non-commercial use and proposing changes to meet demand with this NEPA analysis. Any changes to visitor capacity

levels, commercial use allocations, ROS designations, and management unit boundaries from this analysis and decision will result in updates to the MGRA Management Plan.

3.7.3 Issues and Indicators

This analysis addresses the extent to which the alternatives meet the project purpose and need related to recreation, which includes:

- to provide quality opportunities for all visitors to enjoy the recreation area,
- to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, and
- to meet the demand of the visitor industry and support the economy of Southeast Alaska.

This analysis also addresses the following issue raised by the public during comment opportunities.

Issue Statement: *Proposed increases in visitor capacity and commercial use, changes in management unit boundaries, and the addition of motorized boats on Mendenhall Lake could adversely impact visitor experience by creating increasing encounters between groups and causing visual and noise impacts.*

Measurement Indicators:

- Qualitative evaluation of potential impacts to recreation experience from increased frequency of social encounters on trails and in high value local areas³
- Qualitative evaluation of the visibility of proposed project components from key viewpoints in the MGRA in relation to ESI and SIO
- Evaluation of types of operational noise in the MGRA, including number and size of boats on the lake daily and estimated number of buses and visitors

3.7.4 Affected Environment

3.7.4.1 Environmental Setting

The Mendenhall Glacier has been a destination since the early 1900s when the Tongass National Forest was established and steamships began bringing visitors to the region. In those days, the head of Mendenhall Valley was covered completely by the glacier, and the lake did not exist. The current Visitor Center area was uncovered from the ice in 1941. Regional Forester Frank Heintzleman designated the MGRA for public recreation use in 1947 (USDA Forest Service 2018). The Visitor Center was constructed in 1962.

Today, the MGRA is a valued Juneau recreational asset. The Forest Service maintains year-round recreation opportunities at this site and provides regular trail upkeep, vegetation management, and viewshed maintenance. There is a wide range of recreation opportunities available at the MGRA. Juneau locals visit the MGRA in all seasons to walk or hike, bike, fish,

³ A social encounter, for purposes of this document, occurs when a person or group using an NFS trail or other facility, including established scenic viewpoints, passes or is passed by another person or group.

view birds and wildlife, cross-country ski, skate, camp, and to be immersed in the natural environment. The summer season is dominated by tourist traffic when mostly non-locals come to see the glacier and view wildlife in a natural habitat and take part in the other available recreation opportunities. As discussed in Section 3.7.2.1, MGRA’s recreation experience is managed as prescribed by the Forest Service’s ROS class framework and is intertwined with setting features such as scenic quality, level of perceived noise, and number of other visitors present. All these factors are discussed below as they relate to the visitor experience.

3.7.4.2 Existing Recreation Resources, Uses, and Experiences

The MGRA offers a multitude of experiences that encompass five of the seven ROS classes, making it a highly-desirable destination for a wide variety of visitors and ability levels. Table 3-15 below shows the ROS classes for features and locations around the MGRA (USDA Forest Service 2018).

Table 3-15. ROS Designations in the MGRA

ROS Class Designation	Allowable Number of Social Encounters^a	Corresponding MGRA Component^b
Urban	Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the operating season.	Portions of the Visitor Center Unit (trails: Nugget Falls, Steep Creek, Photo Point); Visitor Center area
Rural	User may meet many (more than 20) other parties per day on trails, in dispersed areas, on roads, and in developed facilities.	Mendenhall Campground
Roaded Natural	User meets less than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season.	Portions of Visitor Center and West Glacier Units (trails: East Glacier, Powerline, Moraine Ecology, Trail of Time, West Glacier, Tolch Rock, Aak’w Sit’); all of Dredge Lakes Unit
Semi-Primitive Motorized	User meets less than 10 parties per day on trails, roads, and shorelines during 80 percent of the primary use season.	Mendenhall Lake (winter motorized use only) and Mendenhall River
Semi-Primitive Non-Motorized	User meets less than 10 parties per day on trails and waterways during 80 percent of the primary use season.	Portions of Visitor Center Unit (Nugget Creek Trail)

^a USDA Forest Service 2016, Appendix I

^b ROS designations provided for MGRA management units in the 1996 MGRA Management Plan (page 11) and 2015 Decision Notice for MGRA Management Plan Revision (USDA Forest Service 1996 and 2015).

Glacier Viewing

One of the main draws for visitors to the MGRA is the Mendenhall Glacier. The toe of the glacier comes into view initially just prior to reaching the first parking lot traveling north on

Glacier Spur Road, giving that first “wow” moment. Toward the north end of Glacier Spur Road, the view expands to show the glacier extending back between Mount McGinnis and Mount Bullard toward the Juneau Icefield. At the Visitor Center, the terminal mile of the glacier is visible.

The most prominent glacier views are from locations within the Visitor Center Unit, but views of the glacier are apparent from all management units in the MGRA. Within the Visitor Center Unit, the Visitor Center, parking area, pavilion, Photo Point Trail, Nugget Falls Trail, and East Glacier Trail offer views from different vantage points. The Dredge Lakes and West Glacier Units do not have as many spectacular viewpoints, but the glacier is visible from points along the lakeshore, Moraine Ecology Trail, West Glacier Trail, the campground, and at Skater’s Cabin. According to glaciology predictions, the glacier will become more difficult to see and will possibly disappear from the view of the Visitor Center and immediate surroundings in the next 20 to 30 years (Amundson et al. 2020). See Section 3.11 for a discussion of modeled rate of glacial retreat.

Visitor Center

The Visitor Center has been a significant attraction since its construction in the 1960s, particularly for guided tourists who use it as a jumping off point for exploration of the area. For most, the desired experience is the view of the glacier from the large expanse of north-facing wall of the center’s windows. The Visitor Center also offers glaciology exhibits, a theater with a short film featuring the glaciers of the Tongass National Forest, and a bookstore. Forest Service rangers and staff are available to answer questions or to direct visitors to trails and attractions. The Visitor Center, outside staircase, and parking lot provide connections to popular trails such as the Trail of Time, Steep Creek Trail, Nugget Falls Trail, and Photo Point Trail. During winter months, locals enjoy “fireside chats” at the Visitor Center, opportunity to learn about natural history in the Juneau area with a more intimate atmosphere than is available during the summer months.

Trails (Biking, Hiking/Walking, Cross-Country Skiing)

There are over 22 miles of Forest Service designated trails available for year-round use throughout the MGRA. Trails vary in developed scale from Forest Service Trail Class 1 to Class 5 (minimally to fully developed; FSH 2353, Section 14.2, Exhibit 01) and offer a wide range of expected visitor density and potential social encounters.

Visitor Center Unit Trails

The trails in the Visitor Center Unit are generally the most developed and experience highest visitor use and visitor density. The trails are generally short, easy hikes that offer glacier viewing and wildlife viewing. These trails are popular with visitors that arrive on tour buses or with guides that operate under special use permits as well as independent visitors.

Dredge Lakes Unit Trails

The Dredge Lakes trail network, with the exception of the Moraine Ecology Trail,⁴ is frequented by locals for a variety of uses including walking, biking, and access to lakes in the middle of the unit. Many existing Forest Service designated trails crisscross this area, and several user-created mountain bike trails have emerged in recent years. There are no groomed ski trails in this unit,

⁴ The Moraine Ecology Trail is split between two management units, the Visitor Center Unit and the Dredge Lakes Unit, and is primarily used by guided groups.

but skiing is allowed. There are no service days available to service providers in this unit.⁵ Therefore, use is relatively low along all trails in this area and locals report preference for using this area during the primary use season to avoid encounters with crowds.

West Glacier Unit Trails

Hiking, biking, and skiing occur on the trails in the West Glacier Unit. Hiking and biking tours using service providers are available in this unit. The Juneau Nordic Ski Club grooms ski tracks on the campground roads and a 3.5-mile loop on the lake when conditions allow. West Glacier Trail is a longer, more technical trail that leads to a terminus above the glacier, plus an undesigned, technically challenging spur trail that leads to the toe of the glacier.

Wildlife Viewing

Wildlife viewing is popular within all MGRA management units. Bears, mainly females sometimes with cubs, frequent the area and are a large visitor draw in the summer months. Salmon returning to spawn in late summer attract bears and visitors. The potential for human-bear conflicts exists, particularly on the trails around the Visitor Center where fish-bearing streams and visitors intersect. Birding is also a popular activity. The shore of Mendenhall Lake and the Dredge Lakes Unit are prime bird-watching areas. Mountain goats are observed on the sides of Mount Bullard and Mount McGinnis. Beavers are primarily seen in the Dredge Lakes Unit.

Kayaking, Canoeing, Rafting, and Other Lake Recreation

Non-motorized watercraft are allowed on Mendenhall Lake. Recreational boaters launch from either of two public access points (near the visitor pavilion at the main parking area and near Skater's Cabin) and guided non-motorized boat tours launch from two permitted access points (near Skater's Cabin). Glacier outburst flooding can restrict access to Skater's Cabin and reduce launch areas on the beach. There are times when guided tours conflict with local users at the launch areas, although the addition of a new loading area that is not available for commercial use has improved the situation. There are three designated boat landing beaches on the north and east shores of the lake, near the glacier. Rafting also occurs on Mendenhall River, although popularity has been declining in recent years. Other types of non-motorized recreation on the lake include kiteboarding and windsurfing. Swimming occurs near the Visitor Center on hot summer days, typically by local children. In the winter months, skating and cross-country skiing occur on the lake when the ice is thick enough.

Camping

Camping within the MGRA is only allowed at the Mendenhall Campground and on Mount McGinnis. The campground offers approximately 70 sites in various sizes for tent, car, or motorhome camping. Several small convenience buildings including vault toilets and two bathhouse structures with flush toilets and hot showers are located throughout the campground.

Fishing and Hunting

While fishing is allowed in all management units, it mainly occurs in the Dredge Lakes Unit. Within this unit, Moraine, Glacier, and Crystal Lakes experience the majority of the fishing activity, likely due to stocking by ADF&G. Steep Creek is the only waterbody where fishing is not allowed.

⁵ Except for in the case of Moraine Ecology Trail, which is in two units as mentioned above.

Waterfowl hunting is allowed from September to December in the Dredge Lakes Unit only. This generally occurs on Norton and Glacier Lakes. Large game hunting is prohibited, as is any hunting from January through September or within 1/4 mile of Mendenhall Lake.

Off-Highway Vehicle Use

From December 15 to April 15, when the lake is sufficiently frozen, off-highway vehicles (OHVs; motorized snowmachines and all-terrain vehicles) are allowed in the West Glacier Unit on the west side of Mendenhall Lake or on trails leading to lake access only. OHVs are prohibited in all other areas of the MGRA except for emergencies and Forest Service administrative use. Conflicts have been reported when OHVs ride over cross-country ski tracks.

Miscellaneous Recreation

Other recreation opportunities occur throughout the year in the MGRA, including sledding, ice climbing, northern lights viewing, photography, horseback riding, and berry picking. Many visitors come to the MGRA to picnic, especially along the lakeshore and at Skater's Cabin. The bus parking lot contains a remote-control airplane strip (authorized under the terms of a special use permit) that is available for use if no buses are using the lot.

3.7.4.3 Visitation, Capacity, and Commercial Allocation

Forest Service policies call for evaluating capacity and commercial use allocations when there are significant changes to use or demand (FSH 2709.14, Chapter 50). Visitor use and demand for visitor services at the MGRA has increased since the last MGRA Management Plan revision in 2015. Current visitor demand already exceeds the area's capacity, and MGRA visitation is expected to continue to increase, resulting in a need to re-evaluate capacities and the amount and types of commercial activities that may be accommodated at the MGRA without adverse environmental and/or social impacts.

Juneau is a top Southeast Alaska visitor destination, and the MGRA is a major attraction. Overcrowding, particularly at the Visitor Center Unit, is a problem when cruise ships are in port. When the Visitor Center and surrounding facilities were constructed in 1962, they were designed to have capacity for 25,000 visitors annually (ECI 2021). In 2015, the Visitor Center Unit's capacity was set at 485,000 annual visitors (USDA Forest Service 2014). Following installation of a restroom trailer, bookstore, trail improvements, automated fee machines, expansion of visitor center information desks, and reorganization of the theater entrance and exit in 2019, the Visitor Center Unit's capacity was increased to 543,000 visitors.

It is estimated that 85 percent of current annual visitors arrive with outfitters or guides or on tour buses and the remaining 15 percent are independent visitors (locals and independent/unguided tourists; McDowell Group 2020). In 2019, prior to the COVID-19 pandemic, approximately 620,000 people visited the MGRA. Demand projections estimate that by 2049 that number could reach 999,000 visitors, based on an approximately 2 percent annual increase in visitors. Recognizing that the COVID-19 pandemic has impacted tourism in Southeast Alaska, it may take several years for visitation numbers to realign with anticipated demand, but as happened with previous disruptions such as the 2009 recession, visitorship is expected to return to the projected trendlines. The 2020 summer season saw record low visitor numbers due to a cancelled cruise ship season, and the 2021 cruise ship season was shortened. However, it is anticipated that the Southeast Alaska tourism industry will rebound and that visitor numbers will exceed pre-pandemic levels.

Crowding impacts the experience that visitors, particularly local residents, would like to experience when they visit the MGRA. Some Juneau locals reported through the project’s public comment process that they avoid the MGRA completely in the summer, or only use the more remote areas in the MGRA such as the Dredge Lakes and West Glacier Units, which generally remain free of crowds. Recently, the CBJ contracted McKinley Research Group to conduct a survey of Juneau residents and gather opinions on tourism-related issues to help inform tourism management in Juneau. Overall impacts from the visitor industry were characterized by survey respondents as positive (36 percent), both positive and negative (33 percent), no impacts (20 percent), and negative (8 percent). Notably, more than half of the respondents (57 percent) reported feeling either very affected (30 percent) or somewhat affected (27 percent) by crowding at Mendenhall Glacier (McKinley Research Group 2021).

Crowding at the MGRA causes issues, such as vehicular traffic, crowds at viewing platforms, and increased social encounters at trailheads and on trails, which can diminish the visitor experience. The Visitor Center Unit experiences high levels of summer congestion, especially during peak visitation days (generally defined as days when more than 4 large cruise ships are in port and more than 10,000 visitors arrive in Juneau). Visitors arriving on cruise ship tour buses during peaks cause bottlenecks and long wait times in the parking areas, in restrooms, near informational signs, and on trails closest to the Visitor Center. A lack of available spaces in the parking area sometimes results in independent visitors parking alongside Glacier Spur Road and then walking the rest of the way to the Visitor Center, creating a safety issue with a narrowed roadway and added blind spots.

The Forest Plan does not establish a threshold for social encounters for the Urban ROS class, assuming these areas will have a high level of use and interaction. However, the Forest Service has assigned capacities for trails with an Urban ROS designation based on a limit of 100 people at one time (PAOT), as described in the 2015 MGRA Management Plan revision (USDA Forest Service 2014). In recent years, Urban ROS trails such as Steep Creek and Photo Point have been estimated to have between 100 to 200 or more PAOT during the primary use season (May 1 to September 30; Appendix A; USDA Forest Service 2018). Table 3-16 lists annual capacity, ROS designation, allocated special use permit service days, and actual 2019 commercial use for several trails, Mendenhall Lake, and Mendenhall River. Reported commercial use does not reflect all use for trails around the Visitor Center such as Photo Point and Steep Creek. Guided tours are less common on these trails, but most unguided visitors will walk at least one since they are conveniently located, easy to access, and popular. Trails near the Visitor Center are often at or over capacity, especially during salmon season when bear viewing platforms are in high demand.

Table 3-16. Annual Capacity and Reported Commercial Use for MGRA Facilities

Facility ^a	ROS ^b	Annual Capacity ^c	Percent Allocated to Commercial Use (# of service days)	Actual Commercial Use, 2019 ^d
Visitor Center Unit				
East Glacier Trail	RN	36,720	30 (11,016)	6,467
Powerline Trail	RN	36,720	30 (11,016)	5,577
Nugget Falls Trail	U	153,000	2 (3,060)	1,415

Facility ^a	ROS ^b	Annual Capacity ^c	Percent Allocated to Commercial Use (# of service days)	Actual Commercial Use, 2019 ^d
Steep Creek Trail	U	153,000	2 (3,060)	778
Moraine Ecology Trail ^e	RN	36,720	50 (18,360)	18,352
Trail of Time	RN	36,720	30 (11,016)	12,998
West Glacier Unit				
West Glacier Trail	RN	36,720	20 (7,344)	4,781
Tolch Rock Trail	RN	36,720	10 (3,672)	0
Mendenhall Lake	SPM	32,480	50 (16,240)	15,066
Mendenhall River	SPM	30,000	50 (15,000)	17,320
Dredge Lakes Unit				
Moraine Ecology Trail ^f	RN	36,720	50 (18,360)	see above

^a Individual capacities for trails and sites under each of the management units will total more than the overall capacity for that management unit; total capacity for each management unit recognizes that many visitors will use more than one trail or site and therefore reflects the expected number of visitors. Special use permits would be issued after reviewing each individual trail or site capacity in order to maintain user experience objectives.

^b ROS labels used are derived from the Forest Plan (USDA Forest Service 2016, Appendix I) and are as follows: **Urban (U)**, **Roaded Natural (RN)**, and **Semi-Primitive Motorized (SPM)**.

^c Existing capacity numbers from the 2015 Decision Notice for the MGRA Management Plan Revision and MGRA Supplemental Information Report (USDA Forest Service 2015 and 2019a)

^d Special use permit reported actual use data, 2019 (USDA Forest Service 2019b)

^e Moraine Ecology Trail is in two management units: the Visitor Center Unit and the Dredge Lakes Unit.

^f Capacities are not established for most trails within the Dredge Lakes Unit, with the exception of the Moraine Ecology Trail which is in two units. Commercial use in this unit is restricted to the Moraine Ecology Trail only.

Trail Monitoring Surveys

Due to comments received during the early planning stages for the Master Plan about negative impacts from increased trail use, the Forest Service implemented a monitoring plan during the primary use season (May 1 to September 30) of 2017 through 2020.⁶ Four trails were monitored by Forest Service staff on varying days and times. Because of the COVID-19 pandemic, the data for the 2020 season reflects mostly local use (average 90.6 percent Juneau residents, 9.4 percent non-Juneau residents; USDA Forest Service 2020a). At times, monitored trails exceeded the Forest Plan ROS thresholds for number of encounters (Table 3-17; USDA Forest Service 2017a, 2018a, 2019c, and 2020a).

The Forest Plan gives thresholds for number of encounters for each ROS classification, except Urban (Table 3-15). Trails with an Urban ROS designation do not have a threshold for number of encounters since a high number of users is expected. However, as a conservative estimate of trail crowding, the threshold of 20 social encounters was used. As shown in the table below, 2 trails are already exceeding 20 social encounters between 5 and 28 percent of days counted.

⁶ Trail monitoring was also performed during the 2016 primary use season but due to varying data collection methods and procedures, data from those efforts could not be included. Nugget Falls Trail was also monitored during 2016 and once in 2017 but subsequently omitted from later years' surveys since it is already experiencing large crowds and high levels of encounters. On a peak day in 2016, Forest Service staff recorded more than 700 visitors on Nugget Falls Trail during one 4-hour period in August (USDA Forest Service 2016b).

Although exceeding 20 encounters is allowed for 20 percent of the primary use season (May 1 to September 30), in the case of East Glacier Trail, the maximum number of encounters per day was exceeded for more than 20 percent of the monitoring period in 2019. Interestingly, during the 2020 summer season when no cruise ships came to Alaska, there were still days that the number of encounters threshold on certain trails was exceeded.

Crowding also can lead to impacts on natural resources (wildlife, vegetation) as people step off trails or facilities to make way for other groups, to lead to viewpoints, or create informal trails when the existing recreation facility is at capacity or perceived to be at capacity. However, guides provide a high level of oversight and management of visitors, keeping visitors on developed trails, away from sensitive habitats, and in safe use areas. Guides have helped manage visitor use near high bear use areas like Steep Creek and near bird nesting areas. Because of this, visitors on guided excursions tend to have fewer impacts on natural resources, particularly wildlife and vegetation, as compared to independent visitors. (USDA Forest Service 2014).

Table 3-17. Forest Service Trail Monitoring Data: Percent of Monitored Days Exceeding 20 Social Encounters

Trail	ROS ^a	2017	2018	2019	2020
Steep Creek Trail	U	0	11	0	0
Trail of Time	RN	0	0	0	0
East Glacier Trail	RN	6	0	28	7
West Glacier Trail	RN	0	8	0	5

^a ROS standards for social encounters are derived from the Forest Plan (USDA Forest Service 2016) and are as follows: **Urban (U)**: Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the primary use season. **Roaded Natural (RN)**: User meets *fewer* than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season. Since trails with an Urban ROS designation do not have a threshold for number of encounters, percentage listed reflects number of days more than 20 parties were encountered, as a conservative estimate of trail crowding.

Source: USDA Forest Service 2017a, 2018a, 2019c, and 2020a

3.7.4.4 Scenery and Viewsheds

This section presents a discussion of the MGRA's ESI, management direction, and SIO based on the Forest Service's Scenery Management System. The Scenery Management System provides a tool for visual resources and landscape management on NFS lands. Refer to Section 3.7.2.1 in this document, the Forest Service's scenery management handbook, or the Forest Plan for a more detailed description of the Scenery Management System and associated terminology (USDA Forest Service 1995 and 2016, p. 4-54).

The MGRA features spectacular landscape viewsheds consisting of the Mendenhall Glacier and associated icefield, high elevation snow-capped mountains with forested side slopes, and water features such as rivers, waterfalls, wetlands, and Mendenhall Lake. The viewshed is distinctive from many locations and its intrinsic beauty elicits a positive human response. Key viewpoints within the MGRA are shown in Figure 3-9 below.

As the glacier recedes, the viewshed is changing and the terminus of the glacier is expected to recede beyond the view of the existing Visitor Center by 2050 (Amundson et al. 2020). Locations within the MGRA that do not have a view of the glacier are classified as indistinct viewsheds, meaning the landscape is more typical of what would be expected in a coastal

rainforest. These include lowlands in the Dredge Lakes and Visitor Center Units. However, regardless of the accessibility of a glacier view, the importance of maintaining the scenic integrity of the area in a mostly natural state is crucial to the desired visitor experience for tourists and locals alike.

Special Interest Areas on the Tongass National Forest generally feature high SIO, except for areas that are developed recreation or interpretive sites (USDA Forest Service 2016, p. 4-55). The MGRA SIO designations are listed in Table 3-18. Scenic integrity changes over time, as some alterations may revegetate and begin to blend in with the surrounding landscape, or as new projects that impact scenic integrity are implemented. It is important to compare the ESI of the project area to the adopted SIO of the area to determine if the existing condition conflicts with management goals (given by the SIO), and how much additional disturbance is allowed.

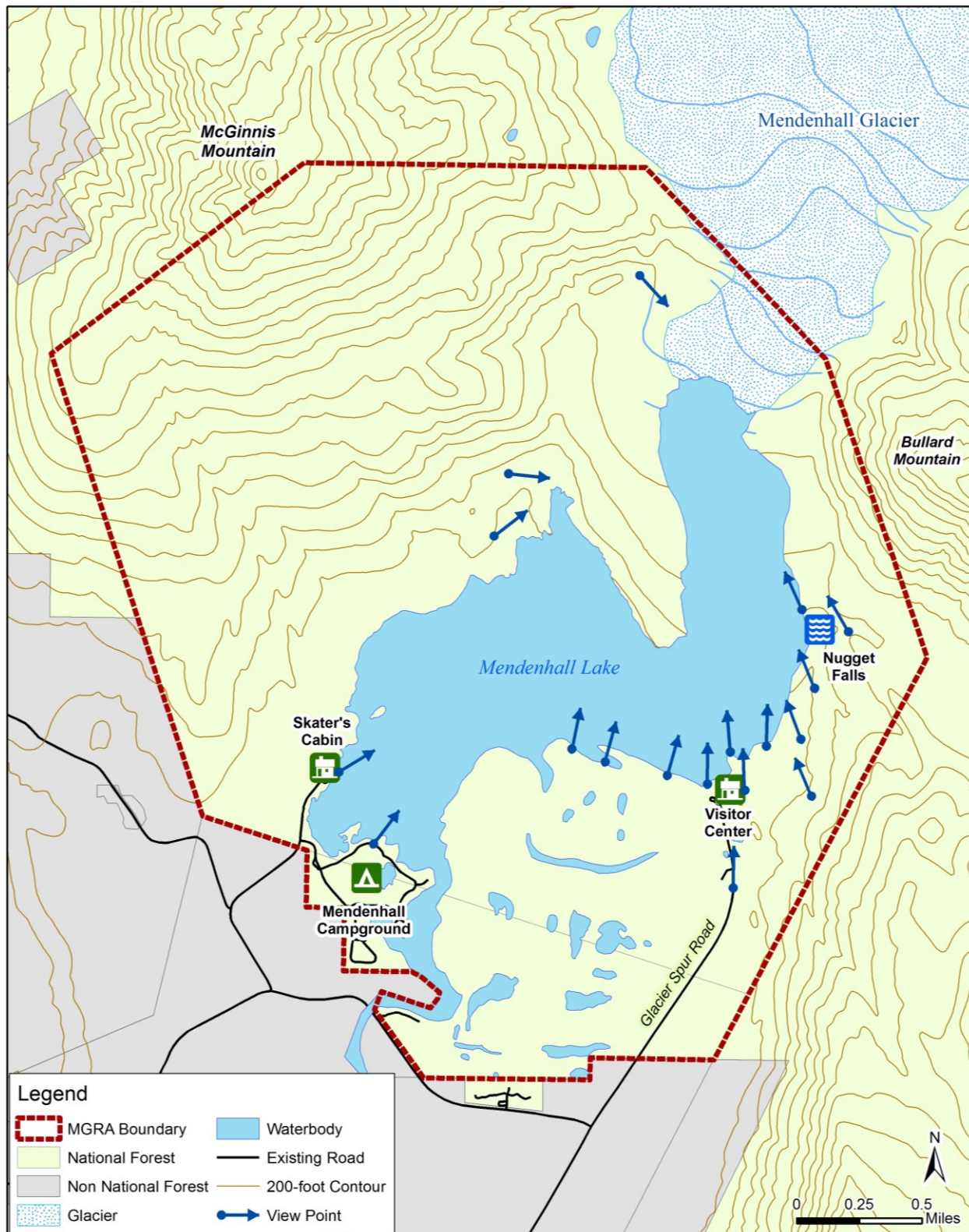
Developed areas such as portions of the Visitor Center and Dredge Lakes Units have a moderate ESI rating and moderate SIO. Under Forest Service guidance, noticeable deviations of the landscape are allowed if the deviations are subordinate to the characteristic landscape. Minimally-developed areas such as the West Glacier Unit and areas proximal to Mendenhall Lake have a high ESI and SIO. The priority in these areas is to maintain the appearance of an intact landscape.

Table 3-18. MGRA Scenic Integrity Objectives

SIO Designation	MGRA Corresponding Areas
High	West Glacier Unit
Moderate	Developed recreation and interpretive portions of the MGRA (campground, Skater’s Cabin, Visitor Center, Dredge Lakes Unit)

Adapted from: USDA Forest Service 2016

Figure 3-9. MGRA Key Viewpoints



3.7.4.5 Noise

Noise pollution can be an issue, particularly during the primary use season and around popular attractions. Noise is a common source of annoyance and at high or persistent levels can be a health and welfare concern. The most significant sources of noise in Juneau come from the airport, flightseeing operations, gravel quarrying, marine transfer stations, and vehicle traffic (CBJ 2013).

No current activities or uses in the MGRA are subjected to noise monitoring. Although there are no designated noise-sensitive zones in the vicinity of the MGRA, managing noise sources and noise pollution within the MGRA is key to the visitor experience and a priority to balancing area development with nature-based encounters. Many people visit the MGRA to experience quiet and solitude. Perceived noise can have an adverse effect on those desired experiences. Human-caused noise sources are present in various parts of the MGRA, most significantly in high traffic areas and transportation corridors. A prominent source of noise comes from parking areas and visitor pick-up and drop-off, and the high use trails around the Visitor Center Unit. Noise from vehicle traffic in the MGRA comes from operation of single-occupancy vehicles, tour vans, and buses and is most noticeable during periods of visitation surges, which usually coincide with the arrival of three or more cruise ships at one time in Juneau. Visitation surges vary greatly depending on cruise ship schedules, which vary from year to year, but typically occurs between May and October. The majority of visitors to the MGRA arrive and depart on buses requiring coordinated waiting and parking queues and prolonged loading and unloading processes. Noise from vehicle traffic is loudest by the bus drop off adjacent to the existing Visitor Center with buses accelerating, idling, and reversing. Buses are present between 7:45 a.m. and 7:00 p.m. during the primary use season, with peak times experiencing up to 6 buses at one time in the parking area and others waiting along the Glacier Spur Road or driving to or from the commercial parking area. Noise from road traffic going to and from the MGRA can be pronounced at roadside trailheads along Glacier Spur Road and heard near various parking areas near Skater's Cabin and the Mendenhall Campground (USDA Forest Service 2018). Helicopters can be heard as they traverse over the MGRA towards the Juneau Icefield (outside the MGRA), and occasional noise can be heard from an adjacent industrial area and gun range on Montana Creek Road.

3.7.5 Analysis Methods

3.7.5.1 Number of Social Encounters

Number of social encounters was selected as an indicator to assess crowding resulting from developing facilities within all management units, thereby potentially spreading the distribution of visitors into traditionally low-use or local-use areas. A social encounter occurs when a person or group using an NFS trail or other facility, including established scenic viewpoints, passes or is passed by another person or group. Group size is intended to be 10 people or less in the Semi-Primitive Non-Motorized and the Semi-Primitive Motorized ROS and 20 people or less in the Roaded Natural ROS. Group limits are not given for the Rural and Urban ROS designations (USDA Forest Service 2016, Appendix I). Encounters do not include people passed by twice, seen or heard in parking lots, nearby sidewalks, in the distance, in boats on the lake, or in aircraft or Forest Service personnel performing administrative duties such as trail maintenance, interpretation, and special use administration.

For this analysis, the number of social encounters indicator for each alternative is assessed by comparing the trail monitoring results for the observed number of *group encounters* per day on monitored trails during the primary use season (May 1 to September 30 or 153 days) with an estimated increase in number of group encounters. To estimate the anticipated increase in number of encounters on monitored trails, the number of group encounters on each monitored trail was averaged over three of the four monitored primary use seasons (2017, 2018, and 2019). Although monitoring was conducted during 2020, due to the COVID-19 pandemic data collected did not accurately reflect peak usage and therefore 2020 monitoring data was not included in averages used for analysis. The average number of encounters was then multiplied by the rate of proposed increase in capacity given for each trail. For example, the West Glacier Trail's existing annual capacity is 36,720 people. Under Alternative 2, the capacity would be increased to 51,360 people, an increase of around 40 percent. Averaging the number of encounters (groups) measured over 3 years by trail monitoring efforts gives an overall 3-year average of 10 encounters per day, and increasing that number by the same factor (0.4) gives an estimated anticipated average of 14 encounters per day. Table 3-20 shows the anticipated increase in social encounters for the four monitored trails under Alternative 2. This methodology is likely an overestimation of increased trail social encounters since some trails would be lengthened, connect to other trails, or be made into looped trails, which are likely to decrease the number of social encounters one may experience on a trail. While this is a simplified method for analyzing anticipated increases in encounters, it gives a basic framework for analyzing effects. The increase in visitation would happen gradually over the next 20 years and would not reflect immediate conditions after addition of new facilities, as described in the adaptive management plan (Appendix B).

To evaluate effects of each alternative on the social setting, this estimate is compared to the Forest Plan threshold or guideline for number of encounters per day (defined by ROS class; Table 3-15). For example, in a unit managed for Roaded Natural ROS, if there are an estimated 20 groups (guided and unguided combined) on the trail at one time, and assuming groups are spread evenly over time and space, then this scenario is below the Forest Plan threshold and guideline for number of encounters). If the estimated groups per day exceeds the desired maximum number of ROS-defined social encounters as indicated in Table 3-15, then for the purposes of this analysis, it would exceed the Forest Plan threshold or guideline and translate into a major effect for this measure. This conservative approach was adopted in this analysis because recreation use patterns are rarely uniform. Certain locations are more frequently used than others due to such factors as scenic attractions, access, facilities, or weather. As a result, more encounters may occur at certain locations.

This analysis uses the groups per day estimates as an indicator and is supported by a more site-specific qualitative description of effects based on other supporting information such as professional knowledge, public comments, outfitter/guide use data, and trail monitoring data.

3.7.5.2 Scenic Resources

Scenic resources were evaluated based on key viewpoints for the Visitor Center Unit, including those with views of the lake, mountains, and glacier from the Visitor Center, Skater's Cabin, Photo Point Trail, Moraine Ecology Trail, Nugget Falls Trail, Nugget Falls, East Glacier Trail, and points along the lakeshore. A visual impacts assessment, architectural renderings for some

project components, and anticipated viewsheds from the Visitor Center and Skater’s Cabin by alternative is included as Appendix C.

3.7.5.3 Assumptions

The proposed action and alternatives represent efforts by the Forest Service to capture the short-term and long-term vision for the MGRA and the resulting analysis in this document is predicated on these basic assumptions:

Continued Demand for Commercial Use

Visitor use levels at MGRA are primarily driven by the cruise ship industry. Statewide and Southeast Alaska long-term visitor industry trends indicate sustained periods of growth since the early 2000s. The COVID-19 pandemic reversed this trend and essentially halted tourism in Southeast Alaska for the 2020 season and into 2021. Some commentators have suggested that post-COVID-19 pandemic cruise ship visitation may not rebound or may decrease due to potential local ordinances limiting cruise ship traffic in Juneau. Others have stated that visitation over the next 30 years could level out or even decrease if the glacier retreats dramatically and is no longer visible from the Visitor Center. However, history indicates Southeast Alaska’s visitor industry follows national and international trends. As the U.S. economy continues to recover and expand, Southeast Alaska’s visitor industry is also expected to rebound. The prospective cruise ship calendar for 2022 for the port of Juneau shows an anticipated passenger volume similar to that of 2019 (Cruise Line Agencies of Alaska 2019, 2021). It is reasonable to assume that demand for commercial use to transport visitors to and conduct outfitter/guide activities within the MGRA project area will continue to increase.

Unguided Recreation Use is Stable

There is limited quantifiable information available about unguided use levels and related trends. It is estimated that visitors arriving with transporters or guides (commercial) make up around 85 percent of those who visit the MGRA, and about 15 percent of those arriving are independent travelers and Juneau residents (McDowell Group 2020). Unguided recreation use is not expected to increase at rates higher than the general population growth, since it is assumed to be closely related to resident population. As described in the socioeconomic analysis, economists expect Southeast’s economy will be rebuilding from the COVID-19 downturn in the coming years, which will likely drive a slow rate of population growth in Juneau (Rain Coast Data 2021).

Based on the expectation of flat growth trends, this section assumes that unguided visitor use will remain relatively stable over the coming years.

3.7.5.4 Effects Analysis and Significance Criteria

The Forest Plan directs the use of standards and guidelines for each ROS class for recreation planning (USDA Forest Service 2016, p. 4-41). For this analysis, indicators and levels of effect have been set for the issues identified in Chapter 1 (see Section 1.5.1). Certain components may also have a beneficial effect on a particular issue or resource. Specific issue statements and indicators for this resource are listed in Section 3.7.3 and levels of effect for each indicator are outlined in Table 3-19 below.

Conclusions, such as whether an effect or impact is negligible, minor, moderate, or major are based upon the professional’s judgment of the magnitude of the change, the context and extent of the impact, and the timing and nature of activities taking place.

Table 3-19. Indicator Units of Measure and Level of Effect for Issue 2: Recreation and Visitor Experience

Indicator	Negligible	Minor	Moderate	Major
In general...	Effect would be hardly noticeable, limited in extent (localized), infrequent (few occurrences during year).	Effect would be noticeable, but localized, occurs less than 15% of the primary use season.	Effect would be readily apparent, affect multiple locations, occurs more than 15% but less than 80% of the primary use season.	Effect would be highly noticeable, extensive (entire use area), occurs on most days of the primary use season (more than 80%).
Social Encounters	Expect no measurable increase or decrease in encounters at any time of year.	Expect more encounters at a few locations less than 15% of the primary use season.	Expect more encounters at multiple locations more than 15% but less than 80% of the primary use season.	Expect more encounters throughout the use area on most days of the primary use season (more than 80%); encounter levels are expected to exceed the Forest Plan threshold or guideline.
Scenic Resources	Considering the visibility of proposed improvements from key viewpoints in the MGRA, negligible to no change to the scenic characteristics of the viewshed. No noticeable change to ESI of the use area.	Considering the visibility of proposed improvements from key viewpoints in the MGRA, impacts to the viewshed from a few locations, resulting in minor change to the scenic integrity of the use area.	Considering the visibility of proposed improvements from key viewpoints in the MGRA, measurable impacts to the viewshed from multiple locations, resulting in moderate changes to the scenic integrity of the use area.	Considering the visibility of proposed improvements from key viewpoints in the MGRA, highly noticeable and extensive (affects most of the MGRA) impacts to the viewshed, resulting in major changes to the scenic integrity of the use area. Impact levels may exceed the Forest Plan threshold or guideline.

Indicator	Negligible	Minor	Moderate	Major
Operational Noise	Expect typical amounts of noise at all times of year; no boat noise anticipated (non-motorized boats); and no additional bus traffic anticipated.	More noise than usual would be perceived in high traffic areas (mainly from buses); no boat noise anticipated (non-motorized boats)	Expect elevated noise levels in high traffic areas and some quieter areas (mainly from buses); moderate boat noise anticipated (maximum decibel rating of 65 dB measured 50 feet from the boat and maximum 48 round trips daily); some noise from maintenance activities (vegetation management, snow clearing, etc.).	Highly noticeable and extensive (affects most of the MGRA) increased levels of noise; major boat noise anticipated (greater than 65 dB measured 50 feet from the boat and maximum 48 round trips daily); substantial noise from maintenance activities (vegetation management, snow clearing, etc.). Impact levels may exceed the Forest Plan threshold or guideline.

3.7.6 Direct and Indirect Environmental Consequences

3.7.6.1 Alternative 1 – No Action

Responsiveness to Purpose and Need

Under the No Action Alternative, the MGRA would retain its existing recreational facilities and no new facilities would be constructed to meet the needs of projected future use.

Under the No Action Alternative, no new trails would be constructed in the Visitor Center Unit to aid in visitor dispersion. During the primary use season, crowding would persist near the Visitor Center and on certain trails. Trails with an Urban ROS would continue to be at or near full capacity and could exceed 80 percent of the design capacity over the primary use season from the combination of guided visitors, unguided visitors, and residents. The Visitor Center facility would continue to be crowded and it would be difficult to engage in the facility's recreational and educational opportunities. There would be wait lines for parking and restrooms. Crowded conditions would continue to create bottlenecks at informational signs, bear viewing platforms, and scenic overlooks.

No improvements would be made to any user-created or user-proposed trails in West Glacier Unit. The West Glacier Unit would be expected to have an increase in visitation over current levels, as a greater proportion of resident users and independent travelers seek quieter areas away from summer crowds. The west side parking area would experience more days of crowding and congestion. The West Glacier Trail, in particular, would receive the bulk of this increase as the only existing way to approach the glacier in the summer months. More visitors may attempt to use the undesignated trails to the glacier, resulting in a greater potential for injuries.

No improvements would be made to any user-created or user-proposed trails in the Dredge Lakes Unit. As mountain biking becomes more popular in the MGRA, the increased trail use would cause wear and tear on user-created trails throughout the unit.

It is expected that the primary use season will become longer as it mirrors Juneau's cruise ship schedule visit; however, under this alternative, the Forest Service would continue to manage commercial use under current allocation levels. Cruise ship visitors will continue arriving with outfitter, guide, and transportation service providers, and permit holders would consistently use all of their service days before the end of the commercial use season. Tourists, especially cruise ship visitors, may look to other permitted transportation providers (taxis, ride share options) and increase use of city buses to get to the MGRA, but these providers would not meet the visitor demand. The walking distance from the nearest city bus stop to the Visitor Center (approximately 1.5 miles) would be a deterrent for those with time constraints, such as cruise ship passengers.

The No Action Alternative would not be responsive to the project's needs to provide quality opportunities for all visitors to enjoy the recreation area, to provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, or to meet the demand of the visitor industry.

Social Encounters

Crowding would become prevalent over more of the primary use season, and the number of social encounters on certain trails would increase.

In the Visitor Center Unit, trails that are already above Forest Plan ROS thresholds for social encounters on busy summer days, such as the East Glacier Trail, would likely have more days on which the number of social interactions is high.

With the No Action Alternative, it is likely that locals would continue to avoid the Visitor Center Unit and instead use areas such as the West Glacier and Tolch Rock Trails, based on preferences stated during public comment periods, leading to more trail encounters per day on these currently lesser used trails.

Under the No Action Alternative there would be a **moderate effect** on social encounters related to the recreation and visitor experience.

Scenic Resources

With glacier recession, existing scenery and viewsheds around the MGRA are likely to change within the next 20 years. However, scenic integrity relates to the native environment, which would not be altered with the No Action Alternative since additional facilities would not be constructed. No changes to existing scenic integrity would occur as a result of the No Action Alternative. There would be a **negligible effect** to scenic resources related to the recreation and visitor experience.

Operational Noise

Existing noise sources (buses, motor vehicles, crowds) would gradually increase with increased visitation under the No Action Alternative. Despite the fact that annual commercial use would be managed through permits, the anticipated 2 percent annual increase in visitors to the MGRA would lead to more days of surging visitation (and therefore more noise) due to more cruise ships arriving in Juneau (permits limit annual but not daily visitation). Peak noise levels would be experienced at the Visitor Center, parking area, and within the Visitor Center Unit and surrounding trails. Without additional facilities to disperse visitors, the noise would likely be concentrated on the east side of the MGRA. With no improvements to the parking area flow and visitor management, buses and personal vehicles would be more likely to experience more days with heavy traffic, delays, and stoppages adding to the existing noise level. There would be no motorized boats on the lake to add to the noise levels. Overall, it is anticipated that the No Action Alternative would have a **minor effect** on operational noise related to the recreation and visitor experience.

3.7.6.2 Effects Common to All Action Alternatives

Temporary Impacts During Construction

During construction, there would be temporary impacts to the recreation experience from limitations on access, crowding, altered scenic resources, and noise from all action alternatives. Impacts on recreation would be most noticeable during installation of the new parking area, Welcome Center and associated plaza area, Nugget Falls Trail, Photo Point Trail, Steep Creek Habitat Restoration, Steep Creek Trail Expansion, and Lakeshore Trail because these are major projects and are planned in an area with many visitors. Temporarily, vegetation removal during construction will make these impacts more visible but revegetation will lessen the impacts over the next 5 to 10 years. Periodic area closures, trail closures, and reduced parking availability would be expected.

Construction is expected to occur over several construction seasons, depending on funding availability, and in all areas of the MGRA, with work occurring mainly during the primary use

season. After completion of construction these temporary impacts would end and the recreation and visitor experience would be impacted as described below.

Welcome Center

The proposed Welcome Center building plans are identical for all three action alternatives. The building would enhance and improve the recreational experience by providing wayfinding, tour gathering points, restrooms, food service, visitor lounge/event space, and protection from inclement weather. Centrally located Forest Service personnel, informational signage, and restrooms would decrease the time spent orienting or waiting for these services and improve overall visitor experience. The building would help disperse visitors, improving crowded conditions in the Visitor Center Unit. The building would benefit Juneau residents, who could use the building year-round as a venue for gatherings and meetings or as an indoor shelter during wintertime activities.

Consideration was given during design and placement of the building to minimize the impact to the viewshed, but the Welcome Center would impact views from the parking area and many other areas in the Visitor Center Unit. The building is a rectangular structure oriented in a north-south direction to reduce the width of the face presented to visitors arriving from the parking area, and placement was chosen so as not to be seen from the Visitor Center windows. Materials and finishes were selected that would be in harmony and blend as much as possible with the landscape and other existing infrastructure such as the Visitor Center, but ESI would be impacted. Anticipated views of the Welcome Center are available as design renderings in Appendix C.

Once constructed, the Welcome Center would not cause additional noise impacts or increase existing noise sources. The proposed site for the building is in a high use area, and would not attract more visitors to this location. Noise may be reduced in the surrounding area through the addition of indoor gathering space thereby reducing the number of visitors that are outside at any one time.

Visitor Center Improvements

Changes to the Visitor Center would include interior updates and traffic flow adjustments that would improve the visitor experience at the Visitor Center. Renovations to the upper floor would offer new and updated interpretive experiences, and building maintenance items and the addition of a cover to the outdoor staircase and emergency exits would improve safety for visitors. There would be no increased noise above existing level, but the addition of a cover over the outside stairs would impact the viewshed looking out from the Visitor Center observatory windows, standing on the Visitor Center outdoor covered deck, and views looking towards the Visitor Center.

Glacier Spur Road Trailheads

By introducing additional parking and trailheads along Glacier Spur Road, trail users would be able to access trails in the Visitor Center and Dredge Lakes Units directly off Glacier Spur Road. This would reduce the need for these vehicles to travel all the way to the Visitor Center parking area or to park on the shoulder of the roadway. Alternative parking areas near trails would allow locals to avoid the congested main parking area. This could encourage more residents to visit in the summer when some may have avoided the MGRA in the past due to crowding and difficulties parking. The parking areas and trailheads would be briefly visible from vehicles passing by on Glacier Spur Road, but would not impact the ESI of the Visitor Center Unit. Noise

levels at the trailheads would be comparable to existing noise levels, as the proposed locations are next to a busy roadway where vehicles currently parallel park on the roadside.

Nugget Falls Trail Expansion

The expansion of Nugget Falls Trail would offer an improved recreational experience on this generally crowded trail by distributing visitors over a greater area. It is likely that the number of social encounters will decrease in the short term and then gradually increase as visitation increases. The proposed loop trail, located entirely on existing user-created trail alignments, would minimally impact the viewshed of recreators on the lake, but would not be visible from any other areas of the MGRA. Noise from the trail would not be expected to increase over existing levels.

Steep Creek Habitat Restoration

The proposed habitat restoration project for Steep Creek would not have an effect on recreational resources or visitor experience, number of social encounters, existing scenic resources, or noise level in the area. Indirectly, improving stream habitat would support the existing salmon population at the MGRA and preserve future wildlife viewing experiences on Steep Creek Trail.

Public Use Cabins

The addition of public use cabins would diversify the recreational opportunities available for visitors that want to use the Mendenhall Campground. They would be unlikely to have an impact on the number of social encounters during the commercial use season, because the cabins would replace existing active campsites and not add new camping areas. The cabins would only be visible from within the campground itself and from a limited number of locations on Mendenhall Lake, since they will be sheltered from view with existing vegetation at the campground. Similarly, existing noise levels would not be impacted during the primary use season because of the forested setting, and because the cabins replace existing active campsites.

Proposed Forest Orders

Management of the MGRA would undergo changes via new rules (Forest Orders) that would delineate areas where food consumption, smoking, dogs, and non-motorized wheeled devices (e.g., bicycles, scooters, roller skates) would not be allowed. These use restrictions would increase safety by reducing the potential for negative wildlife interactions or conflicts between user groups, such as walkers and cyclists. However, some visitors may feel impacted by more stringent restrictions placed on allowable uses of public land.

Interpretive Plan Elements

The interpretive plan would offer new educational opportunities for visitors, install wayfinding signage to improve the visitor experience by reducing confusion, and install benches and shelters that would be available to users in more locations (AldrichPears Associates 2022). These additions would enhance the visitor experience for many people and would be unlikely to induce negative impacts for those not using these facilities.

3.7.6.3 Alternative 2 – Proposed Action

Responsiveness to Purpose and Need

With Alternative 2, there would be new recreation experiences offered and recreational facilities constructed based on projected future use at the MGRA (30-year projection of 999,000 visitors to the Visitor Center Unit; Appendix A) and a longer primary use season (April 1 through October 31 or 214 days), including a Welcome Center, additional interpretive exhibits, an

improved Visitor Center experience, upgraded Steep Creek wildlife viewing, motorized commercial boat tours on Mendenhall Lake, and a network of trails that would connect the east and west sides of the MGRA.

The Welcome Center Plaza would assist visitors in wayfinding and help orient visitors who may be visiting the MGRA for the first time and provide facilities to increase ease of planning their time on site. The proposed building and surrounding plaza area would draw people out of the parking area and reduce crowding for those traditionally crowded areas. The indoor space and shelters would offer protection from the elements. The network of trails proposed around the Welcome Center area would create an easy walking loop around the Visitor Center and provide glacier views. New interpretive facilities would be installed throughout the plaza area, including an amphitheater for ranger presentations or other staff-led programs. The Lakeshore Trail would be a recreation opportunity available for year-round use. All of these elements are likely to make the experience more enjoyable in the Visitor Center/Welcome Center area through improved visitor flow, better distribution of visitors and additional orientation and learning facilities.

Steep Creek Trail would be designed to avoid human-bear interactions and reduce or eliminate the need for trail closures during the primary use season. The decommissioning of the portion of the trail that closes the loop around Steep Creek would give bears better access to one side of the creek without human interference, increasing safety for humans and bears alike.

Other components such as the Dredge Lakes Multi-Use Trails and West Glacier Unit Trails would likely have appeal to locals and independent visitors. These improvements and connections would create an extensive trail network and provide clearer distinction between mountain biking trails and hiking/walking trails. These components represent increased opportunities for year-round recreation through the addition of wider trails in the West Glacier Unit that could be groomed for Nordic skiing. In addition, the new or improved trails would provide safer experiences. The new parking area, picnic sites and day use facilities, and public use cabins at Mendenhall Campground would also increase year-round recreation opportunities. There is the potential that some users may object to improvements, since it could lead to more social encounters, but a diversified offering of experiences is a key component of overall visitor satisfaction.

Under this alternative, the Forest Service would change management unit boundaries and ROS classes, allowing increased use in many areas and on trails. The proposed Dredge Lakes Outer Loop in the Dredge Lakes Unit would be given a commercial use allocation and ROS designation. Over time, the commercial service days for transportation service providers would increase from approximately 462,010 to approximately 690,670 over a longer commercial use season, and trails service days for outfitter and guide services would increase from approximately 53,840 to approximately 178,460 over a longer commercial use season (Appendix B). Service days would increase according to an adaptive management plan (also in Appendix B) to meet the projected demand of the visitor industry in Southeast Alaska.

To create opportunities for additional types of visitor experiences as the natural environment changes and the glacier retreats, Alternative 2 includes the Remote Glacier Visitor Area and the opportunity to travel across Mendenhall Lake via motorized boat to get closer to the glacier (Alternative 2 includes 214,000 service days for motorized boat tours). Visitors that would not otherwise be able to hike or take non-motorized transportation across due to time or mobility constraints would have an opportunity to diversify their experience.

The proposed action was developed to respond to the purpose and need for the project. It would provide quality opportunities for all visitors to enjoy the recreation area, provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, and meet the demand of the visitor industry more than any other alternative.

Social Encounters

Alternative 2 includes increases in visitor capacity and commercial use allocations in certain management units and trails. The East Glacier Trail, Powerline Trail, Moraine Ecology Trail, and Trail of Time all change from a ROS classification of Roaded Natural to Rural, thus changing the estimated number of encounters on those trails from 20 to more than 20 (Appendix A). The proposed Dredge Lakes Outer Loop, which would be a new trail with commercial use allocations, would be classified as Rural ROS as well. The change in ROS classification and corresponding increases in commercial use allocations and permitted service days would likely lead to an increase in encounters in these areas. However, with the addition of built facilities and trails, users would have more areas in which to disperse.

Based on the methods described in Section 3.7.5, Alternative 2 would cause the average number of social encounters to increase over 20 per day for East Glacier Trail, exceeding the standards and guidelines for social encounters for the Roaded Natural ROS. Alternative 2 includes changes to the MGRA Management Plan that would classify the East Glacier Trail as Rural ROS, in which users would expect to meet more than 20 other parties per day. Other trails would be expected to be consistent with the standards and guidelines for current ROS designations.

Table 3-20. Estimated Increase in Number of Social Encounters by Monitored Trail – Alternative 2

Trail ^a	ROS ^b	Proposed ROS (Alt 2)	Capacity Increase (Over Existing)	Average No. of Encounters ^c (Existing / Anticipated)
Steep Creek Trail	U	U	110%	6 / 12.6
Trail of Time	RN	R	110%	4.2 / 8.8
East Glacier Trail	RN	R	110%	10.7 / 22.5
West Glacier Trail	RN	RN	40%	10.3 / 14.4

^a The trails with existing monitoring data from the 2017, 2018, and 2019 seasons are presented for estimation of increased social encounters. Other trails have not been monitored.

^b ROS standards for social encounters are derived from the Forest Plan (USDA Forest Service 2016) and are as follows: **Urban (U)**: Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the primary use season. **Rural (R)**: User may meet many (more than 20) other parties per day on trails and in dispersed areas. Developed sites often are at full capacity, but do not exceed 80 percent of the design capacity over the primary use season. **Roaded Natural (RN)**: User meets *fewer* than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season.

^c Numbers represent the 3-year monitored average based on trail monitoring efforts from the 2017, 2018, and 2019 primary use seasons and the anticipated average based on proposed capacity increases (USDA Forest Service 2017a, 2018a, and 2019c).

Popular areas such as those closest to the Visitor Center and with views of the glacier will likely remain popular with visitors during the primary use season and with residents in the winter. Wildlife viewing in areas such as Steep Creek Trail and Nugget Falls will continue to be an attraction and will likely increase as easily-accessible trails such as Steep Creek Trail receive

upgrades under Alternative 2. Crowding will become less of an issue as new facilities are added to the Visitor Center Unit that would disperse visitors.

Areas immediately adjacent to the face of the glacier are currently accessible during the summer only to those who can traverse the West Glacier Trail or paddle a non-motorized boat across Mendenhall Lake. Adding motorized boat tours on the lake would increase the number of encounters at this location exponentially. Estimated market demand for motorized boat tours indicates that initially, demand would be about 15 percent of commercial use, or 85,000 visitors annually, but may increase as visitation increases over the next 30 years (McDowell 2020). It is anticipated that at maximum there could be a boat departing every 30 minutes for 10 hours per day from the Visitor Center dock across the lake to the glacier, equating to approximately 20 round trips daily. Assuming 214 service days per year and boat capacity of 50 passengers, the vessels would deliver around 214,000 visitors annually to the base of the glacier. This could mean more than 1,000 people arriving at the base of the glacier via motorized boats daily, or around 100 boat passengers per hour during the 10-hour operational period. This would be in addition to those visitors hiking West Glacier Trail and those who take a non-motorized boat across the lake. These three access methods would deliver many more people to the face of the glacier than current conditions and combined with proposed infrastructure (Remote Glacier Visitor Area) would substantially increase the number of social encounters in this area. Combined with proposed infrastructure, the existing character and recreational experience of the area closest to the Mendenhall Glacier would be altered.

In high value use areas that are popular with Juneau residents, additional recreational experiences and easier access to more areas of the MGRA could interrupt the solitude and quiet they have come to expect in some places such as the Dredge Lakes and West Glacier Units. The Lakeshore Trail in particular would be expected to have an impact on walking and bird watching activities for which the area along the shoreline of the lake has become known. Under Alternative 2, the proposed Dredge Lakes Outer Loop in the Dredge Lakes Unit would be given a commercial use allocation and ROS designation. This would increase recreational opportunities in this area where management direction has traditionally limited visitation to create a quiet, peaceful space. Commercial use would be kept to the border of the unit only, preserving the core of the area for individuals, small groups of less than 5 people, and families; however, these presently quieter areas are likely to see an increase in the number of social encounters and increases in noise. While some residents may not value additional social encounters and noise, others may welcome a connected network of trails for walking or Nordic skiing in the winter, and mountain biking in the summer and would continue to frequent the busier areas. Locals would also be able to enjoy access to a new year-round facility at the Welcome Center that could create new opportunities for local events.

Alternative 2 may displace more resident users to areas beyond the Visitor Center Unit as number of social encounters increases and new facilities add interest in popular or local high value areas. As capacity and commercial use allocations increase, more social encounters would be expected. However, with additional facilities, there will be more places and trails for visitors to spread out. Proposed improvements would help to decrease crowding and wait times for facilities in popular areas. With additional parking availability along Glacier Spur Road and in the Mendenhall Campground, some residents may no longer avoid the MGRA during the primary use season since they would be able to avoid the crowds at the Visitor Center and would have better parking access. Overall, it is expected that number of encounters would increase in

multiple areas for more than 15 percent (but less than 80 percent) of the primary use season, and therefore Alternative 2 would have a **moderate effect** on the number of social encounters related to the recreation and visitor experience overall. The Remote Glacier Visitor Area (proposed to be part of the Visitor Center Unit) and the West Glacier Unit would see the biggest changes due to the addition boat access, the Lakeshore Trail, and other infrastructure.

Scenic Resources

Scenic resources were evaluated based on key viewpoints (Figure 3-9) including those with views of the lake, mountains, and glacier from Glacier Spur Road, the Visitor Center, Skaters' Cabin, Photo Point Trail, Moraine Ecology Trail, Nugget Falls Trail, Nugget Falls, East Glacier Trail, West Glacier Trail, and points along the lakeshore. Most of these viewpoints, with the exception of West Glacier Trail, are within a developed area of the MGRA that has a moderate SIO, where noticeable deviations from the landscape are allowed if the deviations are subordinate to the characteristic landscape. Visual impacts from each of the project components were evaluated from these key viewpoints and are presented for the action alternatives in Appendix C.

Views from the Visitor Center, a tourist attraction and local feature, would be impacted by the expanded parking area, Welcome Center Plaza, Crescent Bridge, Photo Point Loop, Lakeshore Trail, Welcome Center Dock, Remote Glacier Dock (North Option), and motorized boat tours on the lake.

The initial view on the approach from Glacier Spur Road will be impacted by the additions of the expanded parking area, Welcome Center Plaza, and crescent bridge over Kettle Pond. These project components will also be visible from the Visitor Center and some trails within the Visitor Center Unit that are higher elevation or not obstructed by vegetation such as Photo Point Trail, East Glacier Trail, and the beach access point on Moraine Ecology Trail. These components may also be visible in the distance from higher elevations in the West Glacier Unit, from points along the West Glacier Trail.

The Welcome Center Plaza will add an area of development that will impact views from, and looking towards, the Visitor Center Unit. The crescent bridge over Kettle Pond will be in the line of sight for visitors attempting to view the glacier from many locations in the plaza area and from the Visitor Center. Visual impacts from the Welcome Center building itself was discussed above in Section 3.7.6.2.

The proposed Lakeshore Trail will be easily seen along the lakeshore, particularly in elevated sections. The trail would be within view from many areas of the MGRA including the Visitor Center, Skater's Cabin, Photo Point Trail, West Glacier Trail, and from the lake itself. Elevated sections of the trail would be prominent amongst the existing landscape.

The Welcome Center Dock will also be visible from many locations around the Visitor Center, the lakeshore, and surrounding trails. However, it will not be visible from the windows of the Visitor Center due to the proposed cutbank "basin" design.

The location for the Remote Glacier Dock's South Option and the Remote Glacier Visitor Area would not be visible from the Visitor Center since the rock outcropping on the north side of the lake screens the location from view. However, the Remote Glacier Dock's North Option, constructed to the east of the screen offered by the rock peninsula, would be visible from the Visitor Center. Boat operations, including docking and passenger loading and unloading would

be visible during most of the day during the primary use season (April to October). Additionally, the associated restroom facility would be visible in the North Option location. This dock (in either location) and the Remote Glacier Visitor Area would be visible from Nugget Falls and from recreators on the east side of the lake. If these facilities are relocated as planned as the glacier recedes, the dock and the Remote Glacier Visitor Area may be moved to an area visible from the Visitor Center in the future, regardless of which dock location option is selected initially.

Scenic integrity of the west side of the lake would be impacted by placement of the West Glacier Dock and tour boats that infrequently access the dock for launching and pulling. The dock would be visible from the lake, most lakeshore areas, Skater's Cabin, and a few areas within the campground, but would not be visible from the Visitor Center. Other project components proposed for the west side of the MGRA would not be visually impactful, as they would be constructed at grade.

The proposed motorized boat operations would impact the scenic integrity of Mendenhall Lake. The route between the Welcome Center Dock and the Remote Glacier Dock would be in view from many areas in the MGRA in all three management units. This impact would be present during most of the primary use season. Forest Plan standards and guidelines indicate this type of development is appropriate for the moderate SIO of the Visitor Center Unit. However, this may be less consistent with the areas with high SIOs that characterize the parts of the West Glacier Unit, and may constitute deviations that are not subordinate to the characteristic landscape. The Forest Plan indicates that all SIOs in Special Interest Areas should be high, except for in the case of "...developed recreation and interpretive portions of Special Interest Areas such as Mendenhall Glacier..." and "exceptions for small areas of non-conforming developments, such as recreational developments, ...may be considered in these LUDs on a case-by-case basis." (USDA Forest Service 2016, p. 4-55). The proposed developments would fall within Forest Plan standards and guidelines for developed recreational portions of Special Interest Areas and would be consistent with existing SIOs for the area. However, as many of the components would be highly visible throughout the MGRA, Alternative 2 would have a **major effect** on scenic resources.

Operational Noise

Noise sources (buses, motor vehicles, crowds) would increase under Alternative 2 with expected increased visitation. Peak noise levels would occur more frequently, but are not anticipated to be any louder at the Welcome Center, Visitor Center, parking area, and throughout the Visitor Center Unit and surrounding trails. High visitation days will become more frequent during the summer season. Based on bus arrival patterns measured in previous seasons, when peak days average between 15 to 18 buses per hour, and an approximate doubling of capacity over the next 20 years, peak days could see around 30 buses per hour at the MGRA. More efficient routing patterns proposed in Alternative 2 would decrease the amount of time buses have to remain waiting in a line to pick up or drop off passengers. With more available dedicated bus parking spaces, drivers would be able to shut down engines while waiting to reduce idling noise. Therefore, noise could be minimized. An increased number of available parking spaces and parking area design separation of private cars and rideshares from bus arrivals will also limit the time buses and cars need to queue up along Glacier Spur Road and the time private cars would drive around seeking a parking spot.

The addition of motorized boats on the lake would increase noise, but it would be tempered with lower boat speeds (to limit creation of wake) and limited noise generation. Noise from the lake-bound vessels would not reach a level great enough to cause damage to human ears but could be a source of annoyance and impact a recreational experience for some near the lakeshore. It is likely that boat noise, even low levels in the background, may be able to be heard at the Visitor's Center area, trails along the lakeshore (Photo Point, Nugget Falls, portions of Nugget Creek), and higher elevation trails (East Glacier and West Glacier). Lakeshore areas near the campground and Skater's Cabin are likely to be protected from boat noise, since the West Glacier Dock would only be used for non-motorized boat launching except for the launch and retrieval of motorized boats at the beginning and end of the seasons. Episodic noise would be experienced near the Welcome Center Dock during maintenance dredging activities expected fewer than one time each summer season.

Proposed additional trails and facilities would disperse visitors, causing more noise in quieter areas such as the lakeshore and on the lake itself. The addition of boat access to the glacier would lead to many more visitors and a level of conversational noise that could approach crowd levels at the base of the glacier.

Daily background noise would gradually increase in the high traffic areas of the MGRA as visitation and commercial use allocations increase but would be less noticeable in areas that already experience noise during the commercial use season. Boat operations and increased bus operations would be the greatest contributors to noise effects from Alternative 2. Proposed facilities would help disperse visitors and keep conversational or crowd noise lower than would be anticipated if no additional facilities were constructed. Some proposed facilities (e.g., Lakeshore Trail, Remote Glacier Visitor Area) would also introduce noise to some traditionally quieter spaces that do not experience much noise from human sources. Overall, there would be a **moderate effect** to operational noise related to the recreation and visitor experience under Alternative 2.

3.7.6.4 Alternative 3

Alternative 3 would have many of the same project elements and anticipated impacts as described for Alternative 2. Impacts to recreation resources from project components discussed in Section 3.7.6.2 are not presented again under this alternative. Differences in project elements and associated analyses are discussed below.

Responsiveness to Purpose and Need

With Alternative 3, there would be new recreation experiences offered and recreational facilities constructed based on projected future use at the MGRA (20-year projection of 830,000 visitors to the Visitor Center Unit). Alternative 3 would be similar to Alternative 2, with some alterations. The trails around the Welcome Center Plaza would not be as extensive or provide as many trail connections as Alternative 2. Steep Creek Trail would have six overlook areas over Steep Creek rather than seven, giving less of a wildlife viewing opportunity in those locations. The Lakeshore Trail would offer a similar experience as in Alternative 2, but the west side of the trail would be constructed inland away from the lakeshore. While this would compromise views of Mendenhall Lake from the western portion of the trail itself, it would preserve some of the lakeshore for existing bird watching and other quiet activities. The new parking area, picnic sites and day use facilities, and public use cabins at Mendenhall Campground would also increase year-round recreation opportunities.

Under this alternative, the Forest Service would change management unit boundaries and ROS classes, allowing increased use in many areas and trails. Like Alternative 2, the proposed Dredge Lakes Outer Loop in the Dredge Lakes Unit would be given a commercial use allocation and ROS designation. Over time, the service days for transportation service providers would increase from approximately 462,010 to approximately 554,340 over a longer commercial use season, and trails service days for outfitter and guide services would increase from approximately 53,840 to approximately 167,760 over a longer commercial use season (Appendix B). Service days would increase over time according to an adaptive management plan (Appendix B) to meet the projected demand of the visitor industry in Southeast Alaska.

To create opportunities for additional types of visitor experiences as the natural environment changes and the glacier retreats, Alternative 3 includes the Remote Glacier Visitor Area and the opportunity to travel across Mendenhall Lake via motorized boat to get closer to the glacier. These proposals differ from Alternative 2 in that Alternative 3 would offer 100,000 service days for motorized boats tours and would land on the shore at the Remote Glacier Visitor Area instead of at a dock. Visitors that would not otherwise be able to hike or take non-motorized transportation across due to time or mobility constraints would have an opportunity to diversify their experience.

Alternative 3 would be responsive to the purpose and need for the project. It would provide quality opportunities for all visitors to enjoy the recreation area, provide new recreation and interpretation experiences that emphasize the area's outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, and meet the demand of the visitor industry to a greater degree than Alternatives 1 or 4, but less so than Alternative 2.

Social Encounters

Alternative 3 includes increases in visitor capacity and commercial use allocations in certain management units and trails, but to a lesser degree than in Alternative 2. As in Alternative 2, the East Glacier Trail, Powerline Trail, Moraine Ecology Trail, and Trail of Time would all change from a ROS classification of Roaded Natural to Rural, thus changing the estimated number of social encounters on those trails from 20 to more than 20 (Appendix A). The proposed Dredge Lakes Outer Loop, which would be a new trail with commercial use allocations, would be classified as Rural ROS as well. The change in ROS classification and corresponding increases in commercial use allocations and permitted service days would likely lead to an increase in encounters in these areas compared to the No Action Alternative. There may also be an increased chance of encounters in certain areas compared to Alternative 2 since there would not be as many built facilities and trails for visitors to disperse throughout congested areas. In whole, Alternative 3 would provide more new places to disperse as compared to existing conditions, which would improve the experience for many visitors.

Based on the methods described in Section 3.7.5, Alternative 3 would cause the average number of social encounters to increase over 20 per day for East Glacier Trail, exceeding the standards and guidelines for social encounters for the Roaded Natural ROS (which, according to Forest Plan guidelines, may be exceeded over 20 percent of the season). However, Alternative 3 (like Alternative 2) includes changes to the MGRA Management Plan that would classify the East Glacier Trail as Rural ROS, in which users would expect to meet more than 20 other parties per day. The Steep Creek Trail and Lakeshore Trails have lower proposed capacities and service days under Alternative 3 compared to Alternative 2, but the Steep Creek Trail is still expected to be far below Forest Plan standards and guidelines for social encounters for the Urban ROS

(Table 3-21). Other trails would be expected to be consistent with the standards and guidelines for current ROS designations.

Table 3-21. Estimated Increase in Number of Social Encounters by Monitored Trail – Alternative 3

Trail ^a	ROS ^b	Proposed ROS (Alt 3) ^c	Capacity Increase (Over Existing)	Average No. of Encounters ^d (Existing / Anticipated)
Steep Creek Trail	U	U	75%	6 / 10.5
Trail of Time	RN	R	110% ^c	4.2 / 8.8 ^c
East Glacier Trail	RN	R	110% ^c	10.7 / 22.5 ^c
West Glacier Trail	RN	RN	40% ^c	10.3 / 14.4 ^c

^a The trails with existing monitoring data from the 2017, 2018, and 2019 seasons are presented for estimation of increased social encounters. Other trails have not been monitored.

^b ROS standards for social encounters are derived from the Forest Plan (USDA Forest Service 2016) and are as follows: **Urban (U)**: Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the primary use season. **Rural (R)**: User may meet many (more than 20) other parties per day on trails and in dispersed areas. Developed sites often are at full capacity, but do not exceed 80 percent of the design capacity over the primary use season. **Roaded Natural (RN)**: User meets *fewer* than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season.

^c Matches Alternative 2

^d Numbers represent the 3-year monitored average based on trail monitoring efforts from the 2017, 2018, and 2019 primary use seasons and the anticipated average based on proposed capacity increases (USDA Forest Service 2017a, 2018a, and 2019c).

Alternative 3 may displace more local users to areas beyond the Visitor Center Unit as number of encounters increases and new facilities add interest in popular or high value areas, such as West Glacier Unit and the base of the glacier. Increased frequency of social encounters from the addition of motorized boats would be slightly less than in Alternative 2, given the reduced boat capacity and fewer operational hours. It is anticipated that there could be a boat departing every 30 minutes for 10 hours per day from the Visitor Center dock across the lake to the glacier, equating to approximately 20 round trips daily. Boat tour service days would be limited to 100,000 per year under Alternative 3, with a maximum of 214 service days per year and boat capacity of 35 passengers. Motorized boat operations could deliver around 700 visitors to the base of the glacier daily, or around 70 visitors per hour over a 10-hour period. Additionally, elimination of the Remote Glacier Dock under this alternative might deter some visitors from attempting the trip across the lake. Many more people would be able to visit the face of the glacier and this area would experience a substantial increase in social encounters, although to a lesser degree than proposed in Alternative 2.

As with Alternative 2, it is expected that number of encounters would increase in multiple areas even though additional facilities would allow visitors to disperse. Juneau residents that traditionally have avoided the MGRA in the primary use season may start to visit during those months, even with the expected increase in social encounters, because of the increased ease in parking and access to other, quieter locations like the Dredge Lakes Unit. Alternative 3 would have a **moderate effect** on expected social encounters related to the recreation and visitor experience overall. The Remote Glacier Visitor Area (proposed to be part of the Visitor Center

Unit) and the West Glacier Unit would see the biggest changes due to the addition boat access, the Lakeshore Trail, and other infrastructure.

Scenic Resources

Alternative 3's impacts to scenic resources would be very similar to Alternative 2 with a few differences. Visual impacts from each of the project components were evaluated with relation to key viewpoints and are presented for the action alternatives in Appendix C. The Welcome Center Plaza area would have fewer connecting boardwalk trails directly in view of the Visitor Center and along the lakeshore. The Lakeshore Trail alignment moving inland away from the lake on the west side (closest to Mendenhall Campground) would reduce visual impacts from several areas such as Mendenhall Lake, Skater's Cabin, and West Glacier Trail. The Welcome Center Dock would be prominently visible from the Visitor Center and the lakeshore in this alternative; more so than in Alternative 2 because the dock will extend approximately 120 feet into the lake. The West Glacier Dock would also be slightly more prominent in the viewshed under Alternative 3 since it would be closer to key viewpoints such as Skater's Cabin and the Mendenhall Campground; measured from Skater's Cabin the dock would be 680 feet away rather than 1,420 feet away. The Remote Glacier Dock would not be constructed, so the viewshed around the glacier would remain mostly undeveloped and natural under this alternative. However, the two different landing area location options proposed for glacier access under this alternative would affect scenic resources differently. As in Alternative 2, the South Option for the landing area would not be visible from the Visitor Center. From the North Option landing location, boat operations (loading and unloading) and restroom facilities would be visible from the Visitor Center. The Remote Glacier Visitor Area would be placed in a location that would be screened from view from the Visitor Center. Both the landing area (in either location) and the Remote Glacier Visitor Area and associated floating restroom facilities would be visible from Nugget Falls and from any recreators on the east side of the lake. As the glacier recedes, any or all of these facilities may be moved to an area that is visible from the Visitor Center.

The Forest Plan indicates that all SIOs in Special Interest Areas should be high, except for in the case of "...developed recreation and interpretive portions of Special Interest Areas such as Mendenhall Glacier..." and "exceptions for small areas of non-conforming developments, such as recreational developments, ...may be considered in these LUDs on a case-by-case basis." (USDA Forest Service 2016, p. 4-55). The proposed developments would fall within Forest Plan standards and guidelines for developed recreational portions of Special Interest Areas and would be consistent with existing SIOs for the area. However, as many of the components would be highly visible throughout the MGRA, Alternative 2 would have a **major effect** on scenic resources.

Operational Noise

Under Alternative 3, existing noise sources (buses, motor vehicles, crowds) would be increased similarly to Alternative 2 with expected increased visitation. However, since the bus arrival and departure area would be situated away from rather than next to Steep Creek in this alternative, noise levels would be reduced in the quieter Steep Creek area.

Since motorized boats would be required to be electric-powered under this alternative, the increase in noise level from most boat operations would be reduced (while the engine noise would be almost zero, the propellor noise would still exist). Launching and retrieving activities or any maintenance activities needed during the primary use season while boats are still on the lake could introduce minor noise impacts. Further, occasional noise would also be experienced

near the Welcome Center and West Glacier Docks during seasonal maintenance dredging activities.

Overall, it is anticipated that there would be a **minor effect** to operational noise related to recreation and visitor experience from Alternative 3. Daily background noise would gradually increase over time in the high traffic areas of the MGRA due to increases in visitation and bus operations but less notably in areas that already experience noise during the primary use season. Minimal noise impacts from daily motorized boat operations are anticipated.

3.7.6.5 Alternative 4

Responsiveness to Purpose and Need

With Alternative 4, there would be new recreation experiences offered and recreational facilities constructed based on shorter-term projected future use and demand at the MGRA (15-year projection of 752,000 visitors to the Visitor Center Unit).

Under Alternative 4 the expanded parking, improved visitor flow, and additional wayfinding would reduce confusion, lines, and wait times at the Visitor Center area. However, under this alternative, there would be fewer and less diversified new recreation experiences and facilities than in Alternatives 2 or 3. There would not be as many places for visitors to disperse in this congested area as in Alternatives 2 and 3, but still more as compared to the existing condition, which would improve the experience for many visitors.

The Lakeshore Trail would largely be pulled back from the lakeshore and would not cross the river to the west side, offering a different experience as Mendenhall Glacier would only be visible for a short portion of the trail. This would preserve most of the lakeshore for existing bird watching and other quiet activities. The lack of connection to the Mendenhall Campground would keep the campground area in its existing quiet state, with new public use cabins but no new parking area, picnic sites, or day use facilities.

Under this alternative, the Forest Service would change management unit boundaries and ROS classes, allowing increased use in some areas and trails. Over time, the service days for transportation service providers would increase from approximately 462,010 to approximately 533,140 over a longer commercial use season, and trails service days for outfitter and guide services would increase from approximately 53,840 to approximately 121,100 over a longer commercial use season (Appendix B). Service days would increase according to an adaptive management plan (Appendix B) to meet the projected demand of the visitor industry in Southeast Alaska.

The year-round recreational experience, especially for residents, would not be enhanced by the addition of multi-use trails in the Dredge Lakes and West Glacier Units, as these would not be constructed under Alternative 4. Alternative 4 would not create opportunities for additional types of visitor experiences as the natural environment changes and the glacier retreats: Alternative 4 does not include the Remote Glacier Visitor Area or motorized boat tours to the glacier. As in the No Action Alternative, visitors that would not otherwise be able to hike or take non-motorized transportation across due to time or mobility constraints would not have an opportunity to diversify their experience.

Alternative 4 would be responsive to the purpose and need for the project. It would provide quality opportunities for all visitors to enjoy the recreation area, provide new recreation and

interpretation experiences that emphasize the area’s outstanding scenery and wildlife resources even as the glacier recedes out of view of the existing Visitor Center, and meet the demand of the visitor industry, but to a lesser degree than Alternatives 2 or 3.

Social Encounters

Alternative 4 includes increases in visitor capacity and commercial use allocation in certain management units and trails, but to a lesser degree than Alternative 3 (Appendix B). Unlike Alternatives 2 and 3, the East Glacier Trail, Powerline Trail, Moraine Ecology Trail, and Trail of Time do not change ROS from Roaded Natural to Rural in Alternative 4. The Lakeshore Trail would be classified as Urban ROS as in Alternatives 2 and 3, but would offer a different experience as described above. Increased visitation would cause an increased probability of social encounters in a few areas; however, with the addition of built facilities and trails, users would have more available areas to disperse than under existing conditions. To estimate the anticipated increase in number of encounters on monitored trails, the same method was used as for the analysis in Alternatives 2 and 3. Table 3-22 shows the anticipated increase in social encounters for the four monitored trails. It should be noted that this increase in visitation would happen gradually over the next 15 years and would not reflect immediate conditions after addition of new facilities.

Table 3-22. Estimated Increase in Number of Social Encounters by Monitored Trail – Alternative 4

Trail ^a	ROS ^b	Proposed ROS (Alt 4)	Capacity Increase (Over Existing)	Average No. of Encounters ^d (Existing / Anticipated)
Steep Creek Trail	U	U	40%	6 / 8.4
Trail of Time	RN	RN	40%	4.2 / 5.9
East Glacier Trail	RN	RN	40%	10.7 / 15
West Glacier Trail	RN	RN	40% ^c	10.3 / 14.4 ^c

^a The trails with existing monitoring data from the 2017, 2018, and 2019 seasons are presented for estimation of increased social encounters. Other trails have not been monitored.

^b ROS standards for social encounters are derived from the Forest Plan (USDA Forest Service 2016) and are as follows: **Urban (U)**: Interaction between large numbers of users is high. Sites often are at full capacity, but do not exceed 80 percent of the design capacity over the primary use season. **Roaded Natural (RN)**: User meets *fewer* than 20 other parties per day on trails and in dispersed areas during at least 80 percent of the primary use season.

^c Matches Alternatives 2 and 3

^d Numbers represent the 3-year monitored average based on trail monitoring efforts from the 2017, 2018, and 2019 primary use seasons and the anticipated average based on proposed capacity increases (USDA Forest Service 2017a, 2018a, and 2019c).

Alternative 4’s proposed improvements are concentrated to the east side of the MGRA. While the number of social encounters would increase in the Visitor Center Unit, the lack of a connection over Mendenhall River would effectively concentrate visitors in one area. With the improved parking flow and facilities around the Visitor Center, this alternative is less likely to disperse visitors to existing quiet areas that are valued by locals such as the lakeshore, base of the glacier, and Mendenhall Lake itself. As in Alternatives 2 and 3, increased parking availability along Glacier Spur Road may encourage residents to visit the MGRA more during the primary use season to access quieter areas such as the Dredge Lakes Unit.

It is expected that number of encounters would increase under Alternative 4, but only in a few areas since additional facilities would allow visitors to spread out, mostly on the east side of the MGRA. Alternative 4 would have a **minor effect** on expected social encounters related to recreation and visitor experience.

Scenic Resources

Alternative 4's impacts to scenic resources would be greatly reduced as compared to the other action alternatives (Appendix C). The Welcome Center, plaza area, and increased parking area would have the greatest impacts to ESI. Photo Point Trail's inland alignment would make it slightly more visible from the Visitor Center. The Lakeshore Trail moving inland away from the lake for most of its alignment would reduce visual impacts from several areas such as Mendenhall Lake, Skater's Cabin, and West Glacier Trail. With no boat docks or boat operations or Remote Glacier Visitor Area, there would be no impacts to visual resources associated with observing the glacier. The proposed infrastructure would be consistent with Forest Plan direction.

Some proposed components of Alternative 4 would be visible from a few areas within the MGRA that have a high ESI and SIO, consistent with Forest Plan direction. This change in scenic resources would have a **moderate effect** on recreation and visitor experience.

Operational Noise

Existing noise sources (buses, motor vehicles, crowds) would increase similarly to Alternatives 2 and 3. Since the bus arrival and departure area is situated away from rather than next to Steep Creek in this alternative, noise levels would be reduced in this area similar to Alternative 3. Additionally, the omission of motorized boats in this alternative would avoid added noise from boat motors.

Overall, it is anticipated that changes to operational noise would have a **minor effect** on recreation and visitor experience under Alternative 4. Daily background noise would gradually increase in some areas of the MGRA due to increases in visitation and bus operations, but mainly only in areas that already experience noise during the primary use season.

3.7.7 Cumulative Effects

Table 3-23 includes projects important to determining the cumulative effects to recreation resources for this effort. The following discussion describes the anticipated cumulative effects to recreation resources.

Table 3-23. Projects Considered for Analysis of Cumulative Effects to Recreation Resources

Project Name	Type	Action
Helicopter Landing Tours on the Juneau Icefield	Management	Past/Ongoing
MGRA East and West Glacier Trails Maintenance	Maintenance	Present
MGRA Visitor Center Maintenance	Maintenance	Present
Mendenhall Glacier Mineral Withdrawal	Public Land Order Mineral Withdrawal	Present

Project Name	Type	Action
MGRA Point-to-Point Transport Special Use Permitting	Management	Present
Mendenhall Campground Repaving	Trail & Rec Improvements	Present
Back Loop Bridge and Dredge Lakes Trailhead Parking Area Improvements	Trail & Rec Improvements	Present
Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements	Trail & Rec Improvements	Future
Montana Creek Master Plan	Trail & Rec Improvements	Future
Juneau Trails Master Plan	Trail & Rec Improvements	Future
Small Cruise Ship Dock Construction	Infrastructure	Future
A.J. Dock Cruise Ship Berth Expansion	Infrastructure	Future
Franklin Dock Floating Berth Improvements	Infrastructure	Future
Norwegian Cruise Ship Berth (Aak'w [Auke] Landing) Construction	Infrastructure	Future

Climate Change

While impacts from climate change are difficult to predict, it is expected that it has the potential to impact recreational facilities and experiences. Glacial outburst floods, rising sea levels, and increased frequency and magnitude of heavy rain events can damage recreational infrastructure, including trails and parking lots. Recreational experiences at the MGRA could change as the glacier recedes, there are more heavy rain events, and there is less snow in winter.

Responsiveness to Purpose and Need

The Forest Service is planning to conduct improvement and maintenance activities that focus on existing recreation facilities on NFS lands including the MGRA Visitor Center, East and West Glacier Trails, Mendenhall Campground, and Back Loop Bridge and Dredge Lakes Trailhead parking areas. These projects would enhance existing recreation opportunities and improve public access to trails on NFS lands, particularly within the MGRA.

Other projects would expand recreational opportunities elsewhere in the Mendenhall Valley. The Kaxdigoowu Heen Dei Improvements project aims to perform trail repairs and maintenance, including construction of a new trail section and new or modified pedestrian bridge over Montana Creek. The Montana Creek and Juneau Trails Master Plans are in the early planning stages. The Montana Creek project would create a master planning document to identify recreational facilities, current use, and community values and goals for the Montana Creek Valley. The Juneau Trails Master Plan is an effort that would provide coordination between Juneau recreation groups (CBJ, Forest Service, ADNDR Division of Parks and Outdoor Recreation, and Trail Mix, Inc.) to coordinate ongoing maintenance and further development of the trail system in Juneau. As a result, residents and visitors would have a greater variety of recreational choices. Considered together with the proposed action or alternatives, there would be an improvement in recreation opportunities and experience in the Juneau area.

Social Encounters

Infrastructure and management projects that increase transportation access or improve recreation or visitor facilities have the potential to affect the number of social encounters. The proposed increases in visitor capacity and commercial use allocations at the MGRA, Mendenhall Campground repaving, and Back Loop Bridge and Dredge Lakes Trailhead parking lot improvements projects all could attract more (likely Juneau local and independent) recreators to the Mendenhall Valley. Additionally, the MGRA Point-to-Point Transport Special Use Permitting proposal would grant MGRA access to third party rideshare transportation services, making it easier to find independent transport into the MGRA. Improvements to or construction of infrastructure related to the tourism industry (small cruise ship dock, A.J. Dock, Franklin Dock Floating Berth Improvements project, and Norwegian cruise ship berth) would also bring more visitors and increase the likelihood of social encounters in the Juneau area, particularly in the Mendenhall Valley and the MGRA. While the Franklin Dock Floating Berth Improvements project is not an expansion of berthing capacity, it would increase efficiency of the passenger loading and unloading process and offer passengers greater time to spend onshore in Juneau. Overall, it is likely that the frequency of social encounters would increase over time.

In contrast, other projects may decrease the frequency of social encounters by providing additional recreation infrastructure spread around Juneau. The Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements, Montana Creek Master Plan, and Juneau Trails Master Plan would upgrade existing or provide new recreational facilities or plans for new recreational facilities in the Juneau area, which may lead to a greater dispersal of recreators across the Juneau area and decreased concentration of visitors at existing facilities.

Scenic Resources

The Mendenhall Glacier Mineral Withdrawal involves a request to withdraw 4,560 acres of land adjacent to the recreation area from mineral exploration and development to preserve scenic vistas in the Mendenhall Valley. No other project considered would affect scenic resources, and therefore would not be a cumulative effect to scenic resources in the Mendenhall Valley.

Operational Noise

Future consideration and evaluation of helicopter operations on the Juneau Icefield could lead to an increased number of tour landings or number of routes that traverse over the Mendenhall Valley. In conjunction with the proposed action or action alternatives, there could be an increase in overall noise level in the project area.

Similar to impacts to scenic resources, the Mendenhall Glacier Mineral Withdrawal would contribute to the preservation of, rather than impact, the quiet atmosphere at the MGRA. Withdrawal of the land from mining operations prevents noise from mining operations that would not be compatible with the existing or desired recreation and visitor experience. While the planned MGRA maintenance projects (Visitor Center maintenance, East and West Glacier Trails maintenance) would introduce some noise during the construction phase, this noise would be localized and short-term (likely only one construction season). Major infrastructure projects such as cruise ship dock improvements would have longer-term noise impacts since two of the four projects involve additional supports for larger-class cruise ships, but this noise would not be considerable enough to impact the environment in the Mendenhall Valley and would not cumulatively contribute to operational noise impacts from the proposed action or alternatives.

3.8 Watersheds, Wetlands, and Aquatic Habitat

3.8.1 Scope of the Analysis

This section provides a description of the following aquatic resources within the MGRA: watersheds, wetlands and soils, aquatic habitat, surface waterbodies, water quality, and floodplains. The analysis summarizes the applicable aquatic resource reports (available on the project website) for the project including wetlands mapping, Essential Fish Habitat (EFH) Assessment, flood impact study, and analysis of available aquatic habitat and fish species in the project area. The spatial scope of this analysis encompasses all 5,800 acres of the MGRA and considers the larger Mendenhall Glacier and Mendenhall River watersheds. This analysis extends 30 years into the future to encompass projected design capacity.

3.8.2 Regulatory Setting

3.8.2.1 Federal Regulations

EO 11990 Protection of Wetlands

Wetlands and riparian systems are protected under official policy of the Federal government under EO 11990. Under the order, all Federal agencies must consider wetland protection and actively minimize destruction, loss, or degradation of wetlands when carrying out the agency's responsibilities. Federal agencies are also tasked with preserving and enhancing natural and beneficial values of wetlands.

EO 11988 Floodplain Management

EO 11988 protects floodplains by requiring acting agencies to consider alternatives to avoid adverse effects and incompatible development within floodplains to the extent practicable. Any unavoidable adverse impacts to floodplains require appropriate mitigation.

Section 10 of the Rivers and Harbors Act

Under Section 10 of the Rivers and Harbors Act (33 United States Code [USC] 403), a permit authorization is required by the U.S. Army Corps of Engineers (Corps) for construction of any structure (e.g., pier, breakwater, dolphin) in or over a navigable water. Permit authorization also includes any modification through dredging or placement of fill in a navigable water. Navigable waters are waters subject to the ebb and flow of the tide and those waters presently used, used in the past, or susceptible to future use to transport interstate or foreign commerce.

Section 404 of the Clean Water Act

Section 404 of the Clean Water Act (CWA; 33 USC 1344) established a program to regulate the discharge of dredged or fill material into waters of the United States (WOTUS), including wetlands. WOTUS include navigable waters, all interstate waters, other waters where use or degradation or destruction of the waters could impact interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet these criteria or that possess a significant nexus to waters that meet these criteria. The Corps regulates and issues permits for activities that include discharging of dredged or fill materials into WOTUS.

Section 401 of the CWA (Water Quality Certification)

When applying for a Section 404 permit, an applicant must obtain a water quality certification from the appropriate State agency or the U.S. Environmental Protection Agency (EPA) certifying

that the proposed dredging or filling activity complies with the State's water quality standards and criteria under Section 401 of the CWA (33 USC 1341). In compliance with the CWA, Alaska's Water Quality Standards are determined by the Alaska Department of Environmental Conservation (ADEC) Division of Water. Applicable State water quality standards are codified in 18 Alaska Administrative Code (AAC) 70.

Magnuson-Stevens Fishery Conservation and Management Act of 1996

The Magnuson-Stevens Fishery and Conservation and Management Act (Magnuson-Stevens Act; 16 USC 1801) established a program to promote the protection, conservation, and enhancement of EFH for those species regulated under a Federal fisheries management plan. Section 305(b)(2) of the Magnuson-Stevens Act requires Federal action agencies to consult with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that "may adversely affect" EFH. EFH is defined as: "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is defined for the five species of Pacific salmon and covers both their marine and freshwater anadromous lifecycle stages. Freshwater habitat for Pacific salmon includes all streams, lakes, ponds, wetlands, and other waterbodies currently or historically accessible to salmon in Alaska (North Pacific Fishery Management Council 2021).

U.S. Coast Guard Requirements

The Forest Service would require the design and operation of passenger vessels to meet U.S. Coast Guard (USCG) requirements. This includes a review of the vessel design and an approved, well-defined travel route and operations plan. The frequency of fuel supply would be dependent on the fuel type, vessel capacity, and consumption rates. These include the provisions contained under 46 CFR Subchapter T, 33 CFR Parts 151, 155, and 156.

3.8.2.2 State Regulations

Anadromous Fish Act

To protect anadromous fish and their habitat, the Anadromous Fish Act (Alaska Statute [AS] 16.05.871) requires prior notification and approval from ADF&G Habitat Section for any action that would alter, divert, obstruct, pollute, or change the natural flow or bed of an anadromous waterbody. Activities are approved through a concurrence process in cooperation with ADF&G.

Fishway (or Fish Passage Act)

The Fishway Act (AS 16.05.841) requires notification and approval from ADF&G Habitat Section for activities within or across a stream used by fish if it is determined that such uses or activities could represent an impediment to the efficient passage of resident or anadromous fish. Activities are approved through a concurrence process in cooperation with ADF&G.

Alaska Department of Natural Resources

Mendenhall Lake and Mendenhall River are surrounded by Federal lands within the MGRA and were determined to be not navigable by the Alaska State Director of the U.S. Department of the Interior Bureau of Land Management in 1982; thus, they are analyzed as Federal waters in this EIS. The status of the waters and submerged lands of Mendenhall Lake and Mendenhall River may be in question by the State of Alaska. Further discussion of navigability of the lake and the ownership status is discussed in Section 3.8.4.4.

Alaska Water Quality Standards

ADEC provides guidance and enforces compliance regarding the protection of water, land, and air quality. ADEC received authorization from EPA to enforce compliance with CWA measures. ADEC is responsible for maintaining the Alaska Water Quality Standards (18 AAC 70) and implementing the Alaska Pollutant Discharge Elimination System Program. Guidance for nonpoint source pollution is provided by the Alaska Nonpoint Source Water Pollution Prevention and Restoration Strategy (ADEC 2020). Juneau, including the MGRA region, is required to comply with the New Development Management Measure of the Alaska Coastal Nonpoint Pollution Control Program, as outlined in the Alaska Stormwater Guide (ADEC 2011).

3.8.2.3 Consistency with the 2016 Tongass Forest Plan

Direction for managing the Tongass National Forest is based on the applicable LUD provided in the the Forest Plan. As previously mentioned, the MGRA is designated as a Special Interest Area. Specific standards and guidelines for management of Special Interest Areas includes objectives to protect wetlands (p. 4-84), soils and waters (pp. 4-61 to 4-64), fish and fish habitat (pp. 4-9 to 4-14), and riparian areas (pp. 4-48 to 4-52) to the extent practicable, and to ensure all adverse impacts to water resources are mitigated in compliance with prescribed BMPs (USDA Forest Service 2016).

Additional guidance is available in the Forest Service National Core BMP Technical Guide (2012), the Alaska Region Soil and Water Conservation Handbook (FSH 2509.22, Chapter 10), the Soil Management Handbook (FSH 2509.18), and the Forest Service Alaska Regional Water Quality Management Plan addressed in the Memorandum of Agreement dated April 6, 1992 (as amended) with ADEC.

3.8.2.4 Consistency with the MGRA Management Plan

The MGRA Management Plan establishes site-specific future conditions and management direction. As previously discussed, the MGRA Management Plan states that: “the overall direction for the Recreation Area is to retain the area substantially in its natural condition while balancing human recreation needs” (USDA Forest Service 1996a).

The MGRA Management Plan puts specific emphasis on aquatic habitat and concerns about the area’s spawning salmon and trout. It prioritizes fish and wildlife viewing, implementing additional protective measures if negative impacts to fish are detected, and consideration of new fish and wildlife enhancement projects.

3.8.3 Issues and Indicators

***Issue Statement:** Proposed developments including parking lot expansion, trail expansion and construction, bridge construction, Steep Creek realignment and restoration, and the addition of docks on Mendenhall Lake could impact wetlands, aquatic habitat, and water quality.*

Measurement Indicators:

- Quantitative analysis of impacts to wetlands and waterbodies
- Qualitative comparison of alternatives of impacts to aquatic habitat and EFH

- Quantitative analysis of impacts to riparian management areas (RMAs) as total area and percentage of existing RMAs within the MGRA
- Quantitative comparison of alternatives by number of new stream or surface water crossings by Forest Service Class I / Class II stream and Class III / Class IV stream types or lakes and ponds (total number and percent of MGRA total by class type)
- Estimate of altered runoff and risk to water contamination based on acres of increased impervious surface area within 100 feet of surface water
- Comparative analysis of alternatives with regard to impacts from flooding and major flood events

3.8.4 Affected Environment

Most riparian and aquatic habitat within and around the MGRA recently developed after millennia under glacial ice (ABR 2021). These habitats are in a constant state of flux as a result of glacial melting, glacial recession, and isostatic rebound exposing new underlying landscape. A product of glacial activity, the MGRA will continue to experience changing hydrologic and surface water regimes, the creation of new and growing headwater streams, and the continual modification (e.g., channelization) of existing habitats through increased input from surface waters (ABR 2021).

3.8.4.1 Watersheds

The MGRA is within two of Juneau’s watersheds: the Mendenhall Glacier watershed and the Mendenhall River watershed. The Mendenhall Glacier watershed (hydrologic unit code [HUC] 190103010602) is 29,265 acres terminating in Mendenhall Lake and includes the 24,220-acre glacier and surrounding mountains (U.S. Geological Survey [USGS] 2021; Kienholz et al. 2020). The Mendenhall River watershed (HUC 190103010604) encompasses approximately 17,053 acres of land originating in the mountains east of Mendenhall Lake, and it empties to the south into Fritz Cove after passing through the Mendenhall Valley (USGS 2021).

The Forest Service Watershed Condition Framework establishes a nationally consistent approach for classifying watershed condition (USDA Forest Service 2011). The approach is designed to foster integrated watershed assessments, target restoration in priority watersheds, enhance collaboration with partners, and improve watershed condition. Based on this framework, Mendenhall Glacier watershed and the Mendenhall River watershed are “functioning properly” (USDA Forest Service 2021c). The primary waterbodies in the MGRA include Mendenhall Lake, Mendenhall River, Steep Creek, and several lakes and ponds in the Dredge Lakes Unit. There are numerous additional lakes, streams, and drainages, some of which contribute to the primary waterbodies, particularly during heavy rain events.

3.8.4.2 Wetlands and Soils

Wetlands are valuable ecosystems known to perform significant hydrologic, biochemical, and biological functions for their surrounding watersheds. Wetland hydrologic functions include facilitating discharge of water to downstream habitat, providing surface and subsurface water storage, and particulate retention. Wetlands moderate flooding, reduce runoff and sedimentation, and may help sustain stream flows during dry periods. Wetland biochemical functions include

providing organic carbon production and storage, cycling of elements and compounds, moderating pH, and maintaining nutrient storage and plant communities. Wetland biological functions are providing unique habitat for terrestrial and aquatic plants and animals.

Like much of Southeast Alaska, the MGRA contains an extensive network of non-tidal wetlands, including lakes and ponds, that formed as receding glaciers scoured the landscape. A wetland mapping effort in conjunction with the proposed project analyzed approximately one quarter of the total MGRA (1,452 acres), across the Visitor Center Unit, Dredge Lakes Unit, and West Glacier Unit (Table 3-24, Figure 3-10). The most prevalent wetlands type found was 740 acres of forested wetlands, dominant in the West Glacier Unit and Dredge Lakes Unit. Lakes and ponds accounted for 125 acres (most of Mendenhall Lake acreage was not included in the study area), while scrub-shrub wetlands were 128 acres. There were 375 acres of naturally occurring uplands and another 38 acres of artificial uplands mapped in the study area (ABR 2021a).

Soil composition in the MGRA is largely influenced by the retreat of the Mendenhall Glacier. As ice retreated, it left glacial material behind and scraped the underlying bedrock. Glacial outwash deposits cover the Dredge Lakes Unit, formed by melting at the terminus of the glacier and characterized by gray silty sand between 10 and 60 feet thick and dotted with boulders. In the West Glacier Unit and some parts of the Dredge Lakes Unit, moraine deposits of light gray loose till mixed with gravelly sand, up to 80 feet thick, are common. Glacial deposits have formed on the east side of Mendenhall Lake, consisting of darker gray fine to coarse grain silty sand that are several inches to 50 feet thick. Nearer to the current location of the glacier, the side slopes of Mount McGinnis are steep with shallow bedrock (USDA Forest Service 2018).

The predominant soils mapped in the study area are entisols, typically occurring on relatively flat slopes in lowland areas. The entisols in this area indicate somewhat poorly drained soils on alluvial fans and toeslopes. These soils are described as occasionally flooded but not ponded. The next most common soils in the study area are cryohemist and cryosaprist soils occurring on 0 to 5 percent slopes, indicating very poorly drained soils in depressions. These soils are described as rarely flooded and not ponded, but with very high water table at a depth of 0 to 6 inches from the surface (ABR 2021a).

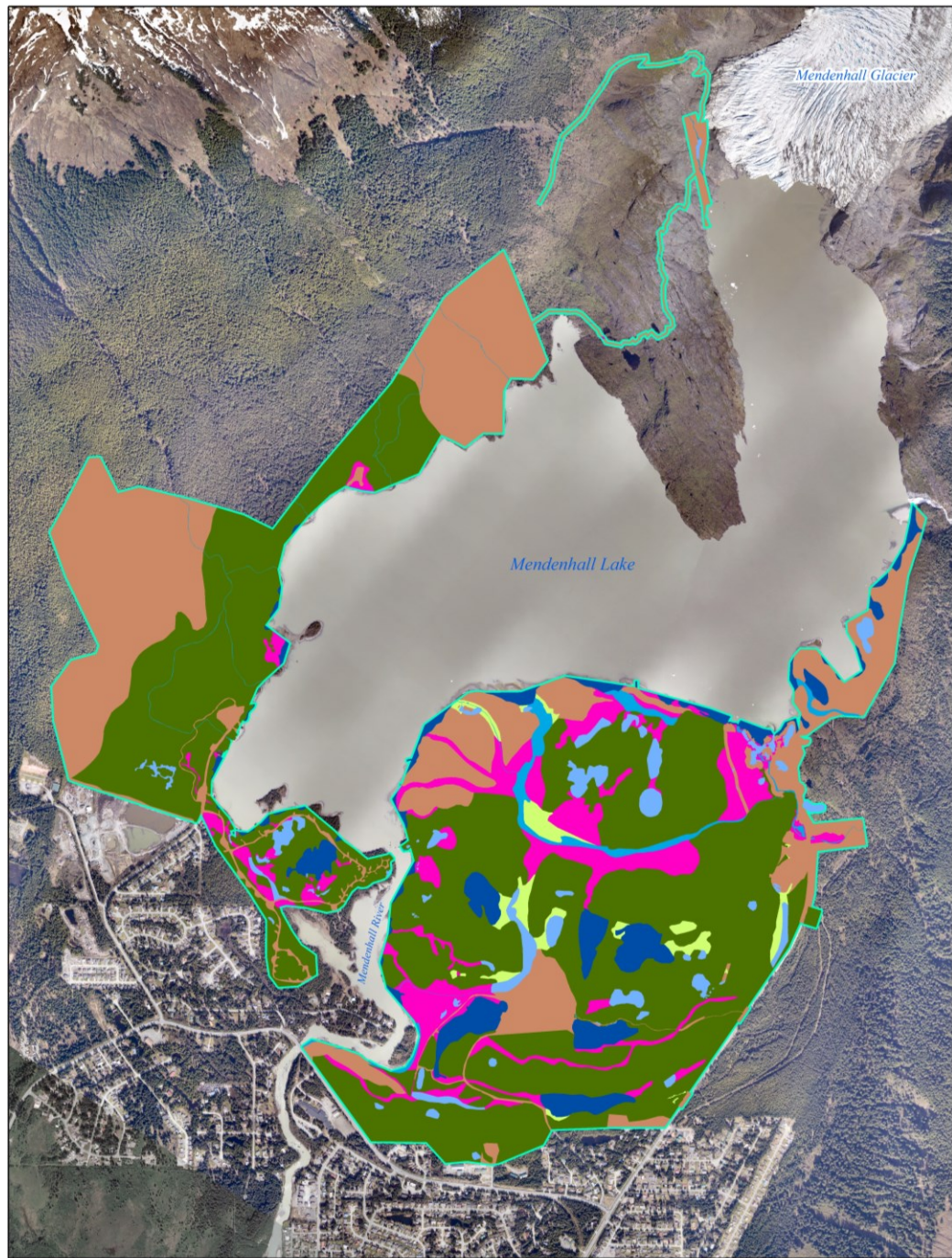
Table 3-24. Wetlands in the MGRA Study Area

Feature	National Wetlands Inventory Code (Wetlands Type)	Acres	% of Study Area
Lakes	• L1UBH (lacustrine limnetic permanently flooded unconsolidated bottom) • L2US2C (lacustrine littoral seasonally flooded unconsolidated sandy shore)	29	2.0
Ponds	• PUBH (palustrine permanently flooded unconsolidated bottom) • PUBHb (palustrine permanently flooded unconsolidated bottom, beaver modified) • PUBHx (palustrine permanently flooded unconsolidated bottom, excavated) • PABH (palustrine permanently flooded aquatic bed)	96	6.6
Rivers	• R2UBH (riverine lower perennial permanently flooded unconsolidated bottom) • R2USC (riverine lower perennial seasonally flooded unconsolidated shore) • R3UBH (riverine upper perennial permanently flooded unconsolidated bottom) • R3USC (riverine upper perennial seasonally flooded unconsolidated shore)	23	1.6
Emergent wetlands	• PEM1F (palustrine semi-permanently flooded persistent emergent) • PEM1E (palustrine seasonally flooded-saturated persistent emergent) • PEM2E (palustrine seasonally flooded-saturated nonpersistent emergent) • PEM1C (palustrine seasonally flooded persistent emergent)	23	1.6

Feature	National Wetlands Inventory Code (Wetlands Type)	Acres	% of Study Area
Scrub-shrub wetlands	• PEM1/SS1E (palustrine seasonally flooded-saturated persistent emergent/broad-leaved deciduous scrub-shrub) • PSS1E (palustrine seasonally flooded-saturated broad-leaved deciduous scrub-shrub) • PSS1C (palustrine seasonally flooded broad-leaved deciduous scrub-shrub) • PSS1B (palustrine seasonally saturated broad-leaved deciduous scrub-shrub)	128	8.8
Forested wetlands	• PFO4B (palustrine saturated needle-leaved evergreen forest)	740	51.0
Uplands	• U (upland)	375	25.8
Artificial fill	• Us (upland fill)	38	2.6
Total		1,452	100

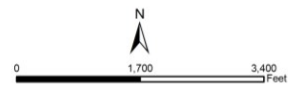
Source: ABR 2021a

Figure 3-10. MGRA Wetlands Mapping Study Area



Legend

	Limit Of Study Area		River
	Uplands and Artificial Fill		Pond
	Forested		Lake
	Scrub-Shrub		
	Emergent		



Riparian Management Areas

Riparian areas are the zone of interaction between aquatic and terrestrial environments, found along the shores of streams and lakes and within floodplains. Riparian areas provide unique habitat for wildlife and vegetation and perform a wide range of ecosystem functions by buffering overland sediment delivery, water temperature, and pollution. The Forest Service delineates these riparian resources into Riparian Management Areas (RMAs) with specific standards and guidelines.

RMAs designate buffer areas along waterbodies at a minimum of 100 feet, greater depending on stream channel type and localized conditions. Forest-wide inventory of channel types is organized by nine basic process groups that share similar interrelationships between watershed runoff, landform relief, geology, and glacial influences on fluvial erosion and deposition. RMA process groups present in the MGRA include flood plain, glacial outwash, alluvial fan, palustrine, high gradient contained, moderate gradient contained, and lakes and ponds. A description of each process group can be found in the Forest Plan (USDA Forest Service 2016, Appendix D).

3.8.4.3 Aquatic Habitat

With a wide variety of aquatic and riparian habitat, the MGRA hosts multiple anadromous and resident fish-supporting waterbodies. The anadromous fish populations in the MGRA fit into a larger ecosystem that includes the entire Mendenhall River, reaches into Fritz Cove and Auke Bay, and is connected to larger fisheries in the Gulf of Alaska.

The waters within the MGRA are used by anadromous fish species for essential lifecycle needs that include spawning, rearing, feeding, and migration. Anadromous waterways in the project area include Mendenhall River, Mendenhall Lake, Kettle Pond, Steep Creek and associated ponds, Nugget Creek, multiple waterbodies in the Dredge Lakes Unit, and multiple streams in the West Glacier Unit (ADF&G 2021b). Waterbodies within the MGRA support Coho and Sockeye Salmon, along with Dolly Varden, Rainbow Trout, and Cutthroat Trout. The Forest Service classifies anadromous fish bearing streams as Class I and streams with resident fish as Class II. Non-fish bearing streams and those with potential to affect water quality are considered Class III streams. Class IV streams are at least 1 foot in width but have minimal potential to erode or transport sediment. Streams within the MGRA as presented by stream class and with the associated RMA in Figure 3-11.

Figure 3-11. MGRA Streams and RMAs by Stream Class



Legend

-  Lake/Pond
-  Riparian Management Area
-  Stream Class 1
-  Stream Class 2
-  Stream Class 3
-  Stream Class 4



Essential Fish Habitat

NOAA Fisheries defines EFH as those waters and substrate necessary for spawning, breeding, feeding, and growing to maturity for those fish species regulated under a Federal fisheries management plan. In Alaska, EFH is defined for the five species of Pacific salmon and covers their marine and freshwater anadromous lifecycle stages. Freshwater habitat for Pacific salmon includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Alaska (North Pacific Fishery Management Council 2021). According to ADF&G's Anadromous Waters Catalog (AWC) and recent stream surveys conducted by ADF&G, the waters within the MGRA are used by anadromous species for essential lifecycle needs and are considered EFH (ADF&G 2021b; Dean 2021). In compliance with the Magnuson-Stevens Fisheries Conservation and Management Act (1976), an EFH Assessment was prepared in conjunction with the proposed project and is available in the project record (Solstice Alaska Consulting [Solstice] 2022). A draft of the EFH Assessment was submitted to NOAA Fisheries on January 11, 2022 and comments from the agency have been incorporated into the document.

Mendenhall Glacier is retreating due to a warming climate, and changing glacier conditions in the MGRA have created additional and altered spawning and rearing habitat for salmonids (ABR 2021). Meltwater streams near the glacier's terminus could become suitable fish habitat as the glacier recedes. Additionally, the MGRA, along with much of Southeast Alaska, is experiencing isostatic rebound as a result of the last ice age, and land is rising at an estimated half inch annually (Larsen et al. 2005). Local elevations and the nature of existing surface water connections are expected to experience gradual changes in the coming decades. Rising land caused by isostatic rebound could increase channel gradients where fish access rearing ponds or wetland areas and make certain routes impassible. Mendenhall Lake is reaching capacity and continues to receive glacial sediment deposits, affecting its depth.

In the summer of 2020, ADF&G expanded the documented extent of salmonids in MGRA waterbodies (Dean 2021). There are likely additional EFH waterbodies that have not undergone surveying or mapping within the MGRA. ADF&G has identified areas for further investigation; however, additional surveys have not been conducted at this time. While a majority of the MGRA has been mapped for existing streams and EFH, comprehensive stream surveys would be completed prior to any ground disturbance. Any newly discovered streams/waterbodies would receive the appropriate protections under the Forest Plan and relevant laws or regulations.

3.8.4.4 Waterbodies / Surface Water

Mendenhall Glacier and Mendenhall Lake

The Mendenhall Glacier is a part of the larger Juneau Icefield, a 1,500 square mile field of interconnected glaciers in the mountains above Juneau. Mendenhall Glacier has been retreating since 1895, before the MGRA was established (ABR 2021). Glacier recession formed Mendenhall Lake, and the glacier has retreated approximately 1.9 miles in the last century. The rate of retreat has increased over the past 20 years, averaging 170 feet per year from 1998 to 2018 (Amundson, Hekkers, and Hood 2020). The area is experiencing ongoing isostatic rebound as a result, causing a gradual ground lift that may change local elevations and the nature of existing surface water connections in the next decades.

Mendenhall Lake dates back to the 1930s when meltwater collected in a glacial moraine dam after the glacier retreated. Today, Mendenhall Lake encompasses 1,052 acres at the surface and is approximately 200 feet deep at its deepest point. It receives ample annual rain and snowmelt

runoff and sees significant glacial calving. The size of Mendenhall Lake has been expanding as Mendenhall Glacier retreats and uncovers more of the lake, and glacial melt also increases the volume of the lake. The lake's basin is approaching capacity. The temperature of the lake averages 37 degrees Fahrenheit (F), and the lake shows thermal stratification following spring melt when the coldest waters are measured at depth. The lake is a sink for coarse and fine sediment primarily from Mendenhall Glacier, along with sediment inputs from Nugget Creek, Steep Creek, and other nearby streams. Mendenhall Lake supports Coho and Sockeye Salmon, Cutthroat Trout, and Dolly Varden, and provides access to important spawning and rearing habitat for Coho and Sockeye Salmon in connected streams and ponds (ABR 2021).

The USCG has interest in insuring safety of commercially operated vessels and so their definition of navigable waters is based on safety and not title or ownership. They define navigable waters as those that are “subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce” (33 CFR 329.4). Reviews of the USCG Navigable Waters of the United States within the Seventeenth Coast Guard District (2012) and the Corps Navigable Waters List (1995) indicated that Mendenhall Lake is not currently listed as a navigable water. However, through recent coordination and consultation with USCG, it was assumed that Mendenhall Lake may be navigable under their definition. The process for a formal determination is underway and is anticipated to be ongoing at the time of a project decision.

The definition of “navigable water” under Federal law with relation to ownership or title is: “Those rivers must be regarded as public navigable rivers in law which are navigable in fact. And they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water.” Additional input from ADNRR on the navigability of Mendenhall Lake is anticipated. Regardless of a determination by Federal or State agencies, current management direction from the Forest Service places a ban on the use of motorized equipment on the lake, except for wintertime motorized uses.

Mendenhall River

Mendenhall River flows approximately 5 miles from Mendenhall Lake to the marine waters of Fritz Cove near the Juneau Airport. Just downstream of the MGRA, there is a small neighborhood along the river's west shore, and Mendenhall Loop Road crosses over the river. Suburban development borders a substantial portion of the east bank of the river downstream of the MGRA, while Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) runs the length of the west side of the river through a protected greenbelt. There is a trail crossing and another major road crossing near the river's mouth at the Glacier Highway.

Average annual mean flow is 1,250 cubic feet/second (cfs), with an annual range of means of 93 to 3,330 cfs; peak flows have reached 27,000 cfs (ABR 2021). The water temperature is cool, averaging approximately 40 degrees F during summer months. The river carries heavy glacial sediment, consisting of coarse and fine glacial materials deposited from Mendenhall Lake, from input by hillside streams, and from river bank erosion.

Reviews of the USCG Navigable Waters of the United States within the Seventeenth Coast Guard District (2012) and the Corps Navigable Waters List (1995) revealed that the Mendenhall River is listed as a navigable water from the mouth of the river to Montana Creek, south of the MGRA boundary. Through coordination and consultation with USCG, it was acknowledged that

the undetermined stretch of Mendenhall River within the MGRA may be navigable. The process for a formal determination is underway and is anticipated to be ongoing at the time of a project decision.

Mendenhall River is a Class I river that supports significant natural annual runs of Coho and Sockeye Salmon, Cutthroat Trout, and Dolly Varden to spawning grounds in nearby tributaries (ABR 2021). Coho and Sockeye Salmon runs from Mendenhall River into Mendenhall Lake followed the retreat of the glacier and are less than 70 years old. Downstream of the MGRA, the Mendenhall River provides some habitat for Chum, Chinook, and Pink Salmon. These salmon, likely spawned from the nearby Gastineau Hatchery, occasionally stray into the MGRA (ABR 2021). Pink Salmon were more common in the MGRA when they were being produced at Gastineau Hatchery, although that hatchery ceased producing pinks more than 15 years ago.

Steep Creek

Steep Creek is a non-glacial tributary that runs approximately 2.2 miles of mostly unbraided stream habitat over a grade of 700 feet before releasing into Mendenhall Lake. Steep Creek originates in the mountains, flows generally west and north, and terminates in Mendenhall Lake near the Visitor Center and parking area. It is a relatively small creek with a drainage basin less than 2 square miles, a bankfull width of approximately 20 feet, and a bankfull depth of approximately 1 to 2 feet. The riparian vegetation adjacent to Steep Creek is in primary succession and lacks large trees along the streambank and woody debris in the stream. The creek drains approximately 8 to 10 cfs with seasonal flash flows of 30 to 40 cfs during spring melt and autumn rains (ABR 2021).

The Class I anadromous fish habitat on Steep Creek terminates at Dipper Falls, which creates a fish barrier approximately 0.6 miles upstream of Mendenhall Lake (ABR 2021). Above Dipper Falls, Steep Creek is considered a Class III stream. Under current conditions, the Steep Creek stream channel lacks naturally occurring pools and features only a few meanders. The creek bed provides minimal suitable rearing habitat. Most of the productive rearing habitat in the Steep Creek network is provided by several small ponds that connect directly to Steep Creek. The downstream portion of Steep Creek provides spawning habitat; however, spawning habitat is limited by stream conditions.

In the 1960s, Steep Creek was relocated west to accommodate construction of Glacier Spur Road. Over time, the channel has responded by straightening, affecting culvert connectivity and contributing to diminished spawning habitat within the creek bed. In 1995, the channel shifted and began flowing through a kettle pond about a quarter mile upstream of Mendenhall Lake, affecting productive substrate deposition (Schneider 2012). Additionally, some portions of the channel have been armored with riprap to prevent erosion. Due to these changes, much of the gravels and small cobbles essential for salmon spawning have washed away as the channel bed has been down cut (Schneider 2012).

Washed out gravels from the current creek alignment have not been replenished because the culverts under Glacier Spur Road are undersized and act as the barrier to natural sediment movement through the channel. Steep Creek passes through two arch pipe corrugated steel culverts that were installed when the creek was relocated in the 1960s. One of the culverts is perched at low flows and has been designated “red” by ADF&G, indicating that culvert conditions are likely inadequate for fish passage of all life stages. The other culvert has been designated “gray” indicating that conditions may be inadequate for fish passage of all life stages

(ABR 2021). Given these problems, the creek experiences increased sediment deposits and channel widening upstream of the culverts, whereas the downstream section sees bed and bank scouring. Periodic beaver activity in the creek and the culverts has also contributed to hindering substrate movement.

In October 2016, the Forest Service conducted a habitat assessment of the pair of Steep Creek culverts that cross under Glacier Spur Road. The survey found the culverts to be a high priority for remediation. The culvert data was analyzed using the Tongass assessment protocol for stream crossings. The resulting matrix yielded an above average score of 528.4 for the Steep Creek Glacier Spur Road crossing. Higher matrix scores are a higher priority for stream crossing remediation. For comparison, the average stream crossings score for Tongass area ADF&G-rated “Class I red pipes” is 234.2 (Schneider 2016).

Diminished spawning gravels downstream of Glacier Spur Road have been observed since 2000. Gravels have been replaced by sand and organic materials due to changes in stream flow, culverts becoming perched over time, and riprap placement (Schneider 2012). The primary substrates in Steep Creek were historically small cobbles and large gravel (69 percent in 2000), which are beneficial for salmon spawning. More recently, substrate composition has consisted of a majority sand and organic sediments (58 percent in 2008), and there has been a reduction in cobbles and gravels (25 percent in 2008) (Schneider 2012). These changes in stream substrates could result in major impacts to salmonid spawning success with time.

The several small ponds that drain into Steep Creek’s lower reaches near Mendenhall Lake provide additional rearing habitat for fish spawned in Steep Creek (ABR 2021). The Pond of Time and Zig Zag Pond provide seasonally-connected rearing habitat for Coho Salmon. The Pond of Time is connected to Steep Creek via an improperly-set, perched culvert that is connected only during high water events or backwater due to downstream beaver activity (Schneider 2016). Zig Zag Pond is seasonally connected and accessible to rearing salmon, dependent on water levels (ABR 2021). Sizes and depths of these ponds are provided below in Table 3-25. At its outlet, Steep Creek empties into Meadow Pond before entering Pavilion Pond and then Mendenhall Lake. The ponds have good mixed gravel substrates and provide spawning and rearing habitat for Coho Salmon and Dolly Varden. These ponds and others in the Visitor Center Unit are listed in Table 3-25 below.

Up to 2,500 Sockeye Salmon and 500 Coho Salmon return to Steep Creek historically, with lower returns recorded in recent years (USDA Forest Service 2018). Surveys from 2013 to 2019 indicate that approximately 1,000 Sockeye Salmon adults return to Steep Creek annually in late July through August. Typical Coho Salmon escapement counts in Steep Creek averaged below 300 fish from 1980 to 2004 (ABR 2021).

Table 3-25. Visitor Center Unit Ponds

Pond	Size (acres)	Depth (feet)	Fish Species Present
Kettle Pond	0.81	25	Coho Salmon (rearing) Dolly Varden (rearing)
Meadow Pond	0.85	10	Sockeye and Coho Salmon (rearing/spawning) Dolly Varden (rearing/spawning)

Pond	Size (acres)	Depth (feet)	Fish Species Present
Pavilion Pond	0.35	12	Sockeye and Coho Salmon (rearing/spawning) Dolly Varden (rearing/spawning)
Zig Zag Pond	0.5	12	Coho Salmon (rearing) Dolly Varden (rearing)
Pond of Time	0.92	20	Coho Salmon (rearing) Dolly Varden (rearing)
Backside Pond	0.2	7	N/A

^a AWC Survey results are available through 2020 season

Source: ABR 2021, ADF&G 2021b

Dredge Lakes Unit Waterbodies

The Dredge Lakes Unit is an extensive network of wetlands, lakes, ponds, and streams. There are nine main lakes in the Dredge Lakes Unit and several other surface waterbodies that are seasonally connected to each other and/or Mendenhall Lake. Additionally, beavers are active in the Dredge Lakes Unit. Beavers affect area hydrology and connectivity by building dams and creating beaver ponds connected to the Dredge Creek system and the south shore of Mendenhall Lake (ABR 2021). Beaver dams may hinder passage of adult fish but generally do not limit juvenile fish movement. Some of the major Dredge Lakes Unit waterbodies are discussed below.

Dredge Creek is a Class I stream that starts at the base of Thunder Mountain and flows under Glacier Spur Road and through the Dredge Lakes Unit before reaching Mendenhall River. It is connected to various ponds and lakes within the Dredge Lakes Unit.

Dredge Lake, Moose Lake, Crystal Lake, and Holding Pond are connected to Mendenhall Lake and Mendenhall River via Class I stream connections. The lakes' surface areas range from 2 to 10 acres. Coho Salmon, Dolly Varden, and Cutthroat Trout have been observed in these waterbodies. Coho fry are occasionally observed in Norton, Glacier, and Moraine Lakes, but there are no recognized stream connections to other waterbodies, and it appears that connectivity is inconsistent and heavily influenced by beaver activity and water levels. There are no fish in Louie or Cashew Lakes.

Dredge Lakes Unit waterbodies have low dissolved oxygen levels and fish kills have been observed during the winter months (Albrecht 2020 and 2018). Data collected in April 2020 found Coho Salmon in water with low dissolved oxygen levels (below 7 milligrams per liter; ADEC 2020a) in the holding pond, Moose Lake, Dredge Lake, Moraine Lake, and Glacier Lake (Albrecht 2020). Glacier, Moraine, and Crystal Lakes are known to experience low dissolved oxygen levels; however, they have been stocked with triploid Rainbow Trout for sport fishing for the last few years (ABR 2021). Fish stocking is anticipated to continue.

Nugget Creek

Nugget Creek is a relatively small stream that is located on the eastern shore of Mendenhall Lake north of the Visitor Center. The creek has a high gradient and barrier falls near its mouth, and therefore does not provide fish habitat past these features. Nugget Creek is Class I from its mouth to Nugget Falls and Class III above the falls. Coho and Sockeye Salmon occasionally access the falls area where spawning gravels are present, although substrates are unstable, and

the area lacks sufficient vegetation and protective stream banks to support successful redds (ABR 2021).

West Glacier Unit Streams

There are various small anadromous fish streams in the West Glacier Unit, including Tolch Creek and Wesley Creek. Consistent Sockeye Salmon spawning and Coho Salmon rearing have been identified in these creeks. Near the glacier, glacial meltwater streams emerge and evolve in response to glacier activity.

3.8.4.5 Common MGRA Salmonids

Waterbodies within the MGRA support Coho and Sockeye Salmon, along with Dolly Varden, Rainbow Trout, and Coastal Cutthroat Trout. Fish species with consistent populations in the MGRA are summarized in Table 3-26.

Table 3-26. Common MGRA Salmonids and Life Stages Present

Species (Common Name, Scientific Name)	Life Stage
Coho Salmon <i>Oncorhynchus kisutch</i>	Anadromous: adult (spawning), juvenile (rearing)
Sockeye Salmon <i>O. nerka</i>	Anadromous: adult (spawning), juvenile (rearing)
Rainbow Trout <i>O. mykiss</i>	Resident: adult
Coastal Cutthroat Trout <i>O. clarkia</i>	Resident/anadromous: adult, immature, juvenile
Dolly Varden <i>Salvelinus malma</i>	Resident/anadromous: adult, spawning, rearing

Source: ABR 2021

Generally, juvenile salmon may remain in freshwater for 1 to 3 years before out-migrating from the MGRA to marine waters in the spring (prior to June 1). Adult salmon migrate upstream into the MGRA to spawn after July 15. Adult Sockeye Salmon spawn in waters within the project area in July and August, and Coho Salmon spawn in waters within the project area in October (USDA Forest Service 2018).

Dolly Varden are found in all units of the MGRA. They are abundant mostly in the southern and smaller form of the two populations found in Alaska. Dolly Varden overwinter in freshwater lakes, including Mendenhall Lake, and spawn in the fall in mixed gravel beds in headwater streams (ABR 2021).

Cutthroat Trout spawn in the spring from April to early June near the MGRA in Montana Creek and some may overwinter in Mendenhall Lake. Sea-run Cutthroat Trout have been observed overwintering in Dredge and Moose Lakes in the Dredge Lakes Unit. However, the MGRA provides little to no suitable spawning habitat for Cutthroat Trout. They are less common than Dolly Varden in the project area; between 1980 and 2003, long-term average harvest of Cutthroat Trout was 261 fish compared to 6,294 Dolly Varden (ABR 2021).

Naturally-spawned Rainbow Trout, and its anadromous counterpart Steelhead Trout, are seen in Mendenhall River as high as Montana Creek. Starting in 2019 on a semi-annual basis, the Forest Service began stocking ponds in the Dredge Lakes Unit (Glacier, Moraine, and Crystal Lakes) with 2,000 to 15,000 individual sterile, triploid Rainbow Trout fingerlings (ABR 2021).

A strong indicator of fisheries health is the composition of available aquatic macroinvertebrates – a key food resource for salmonoids. Analysis of macroinvertebrate compositions of Mendenhall River and Mendenhall Lake have been categorized as “good” to “fair” for anadromous and resident spawning and rearing fish (ABR 2021).

As discussed, an extensive review of fish species, waterbodies, and aquatic macroinvertebrates within the MGRA can be found in Biological Resource Review for the Mendenhall Glacier Recreation Area, Tongass National Forest, Alaska, which is available in the project record (ABR 2021). An EFH Assessment was prepared for the proposed project and can be found on the project website (Solstice 2022).

3.8.4.6 Water Quality

Within the MGRA, there are no waterbodies designated as impaired (polluted) under the CWA by the EPA or ADEC Impaired Waterbodies Database (ADEC 2018). Nearby impaired waters are Duck Creek, Jordan Creek, and Casa Del Sol Creek (also known as Pederson Hill Creek), and these waters meet Mendenhall River downstream of the MGRA. Montana Creek, also downstream of the MGRA, was previously listed as an impaired waterbody, but is no longer listed. Additionally, based on a reviewed of ADEC’s Contaminated Sites Database, there are no contaminated sites reported within the MGRA (ADEC 2021a).

Stormwater captured from the two existing MGRA Visitor Center parking lots passes through absorbent pipe socks fitted to parking lot drainage outfalls to capture sediment and other contaminants in runoff before being discharged to Steep Creek near its outlet to Mendenhall Lake. As part of an educational visitor experience, water quality data was recorded weekly from May to September for two sites along Steep Creek from 2013 to 2018 (Gastineau Guiding Company 2018). One site was located above Glacier Spur Road and the other site downstream of Glacier Spur Road. A summary of the data recorded is provided below in Table 3-27. Results indicate similar conditions upstream and downstream of Glacier Spur Road and overall reasonable conditions for salmon spawning (Gastineau Guiding Company 2018).

Table 3-27. Average Summer Steep Creek Water Quality Parameters (2013 to 2018)

Parameter	Upstream Location ^a	Downstream Location ^a	Ideal Condition
Temperature (degrees F)	51	51	50 – 60 ^b
Conductivity (microsiemens)	63.4	55.1	<300 ^c
Total dissolved solids (parts per million [ppm])	46.0	39.09	<250 ^d
Potential hydrogen (pH)	8.73	8.85	6.5 – 8.5 ^e

^a Gastineau Guiding Company 2018^b Stenhouse et al 2012^c EPA 2011^d Stekoll et al. 2003^e ADEC 2020a

Steep Creek’s average temperature in spring and summer is approximately 50 degrees F and suitable for salmon, based on Stenhouse et al. (2012) which recommends an optimal temperature range for rearing and growth to be between 50 to 60 degrees F (10.0 to 15.5 degrees Celsius). Measurements of total dissolved solids are low and appropriate for salmon, as indicated by Stekoll et al. (2003) finding that increasing concentrations of total dissolved solids above 250 parts per million (ppm) can cause reduced rates of fertilization. There is no water quality standard for stream conductivity in the western U.S., including Alaska; however, when compared to the aquatic life benchmark of 300 microseimens or below for Appalachian streams (EPA 2011), the measurements taken in Steep Creek suggest conditions are likely suitable for salmon. (It is noted that caution is required when applying criteria derived for one ecoregion to another.) ADEC water quality standard criteria for aquatic life recommends a pH level between 6.5 and 8.5 or less than 0.5 pH units above or below natural conditions (ADEC 2020a). However, pH level was consistently high in both Steep Creek locations, averaging around 8.8. Under a separate sampling effort in 2013, six locations (four primary and two control) in Steep Creek were tested for hydrocarbons and no contamination of concern was identified (Admiralty Environmental 2013). The absence of known contamination concerns within Steep Creek suggests a high pH in the creek is a natural background condition.

The CBJ uses the commercial overflow parking lot for snow storage during the winter. Stormwater runoff in the commercial overflow parking lot infiltrates the gravel parking surface, which consists primarily of glacial till that can bind and sequester some pollutants from stormwater. Heavy metals carried in snow from city streets can be present in melt water from snow storage sites. Nonpoint source pollutants from snowmelt can contain heavy metals from the dry and wet deposition of exhaust from diesel and unleaded gas-fueled vehicles, tire wear, and brake pad wear.

In 2012, the CBJ added a retention pond at the south end of the parking lot/snow storage site to allow sediment and heavy metals to settle out and to dilute runoff into the connected beaver pond (USDA Forest Service 2012b). Swales direct meltwater to the retention pond, although some runoff from the northern half of the lot likely flows directly north to the Steep Creek drainage and into Mendenhall Lake.

Before the retention pond was built, water quality sampling was conducted in the beaver pond south of the parking lot and an upstream control site along Steep Creek.⁷ In 2010, sampling in the beaver pond identified one exceedance of the chronic exposure level (level of a pollutant that a four-day period of exposure would result in toxicity for aquatic life) for iron (USDA Forest Service 2012b). The beaver pond measured 1.6 milligrams per liter, while the chronic exposure level is 1.0 milligrams per liter (ADEC 2008). In 2011, iron levels were below the chronic exposure level. In 2010 and 2011, levels of barium, magnesium, potassium, total suspended solids (TSS), and turbidity were below water criteria standards. Hydrocarbons, arsenic, and mercury in all locations were below detectable limits (USDA Forest Service 2012b).

Following installation of the retention pond, CBJ monitored water quality in the retention pond, the connected beaver pond, and an upstream Steep Creek control site. Samples taken in 2015, 2017, and 2021 were analyzed for total aromatic carbons (TAH), total aqueous hydrocarbons (TAqH), benzene, toluene, ethylbenzene, and xylene (BTEX), total recoverable metals (including iron), chloride, TSS, and turbidity (Admiralty Environmental 2021, 2017, and 2015). No water quality exceedances were identified in any sample locations; results suggest the retention pond is effectively diluting contaminants.

Byproducts of petroleum hydrocarbons (TAH, TAqH, and BTEX) have not been detected in any sampling locations, suggesting there is no noticeable contamination from vehicle fuels. TSS (possibly associated with vehicle wear) were below detectable limits for all sampling events. Sampling consistently found low levels of some metals (barium, iron, magnesium, potassium, and zinc) and chloride in all waterbodies. Levels of metals and chloride have been well below acceptable limits; they were elevated in the detention pond and lowest in Steep Creek (ADEC 2021). Turbidity has also been highest in the retention pond, but below limits in all sampling locations (Admiralty Environmental 2021, 2017, and 2015; ADEC 2020a).

In 2006, 2007, and 2012, water quality data was recorded along the Mendenhall River near Mendenhall Loop Road, just south of the MGRA. Dissolved organic and inorganic solids (carbon, total nitrogen, and phosphorus) were all low or below detectable limits, suggesting good conditions for aquatic life. However, water quality parameters were below ideal conditions for aquatic life for conductivity and temperature, and turbidity was relatively high for aquatic life (EPA 2011; ADEC 2008). Additionally, as discussed above, ponds in the Dredge Lakes Unit have been documented to have levels of dissolved oxygen below ADEC water quality standards.

3.8.4.7 Floodplains and Flood Events

The Mendenhall River is the only waterbody in the MGRA that has been mapped for flooding risk by the Federal Emergency Management Agency (FEMA). As mapped by FEMA, the 1-percent annual exceedance probability (AEP) base flood elevation, also known as a 100-year flood, for the river ranges from 57 to 63 feet in the project area (FEMA Flood Maps 02110C1237D and 02110C1239E; FEMA 2013). However, the FEMA 1-percent AEP base flood elevation does not consider the impacts of the recurring glacial lake outburst events.

Since 2011, the MGRA and surrounding areas have experienced regular, periodic flooding due to glacial lake outburst floods, also known as jökulhlaups. The glacial lake outburst floods are

⁷ The control site and the beaver pond hydrologically connected to the commercial overflow parking lot are in two different drainages. The control site is along Steep Creek which outlets in Mendenhall Lake and beaver pond outlets to Dredge Creek.

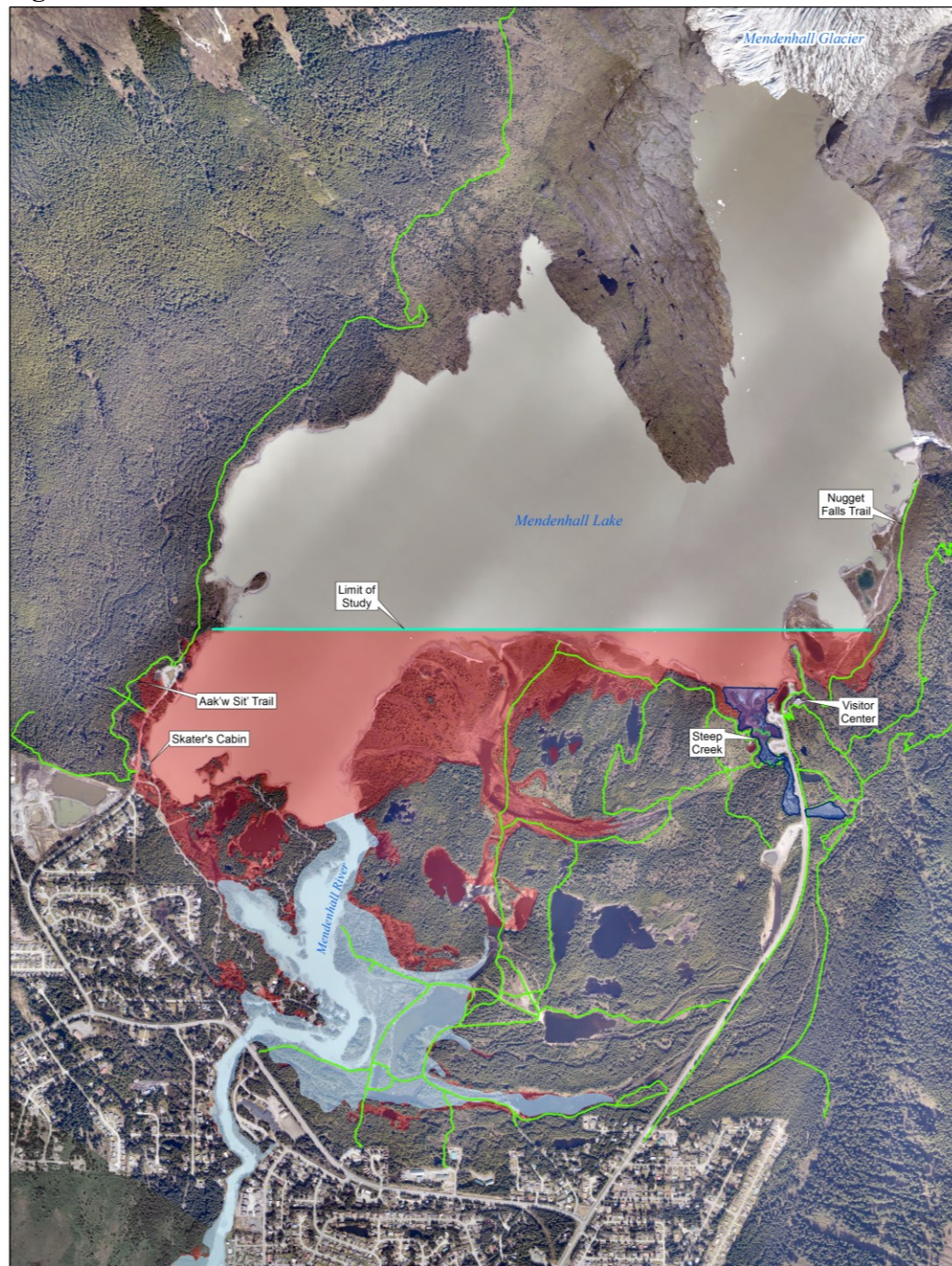
caused by the sudden failure of an ice dam holding a glacial lake, Suicide Basin, located upstream along Mendenhall Glacier. When the ice dam gives way, large volumes of water and ice rapidly flow across Mendenhall Glacier and into Mendenhall Lake. These outbursts cause a sudden increase in the elevation of Mendenhall Lake and increase flows in the Mendenhall River. The rapid rise of lake level and river flow causes flooding in the vicinity of these waterbodies. Glacial lake outburst floods have been occurring at least once, and sometimes twice, a year since 2011 (AWR Engineering, LLC [AWR] 2021).

Glacial lake outburst flooding has closed roads and trails, inundated homes, and eroded streambanks along Mendenhall River downriver from the MGRA. Over the past decade, residents living along Mendenhall River have been under periodic flood warnings, prepared to evacuate promptly in the event of a sudden flash flood. Peak Mendenhall River flows from glacial lake flood events in 2014 and 2016 exceeded a 2-percent AEP, or 50-year flood magnitude, as designated by FEMA (Kienholz 2021). Glacial lake outburst floods have not coincided with heavy rain events common in the Juneau area. Based on analysis of the glacier and area topography, glacial lake outbursts and larger flood events are expected continue for 10 to 20 years (Kienholz 2021). In that timeframe, Mendenhall Glacier is expected to retreat such that ice coverage would be too thin to form a substantial ice dam at Suicide Basin.

As a supplement to the current FEMA mapping, a multi-agency team focused on evaluating risks from flooding and other natural disasters completed a glacial lake outburst flood inundation mapping project for the southern shoreline of Mendenhall Lake and along Mendenhall River in 2015 (Alaska Silver Jackets 2015). The combined data from FEMA and the Alaska Silver Jackets better visualizes the flooding extent along the southern shoreline and Mendenhall River (Figure 3-12). Additionally, AWR modelled an event combining a 1-percent AEP event and a glacial lake outburst flood occurring at the same time for a conservative approach to analysis of lake and river elevations for this project. According to the modeled scenarios, maximum lake water surface elevation during a combined flood event could range from 66 to 68 feet (AWR 2021a). The project mapped area inundation for various flood stages and is the basis for much of the flood impacts discussed in this analysis.

According to FEMA's Flood Map Service Center, Steep Creek lies within an area of minimal flood hazard (Zone X; Flood Map 02110C1237D; FEMA 2013), and FEMA has not mapped a 1-percent AEP base flood elevation for Steep Creek. The Steep Creek base 1-percent AEP floodplain was modeled and defined as part of the hydrologic study undertaken in conjunction with the proposed project (AWR 2021). In general, Steep Creek's floodplain upstream of Glacier Spur Road is bounded by a trail embankment to the north, a natural ridge to the south, and Glacier Spur Road to the west. Downstream of Glacier Spur Road, the floodplain is bounded by a natural rise on the west and Glacier Spur Road to the east. Flooding occurs seasonally during the spring melt and when autumn rains increase surface runoff input into the creek (AWR 2021). Where Steep Creek flows into Mendenhall Lake, Steep Creek has experienced notable flooding during glacial lake outburst flood events (Figure 3-12).

Figure 3-12. MGRA Flood Inundation Areas



Legend

- Alaska Silver Jackets 1-Percent Annual Exceedance Probability (AEP) Flood Inundation Area
- Modeled Steep Creek 1-Percent AEP Flood Inundation Area
- FEMA 1- Percent AEP Flood Inundation Area
- Limit Of Study
- Existing Trail



3.8.5 Analysis Methods

3.8.5.1 Effects Analysis and Significance Criteria

The Forest Plan outlines specific standards and guidelines for project activities in riparian areas, wetlands, and streams (USDA Forest Service 2016: 4-48 to 52, 4-61 to 64, 4-84). This analysis uses a set of indicators to characterize key issues identified in Chapter 1 (see Section 1.5.1, Issue 3). Certain components of the proposed action and alternatives may have a beneficial effect on a resource. Units of measure and levels of effect to resource indicators are listed in Table 3-28 below.

Table 3-28. Indicator Units of Measure and Level of Effect for Issue 3: Watersheds, Wetlands, and Aquatic Habitat

Indicator ^a	Negligible	Minor	Moderate	Major
Wetlands	No measurable impacts to wetlands, including alterations to the continuity and integrity of wetlands.	Measurable disturbances (in acres) that are localized and would not impact the overall condition of area wetlands (size, continuity, or integrity) or the natural processes facilitated by those habitats.	Measurable disturbances (in acres) and permanent loss of wetlands that would not impact the overall condition of area wetlands (size, continuity, or integrity), but that have the potential to impact natural processes and connectivity on a local scale.	Measurable disturbances (in acres) and permanent loss of wetlands that may affect the overall condition of wetlands (size, continuity or integrity) and the natural processes facilitated by those habitats on an area-wide scale.
Riparian Management Areas (RMAs)	No measurable impacts to RMAs for Class I, II, or III streams. No impacts adjacent to Mendenhall Lake.	Total acres of RMAs impacted is less than 5% of area of existing RMAs impacted. The localized condition of watershed processes would not be affected.	Total acres of RMAs impacted is greater than 5% but less than 25% of area of existing RMAs. The localized condition of watershed processes could be affected, but the overall condition would not change.	Total acres of RMAs impacted is greater than 25% of area of existing RMAs are impacted. Overall condition of watershed processes would be affected.
Water Quality	No increase in impervious surfaces located within 100 feet of water resources, and no estimated increase in runoff potential. Boats are non-motorized or electric only.	Minimal to minor increase in impervious surfaces located within 100 feet of water resources, an increase of less than 5% of the total MGRA area. Non-electric motorized boat operations authorized.	Moderate increase in hardened surfaces located within 100 feet of water resources, an increase of more than 5% and less than 10% of the total MGRA area. Non-electric motorized boat operations authorized.	Major increase in hardened surfaces located within 100 feet of water resources, an increase of more than 10% of the total MGRA area. Increased proposed boat operations and fueling frequency; maximum speed limits not enforced.

^a Indicators associated with EFH, stream and surface water crossings, and major flood events are compared qualitatively or among alternatives and are not assigned “negligible” through “major” classifications as part of analysis.

3.8.6 Direct and Indirect Effects

3.8.6.1 Alternative 1 – No Action

Wetlands and Waterbodies

Under the No Action Alternative, there would be no impacts from construction or facilities in or near wetlands. There would be ongoing disturbance in wetlands from users stepping off established trails and creating new social trails as visitation increases over time across all areas of the MGRA. Sensitive wetland types (non-forested wetlands on organic soils, particularly near the shoreline of Mendenhall Lake) would be the most susceptible to trampling. The Dredge Lakes Unit in particular would be likely to have increased wetlands damage as mountain bikers continue to create areas of wandering tread riding around obstacles or muddy areas on the more primitive, user-created singletrack trails (ECI 2021). The unit will continue to experience flooding, with certain trail segments under water at times. When trails are inundated, loose soils from unpacked tread may cause increased wetlands sedimentation and reduced wetlands volume over time. However, these impacts would likely be minor in scale and localized around particular trail routes. The No Action Alternative would have a **minor effect** on wetlands and waterbodies.

Essential Fish Habitat

Under the No Action Alternative, Mendenhall Lake and River would continue to provide quality habitat for several fish species. The condition of Steep Creek would continue to degrade as the undersized culverts further exacerbate the scouring and straightening of the stream section downstream of Glacier Spur Road, leading to a decline in available spawning gravels and spawning habitat. As addressed above, limited spawning habitat within Steep Creek from reduced gravel counts and perched culverts would persist and conditions could potentially worsen over time. However, the lack of adequate culvert crossings for Steep Creek at Glacier Spur Road would be addressed by the Forest Service independently of this action in order to meet Forest Plan guidelines.

Most of the MGRA was covered under ice a little more than a century ago, and as a result, the aquatic environment is rapidly changing. It is possible that more aquatic habitat would be created in the future as a result of natural processes (ABR 2021). However, as Mendenhall Lake continues to receive glacial sediment deposits, its depth could start to decrease. Rising land caused by isostatic rebound could increase channel gradients where fish access rearing ponds or wetland areas and make certain routes impassible.

Riparian Management Areas and Stream Crossings

Under this alternative, current recreational activity within RMAs and streams would continue, including visitors stepping or riding off trails. Impacts from sedimentation would persist or worsen particularly near user-created trails as surfaces become worn and tread loosens. There would be no new facilities built in or near RMAs or over streams, and therefore the No Action Alternative would have a **negligible effect** on RMAs and stream crossings.

Water Quality

Overall water quality in the MGRA is likely to remain high with the No Action Alternative. However, in waterbodies directly adjacent to main traffic routes in the MGRA, a gradual degradation may occur due to the increase in traffic that is expected over time. Although contamination is managed by stormwater protection measures in BMPs, projected increases in visitation may exceed BMP effectiveness with current facility conditions. In the case of declining

effectiveness, the Forest Service would work to reconfigure existing BMPs in order to maintain water quality standards. The No Action Alternative would have a **negligible effect** on water quality.

Flood Events and Floodplains

Under the No Action Alternative, some existing visitor facilities in the MGRA would continue to be affected by glacial lake outburst flood events. Based on past flood events and recent inundation modeling, prominent features likely to experience flooding could cause periodic trail closures and possible damage at the existing Nugget Falls Trail, Mendenhall Campground, and trails in the Dredge Lakes Unit (AWR 2021). There could also be flooding along Skater's Cabin Road and in the West Glacier Trailhead parking lot. Inundation of existing facilities from glacier outburst flooding is anticipated to continue impacting the MGRA for the next 10 to 20 years, with larger flows possible in the near future.

3.8.6.2 Direct and Indirect Effects Common to All Action Alternatives

All action alternatives would temporarily impact wetlands, streams, and riparian areas during construction activities. These impacts would be minimized through sediment and erosion controls using applicable BMPs (see Chapter 2, Section 2.4). Temporary impacts to EFH and fish from pile driving and dredging or discharging of fill in aquatic environments are likely, but would be minimized through use of stream diversions and timing windows, as appropriate. Ground disturbing activities would be avoided along the lakeshore from April 1 to May 31 due to the outmigration of salmon fry. Instream work in Steep Creek would be conducted from June 1 through July 15, which is the period between out migration of salmon fry and return of adult Sockeye Salmon.

All new facilities crossing fish-bearing waterbodies would be designed to meet fish passage standards per FSH 2090.21 (Aquatic Habitat Management Handbook). Refer to Chapter 2, Section 2.4.2 and the EFH Assessment (Solstice 2022) for mitigation measures for wetlands and aquatic habitat.

The following project components are similar or identical in size and placement in all action alternatives and would have the comparable impacts to water resources across all action alternatives:

- Welcome Center Complex
- Nugget Falls Trail Expansion
- Glacier Spur Road Trailheads
- Steep Creek Habitat Restoration
- Public Use Cabins
- Forest Orders
- Interpretive Plan Elements

Welcome Center Complex

The Welcome Center Complex, including the plaza area and the Welcome Center building, would permanently impact approximately 13,200 square feet (sq ft) of wetlands (PEM1/SS1E and PUBH). A curved elevated bridge would cross over Kettle Pond next to the Visitor Center,

and a portion of the bridge abutments and some piles would be placed in the riparian areas. Kettle Pond, which is directly connected to Mendenhall Lake and provides rearing habitat for Coho Salmon and Dolly Varden, would be avoided. The complex would impact high value wetlands and alter waters that support aquatic habitat. The complex would also increase impervious surfaces adjacent to the Visitor Center near Mendenhall Lake, Steep Creek, and Kettle Pond from 9,000 sq ft to about 23,000 sq ft, which could alter water quality by increasing sedimentation and runoff into nearby surface waters, potentially impacting fish and aquatic habitat by increasing water turbidity and clogging fish gills.

The Welcome Center building and the associated plaza would not adversely impact the flow of flood waters. The design elevation for the Welcome Center was determined through a flood flow analysis considering a glacial lake outburst flood and heavy rainfall event (AWR 2021a). The Welcome Center floor elevation would be above expected flood levels for a combined event, protecting the building from potential flooding damage and preventing impediment of flood waters.

Nugget Falls Trail Expansion

The expansion of Nugget Falls Trail would permanently impact approximately 2,800 sq ft of wetlands. Most of the trail alignment is within uplands areas, but the trail would cross over one small Class I stream tributary to Mendenhall Lake and two open lake channels (L2USC2C). The trail would be designed to accommodate normal flood flow and to withstand possible inundation during high lake level events. Drainage culverts placed throughout at-grade portions of trail would allow for the movement of flood waters.

Glacier Spur Road Trailheads

The three trailheads proposed along Glacier Spur Road would permanently impact approximately 24,000 sq ft of mostly PFO4B and a very small section of PEM2E wetlands. These saturated forested wetlands are connected to the larger network of wetlands, streams, and small lakes in the Dredge Lakes Unit that support anadromous fish. All three trailheads would be constructed outside of the 1-percent AEP floodplain of Steep Creek and Mendenhall River and potential areas of inundation from glacial outburst flooding.

Steep Creek Habitat Restoration

As mitigation for impacts to aquatic habitat and EFH, in-stream restoration activities at Steep Creek would cause temporary disturbance to existing aquatic habitat and RMAs through channel realignment and culvert replacements, but are designed to improve long term stream conditions after construction. The project (including the culvert replacement) would alter 1,350 linear feet of a Class I stream and adjacent riparian areas (Table 3-29). Other improvements made to waterbodies adjacent to Steep Creek would increase the availability of rearing habitat in the stream network, including replacing the perched culverts under Glacier Spur Road with a vehicle bridge, and culvert replacement at the Pond of Time.

Table 3-29. Aquatic Impacts – Steep Creek Habitat Restoration

Impact type	Stream length (linear feet)	RMA (acres)
Temporary (construction only)	1,500	4.1
Permanent	1,350	0.6

The proposed habitat restoration would result in a short-term effect to EFH and EFH-managed species by temporarily rerouting water flows in the project area and altering hydrologic conditions and flows during construction. These changes could introduce short-term nonpoint source pollution via an influx of sediment and nutrients. Habitat restoration could also temporarily disrupt feeding opportunities, disturb or remove native species, and disturb habitat. BMPs such as fish timing windows for construction and erosion control methods would be incorporated into construction plans to reduce potential for increased sediment and altered habitat conditions.

Ultimately Steep Creek restoration and enhancement would contribute to restored habitat conditions, hydraulic flow, and increased connectivity with local ponds and is likely to lead to more available high quality spawning and rearing habitat for salmonids. The improved habitat could be expected to increase returns of local fish stocks in the future. Although the habitat restoration is very likely to improve EFH habitat in Steep Creek itself, successful execution of a connection of the main channel with disconnected or seasonally-connected ponds is dependent on morphology of the constructed connection and depth (Roni et al. 2014). Additional connections to rearing ponds would not be a guarantee of increased habitat availability, particularly when considered with minor ground slope changes stemming from ongoing isostatic rebound.

Improving fish passage under Glacier Spur Road with a vehicular bridge would enhance flood conveyance of the creek. The area inundated by the 1-percent AEP flood would be expected to decrease approximately 18 percent as a result (AWR 2021). The vehicle bridge and realignment would both decrease and shift the location of the area of inundation expected for a 1-percent AEP flood event (Figure 3-13).

To mitigate for impacts to aquatic habitats under all build alternatives, a connection between Steep Creek and Backside Pond would be constructed, and the pond would be enlarged to provide 1,200 sq ft of additional rearing and overwintering habitat.

Public Use Cabins

The Public Use Cabins would permanently impact approximately 3,300 sq ft of PFO4B wetlands in the campground area. The cabins would not directly impact any streams or fish habitat but, depending on final placement, Cabins B, C, D, and E would be within 200 feet of Mendenhall Lake or Mendenhall River, and may be placed within the lake's RMA. Vegetation clearing in the RMA would occur during construction, but the area of clearing would be minimal and localized, and these areas would be revegetated after construction completion.

As mapped by FEMA, the proposed location for the cabins would be outside the 1-percent AEP flood zone for the Mendenhall River. Cabins B and D would be within the glacial lake outburst flood zone and designed appropriately to withstand mapped flood inundation during a glacial lake outburst event. Storm water runoff from these sites may increase sediment in nearby receiving waters, especially from loosened disturbed soils that would persist after construction prior to revegetation of the area without altering long-term local water quality.

Essential Fish Habitat

As required by Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act, NOAA Fisheries was consulted regarding potential effects to EFH resulting from the action alternatives. EFH and fish would be affected by construction activities occurring within aquatic environments under all action alternatives, such as pile driving, dredging, and

discharging, and by certain project components themselves, such as overwater structures and boat operations.

Pile driving within wetlands and waterbodies could be required for the following project components: Crescent Bridge, Photo Point Loop, Lakeshore Trail and Lakeshore Trail Bridge, two bridges along the Nugget Falls Trail expansion, the Steep Creek Boardwalk, and the Welcome Center Dock and West Glacier Dock. Noise from pile driving hammers could affect the distribution and behavior of juvenile salmon and other species of fish by causing them to change migration routes to avoid an area or leave an area entirely (Limpinsel et al. 2017).

Physical injury to salmon, such as fatal damage to swim bladders in small fish and compromised swim bladders in larger fish, would be possible from underwater sound. Some sedimentation and turbidity would be expected during pile driving from sediment displaced by the pile, potentially causing temporary disorientation, reduced feeding efficiency, and clogged fish gills (Limpinsel et al. 2017).

Dredging impacts EFH by removing or burying organisms, increasing turbidity, altering contaminant release and uptake, and altering the hydrodynamics and physical habitat of the aquatic environment (Limpinsel et al. 2017). Dredging would also temporarily increase turbidity, blocking sunlight, diminishing visibility, and affecting feeding behaviors of resident and anadromous fish. Increased turbidity and elevated noise levels would temporarily displace and injure fish and degrade EFH. Turbidity could also hinder feeding efficiency by clogging or damaging fish gills from suspended solids (Limpinsel et al. 2017). Riprap fill may also be required to support the Welcome Center and West Glacier Docks, which could have negative impacts on salmonids in Mendenhall Lake. Riprap is particularly harmful to juvenile fish as they tend to travel along near-shore environments, and solid fill along the shoreline forces them out into deeper water and exposes them to increased levels of predation.

Most project components would involve discharged fill into wetlands. Discharge of fill in either wetlands or waterbodies in the project area would cause increased sedimentation in streams or ponds and temporary changes in stream flow patterns. Any increased sedimentation in EFH could potentially cause temporary disorientation, reduced feeding efficiency, and clogged fish gills. Loss of wetlands and riparian habitat would have the potential to impact EFH by: reducing the production of detritus and wetlands vegetation, a food source for fish, invertebrates, and waterfowl; altering the movement of nutrients to and from adjacent aquatic and terrestrial systems; increasing turbidity and sedimentation; altering flood control, groundwater recharge, and other hydrological dynamics; reducing pollutant filtration and absorption from uplands; and altering atmospheric functions, such as nitrogen and oxygen cycles (Limpinsel et al. 2017).

The proposed Welcome Center Dock, West Glacier Dock, the north and south options for the Remote Glacier Dock, Steep Creek Boardwalk, Lakeshore Trail Bridge, Crescent Bridge, Nugget Falls Trail, Photo Point Loop, and various smaller bridges, drainage culverts, and overlooks would include structures over EFH. Depending on their height, overwater structures could cause changes to ambient light conditions, limiting the distributions of plants, invertebrates, and fish or reduce complexity of the habitat below the structures (Limpinsel et al. 2017).

Additional EFH could emerge within the project area over the use life of the project as the glacier recedes. For example, the Class III glacier meltwater stream near the proposed Remote Glacier Visitor Area does not currently support fish but could provide suitable salmon habitat in

the future. Changing conditions would need to be considered as the Remote Glacier Visitor Area and associated trail are moved in response to glacial recession.

Vessel traffic and recreation on the lake (motorized and non-motorized) would potentially disturb or displace managed EFH species by increased risk of contamination and altering the immediate wave regimens. Given imposed limits on vessels noise and speed, underwater noise generation from boats would not be expected to disturb EFH or fish.

Alternatives 3 and 4 would have fewer impacts overall on EFH than Alternative 2. Fill in Zig Zag Pond would be limited to 2,500 sq ft for the proposed parking lot development for both Alternatives 3 and 4. Alternative 3's Welcome Center Dock configuration would greatly reduce dredging in Mendenhall Lake, and vessel traffic would be reduced, with smaller electric-powered vessels operating fewer trips per day. Alternative 4 would further reduce impacts to EFH, with no docks or motorized boats proposed on the lake, and fewer overwater structures.

The Forest Service has determined that the Mendenhall Glacier Visitor Facility Improvements Project may cause permanent and adverse effects to EFH. Adverse effects would be minimized through BMPs and proposed conservation measure implementation and/or compensated appropriately during the permitting process. Mitigation for any in-water and wetlands fill would involve concurrence with ADF&G and the Corps.

Forest Orders

Management of the MGRA would undergo changes via new rules (Forest Orders) that would delineate areas where visitors could consume food, smoke, walk leashed dogs, and use non-motorized wheeled devices (e.g., bicycles, scooters, roller skates). Implementation of Forest Orders would prevent damage to wetlands and riparian areas from off-leash dogs.

Interpretive Plan Elements

Facilities proposed in the new interpretive plan (signage, benches, covered shelters, and discovery 'nodes', etc.; AldrichPears Associates 2022) would be placed outside of wetlands, streams, and riparian areas.

3.8.6.3 Alternative 2 – Proposed Action

Alternative 2 proposes the highest level of impacts to aquatic resources of the three action alternatives. Table 3-30 gives a summary of the estimated wetlands and RMA impacts, new impervious surface area, and stream crossings from all components of this alternative.

Table 3-30. Summary of Impacts to Aquatic Resources – Alternative 2

Impact type	Total Crossings	Area (acres)	Percentage of Study Area
Wetlands	N/A	15.7	1.5
RMAs	N/A	12	0.02
Water crossings	46	N/A	N/A
New impervious surface area	N/A	8.96	0.15

Wetlands and Waterbodies

A majority of Alternative 2's components would impact wetlands to some extent (Table 3-31). The expanded parking area would fill a palustrine wetland area completely (Zig Zag Pond; approximately 20,000 sq ft of PUBH) near the Visitor Center. Although there are several other similar ponds near the Visitor Center, Zig Zag Pond is seasonally-connected to Steep Creek and provides rearing habitat for fish. Including Zig Zag Pond, the parking area and the Welcome Center Complex together would permanently impact around 33,000 sq ft (0.77 acre) of a network of palustrine and lacustrine wetlands near Mendenhall Lake and the mouth of Steep Creek.

Wetlands impacts from proposed trails would total an estimated 12.8 acres. Under this alternative, the portion of the Lakeshore Trail in front of the Welcome Center would mostly be constructed within uplands with minimal wetlands impacts, but the trail would cross over the mouth of Steep Creek and involve piles and bridge abutments in wetlands. The entire trail length would impact around 2.86 acres (124,000 sq ft) of palustrine, riverine, and lacustrine wetlands, from the mouth of Steep Creek through to the campground and West Glacier Trailhead parking area. Associated campground changes, such as the new day-use parking area, would also impact wetlands (9,000 sq ft; 0.21 acre). In addition, Lakeshore Trail would increase access to sensitive areas and involve visitors stepping off the trail (including the gravel spur trails) in new places, potentially leading to new user-created trails and exacerbating ongoing wetlands impacts.

During construction of the Steep Creek Trail Expansion, there would be temporary impacts to around 16,000 sq ft (0.37 acre) of mostly PFO4B wetlands. However, permanent impacts to wetlands from boardwalk pilings would be less than 2,000 sq ft.

The Dredge Lakes Outer Loop would permanently impact around 6.6 acres of wetlands. Additionally, improving and formalizing user-created trails within the Dredge Lakes Unit would have local and temporary impacts to wetlands during construction and maintenance and upgrades. In the long term, formalizing these trails could help to retain wetland integrity since properly-maintained trails would decrease incidences of users diverting around areas of disrepair or poor drainage and into adjacent wetlands.

The three proposed dock facilities would permanently disturb a total of 28,800 sq ft (0.66 acre) of mostly lacustrine wetlands. Excavation of the shoreline required to create the Welcome Center Dock basin would impact 22,500 sq ft (0.52 acre) of wetlands near the mouth of Steep Creek. Dredging within the lake to remove approximately 20,300 cubic yards of material would also be required at this location to reach appropriate depths for boat operations. The West Glacier Dock would impact approximately 6,300 sq ft (0.14 acre) of wetlands to construct the launch ramp and access road. Support pilings and fill (likely riprap) would be required in the water at the Welcome Center and West Glacier Docks to support installed structures. Additionally, maintaining the required depth for boat operations at the Welcome Center Dock would require ongoing, periodic dredging that would temporarily impact wetlands in the area.

There would be a total of approximately 15.7 acres of permanent disturbance (cut or fill) in wetlands and waters from implementation of Alternative 2, representing 1.5 percent of the 1,039 acres of wetlands identified in the MGRA study area (Table 3-31). Any additional wetlands or waters temporarily affected by construction would be restored and/or revegetated after completion of work. There could be additional impacts to wetlands from invasive species introduced or spread during construction or from visitors walking off of established trails (see Section 3.6.6.3).

Although effects from this alternative could potentially be both deleterious (filling of Zig Zag Pond) and beneficial (restoration of important fish habitat within Steep Creek, connection to and enlargement of Backside Pond), this alternative would have a **moderate effect** on wetlands and waterbodies.

Table 3-31. Area of Wetlands and Waters Impacts by Type, Square Feet (Acres) – Alternative 2^a

Project Component	Rivers	Ponds	Emergent	Scrub-Shrub	Forested	Lake	Total^b sq ft (acres)
Parking and Access Expansion	0	20,000	320	0	40	0	20,360 (0.47)
Welcome Center Complex	0	2,200	0	11,000	0	0	13,200 (0.30)
Visitor Center Improvements	0	0	0	0	0	0	0
Glacier Spur Road Trailheads	0	0	2,000	0	22,000	0	24,000 (0.55)
Lakeshore Trail	170	0	60	54,100	53,000	17,200	124,530 (2.86)
Campground Day Use Area	0	0	0	0	9,000	0	9,000 (0.21)
Dredge Lakes Outer Loop	920	4,000	2,000	62,600	201,400	17,300	288,220 (6.60)
Public Use Cabins	0	0	0	0	3,300	0	3,300 (0.08)
Nugget Falls Trail Expansion	530	0	0	0	0	2,300	2,830 (0.06)
Steep Creek Habitat Restoration	0 ^c	0	0	3,500	25,000	0	28,500 (0.65)
Steep Creek Trail Expansion	700	50	0	750	0	0	1,500 (0.03)
Dredge Lakes Multi-Use Trails	0	0	1,500	1,500	24,000	0	27,000 (0.62)
Welcome Center Dock	4,500	0	0	9,000	0	9,000	22,500 (0.52)
West Glacier Dock	0	0	0	4,800	0	1,500	6,300 (0.14)
Remote Glacier Dock	0	0	0	0	0	0	0
Remote Glacier Visitor Area	50	50	0	0	0	0	100 (0.002)
West Glacier Unit Trails	3,500	2,000	0	500	107,000	0	113,000 (2.59)
Total^b sq ft (acres)	10,370 (0.24)	28,300 (0.65)	5,880 (0.13)	147,750 (3.39)	444,740 (10.21)	47,300 (1.09)	684,340 (15.7)

^a Source: ABR 2021a: wetlands types included in categories: Rivers (R2UBH, R3UBH, R2USC); Ponds (PUBH, PUBHb); Emergent (PEM1F, PEM2E, PEM1E); Scrub-Shrub (PEM1/SS1E, PSS1E, PSS1C, PSS1B); Forested (PFO4B); Lake (L1UBH, L2USC2C).

^b Totals may not add up because of independent rounding

^c Steep Creek impacts to the river wetlands type are essentially null since the creek is being relocated, not removed

Riparian Management Areas

Direct impacts to riparian areas would be localized, except for in the case of the Steep Creek Habitat Restoration (discussed above) and Lakeshore Trail. Placement of the trail along the shoreline of Mendenhall Lake would permanently impact about 4.0 acres of the RMA of Mendenhall Lake, ponds, and Class I streams (Table 3-32). The lake's RMA would be temporarily impacted through vegetation removal during construction and vegetation trampling from increased visitation in these areas. There could be additional impacts to riparian areas from invasive species introduced or spread during construction or from visitors walking off of established trails (see Section 3.6.6.3). Additionally, operation of motorized boats near the shoreline could cause increased wave action and damage high value shoreline habitat. Total acres of permanent impacts (clearing, facilities) within RMAs from this alternative would equal around 12 acres, equating to 2.2 percent of total acreage of riparian areas in the MGRA for all classes (550 acres), with additional temporary impacts to RMAs expected during construction. Alternative 2 would have a **minor effect** on riparian areas in the project area.

Table 3-32. RMA Impacts by Stream Class and Total Number of Water Crossings – Alternative 2

Type of Waterbody	Acres	Percentage of Existing	Total Crossings
Stream Class I & II	4.9	1.7	19
Stream Class III & IV	0.1	0.1	15
Mendenhall Lake/Other Lakes and Ponds	7.0	4.5	12
Total	12.0	2.2	46

Stream/Water Crossings

Alternative 2 proposes construction of several new stream and water crossings and maintenance and/or upgrades of some existing crossings as part of the following components: Lakeshore Trail, Dredge Lakes Outer Loop, Steep Creek Habitat Restoration, expansions of Steep Creek Trail and Nugget Falls Loop, Dredge Lakes Multi-Use Trails, West Glacier Spur Trail, West Glacier Multi-Use Trails, and the Remote Glacier Visitor Area. Data used to calculate the number of stream or water crossings was compiled using all existing and available information from Forest Service and ADF&G databases and surveys, and from the wetlands report for the project (USDA Forest Service 2021d; ADF&G 2021b; Dean 2021; ABR 2021a). However, there could be additional crossings from undocumented streams or drainages in the area. There would be 19 new stream crossings under this alternative over Class I or II streams and 15 new stream crossings over Class III or IV streams, largely from small drainages on Mount McGinnis crossed by the West Glacier Spur Trail. There would also be 12 crossings introduced over existing ponds or sections of Mendenhall Lake (Table 3-32). The crossings could be culverts, bridges, or parts of elevated trails, depending on the area and characteristics of the water being crossed.

Potential impacts from additional water crossings include increased sediment deposit during construction, destabilization of stream banks, increased maintenance needs, and potential for future failure of culverts or bridges. Culverts have an additional impact related to wildlife activity; beavers are attracted to the noise of running water through a culvert and will instinctively build a dam (Nolte et al. 2005). Beaver dams can plug culverts and lead to ponding, flooding, or trail and road washout. Due to the high level of beaver activity in the MGRA, it is

likely that the additional water crossings proposed will necessitate ongoing maintenance operations to clear the culverts, or beaver-deterrent activities to keep culvert damming to a minimum. A maintenance plan would be developed to control beaver activity in the area.

Water Quality

Increasing impervious surfaces can cause higher volume storm water runoff and increased sediment and pollutants in storm water, which can reduce nearby water quality. Increased impervious surfaces could exacerbate impacts from vegetation clearing within riparian areas, as discussed above. Water quality of sensitive streams may be impacted by as little as 5 to 10 percent impervious surface area when measured as a percent of total land area in the watershed (Paul and Meyer 2001, Schueler 2003).

The combined area of the new parking area, paving two-thirds of the commercial parking lot and Welcome Center Plaza under Alternative 2 would install approximately 5.2 acres of impervious surfaces near several Class I streams and waterbodies. This area accounts for 0.09 percent of the total area of the MGRA and about 0.03 percent of the total Mendenhall River watershed area. Proposed increases in visitation would bring additional vehicle traffic to the parking area and along Glacier Spur Road.

While the parking area and plaza area would represent a larger expanse of paved surfaces near important waterbodies, the stormwater management system for the plaza and parking area, including vegetated swales, bioretention areas, and oil-grit separators, would be designed to achieve an 80% reduction in average annual TSS prior to discharge. A water quality monitoring program would be developed with ADEC to ensure that installed stormwater runoff control structures are working effectively and that water quality in Steep Creek is not impacted.

The commercial parking lot south of the main parking area would continue to serve as an idling or overflow location for waiting motorcoaches and a third of the surface would remain permeable to stormwater runoff. During the winter, the existing snow storage area would continue to serve as snow storage for the CBJ and remain unpaved; water quality testing at this location indicates there have not been significant impacts to water quality downstream of the parking lot, and these conditions would be expected to continue under this alternative. Proposed increases in visitation would also bring additional vehicle traffic to the West Glacier Unit and along Skater's Cabin Road, potentially increasing the burden on existing drainages.

Other projects under Alternative 2 would add additional impervious surfaces within the watershed. The Lakeshore Trail, Lakeshore Trail Bridge, and new campground parking area would add around 2.9 acres of impervious surface area near wetlands and fish-bearing streams. To the extent feasible, existing vegetated buffers would be maintained to protect wetland and water quality and reduce impacts from sediment or contaminant runoff of impervious surfaces.

Neither Steep Creek Trail improvements nor the Remote Glacier Visitor Area are anticipated to increase total impervious surface area in the MGRA. Although situated directly adjacent to an important Class I stream, Steep Creek Trail's boardwalk surface would be constructed with galvanized grating or fiberglass-reinforced plastic decking. The Remote Glacier Visitor Area and associated trail construction would add a minimal amount of impervious surface area (0.06 acres).

The Boat Dock Trail would add an additional 0.8 acres of impervious surface area. The three dock structures and associated facilities would add a small area of impervious surfaces, mostly

from increased concrete for parking, boat turn-arounds, and West Glacier boat launch and equipment storage. The dock structures themselves would be composed of timber decking, open steel grating, or composite traction plates and would not create additional impervious surfaces.

The total acreage of additional impervious surfaces from all components under Alternative 2 would be approximately 8.96 acres, or 0.15 percent of the MGRA's 5,800 acres and 0.05 percent of the total Mendenhall River watershed.

Motorized boat operations under this alternative could also contribute to diminished water quality in Mendenhall Lake and Mendenhall River. Motorized boat activity, depending on engine, horsepower, and depth of water, can stir up sediment on the lake bottom and increase turbidity of the water. Further, nearshore wakes could erode the lakeshore leading to increased lake sedimentation. Turbidity impacts would likely be low since boat speeds would be regulated near the shoreline, particularly near sensitive bird nesting areas. Boats may emit some of their unburned fuel into the water; however, tour boats would be required to operate with alternative fuels under Alternative 2 to keep water quality impacts to a minimum.

Boats powered by biodiesel blends, ethanol blends, natural gas, propane, or electricity all have advantages over traditional gasoline- or diesel-powered vehicles as clean-burning, renewable fuels that cause far less damage to the environment if inadvertently spilled or otherwise released. Boats would refuel at the West Glacier Dock, but on-site fuel storage would not be allowed. However, the proposed boat operations could pose a risk of discharging contaminants during fueling, maintenance, or operations. Impacts to water quality from project operations would be minimized by implementing BMPs such as requirements for response materials to be on site during any fueling or maintenance procedures as listed in the EFH Assessment (Solstice 2022).

The seasonal, portable restroom facilities on land for both location options for the Remote Glacier Dock also present a potential risk to water quality. The facilities would require periodic sewage pumping, with a frequency to be determined based on level of use, and would be removed seasonally. Risks include spill or leaking of sewage or fuel during regular operations or during removal, maintenance, or pumping activities. Facilities would be maintained in accordance with Federal (CWA; 33 USC 1344), State (18 AAC 60), and local regulations (05 CBJ Administrative Code 45.005), and direction given by Forest Service policy (FSM 2330; FSM 7430; FSH 7409.11, chapter 50) related to solid waste to reduce risks of contamination to water resources during operations and use.

Construction-related dredging and other in-water work for installation of boat docks and Lakeshore Trail Bridge and periodic maintenance dredging at the Welcome Center Dock would also increase lake turbidity and temporarily diminish water quality. Diesel-powered construction vessels are also likely to be used to support construction operations such as pile driving and dredging for installation of the Welcome Center and West Glacier Docks. Diesel-powered vessels would also be used to support certain maintenance activities such as seasonal placement and removal of dock floats and Remote Glacier Visitor Area facilities. These impacts would be localized and temporary and could include decreased dissolved oxygen concentration, changes in pH levels, release of contaminants such as fuel, or sunlight blocking. Water quality would be expected to return to normal as sediment settles, but the duration and range of impact would depend on many factors including extent and magnitude of dredging, construction methods, and timing. Work would be scheduled outside of critical fish life-cycle windows. Fish habitat impacts are discussed in more detail in the EFH Assessment (Solstice 2022).

Concrete supports for the Lakeshore Trail Bridge, Crescent Bridge, and Glacier Spur Road Bridge would be placed outside of MGRA waterbodies but could be placed within wetlands, riparian areas, and flood inundation areas. There could be temporary impacts to water quality during construction. Placement of these supports could cause erosion overtime, and given that their placement would be in close proximity to waterbodies, water quality could be affected.

Additionally, increased impervious surfaces near waterbodies could exacerbate impacts from vegetation clearing within riparian areas. Vegetation removal in riparian areas causes decreased root binding effects on soil, increasing erosion potential and flow velocities, particularly during periods of high flow such as glacial outburst flooding. Over time, impacts to RMAs may cause a reduction in suitable aquatic habitat. Riprap stabilization of the trail would afford some protection against erosion; however, this fill material would replace plant communities that naturally provide structural stabilization for banks and otherwise contribute to the aquatic habitat through shading, leaf fall, and nutrient inputs (National Resource Council 2002).

Increased visitor capacity would bring more vehicle and foot traffic into the MGRA, and the Mendenhall River Sub-watershed by association. Water quality could also be impacted by erosion and increased sedimentation in area waterbodies caused by more foot traffic on dirt trails or visitors venturing off of established trails. Similarly, increased mountain bike traffic on the multi-use trails in the West Glacier Unit and Dredge Lakes Unit could increase erosion and cause sedimentation in adjacent waterbodies.

Water quality could be impacted through increased impervious surface area, the addition of commercial motorized boats, additional stream and overwater crossings, and initial and periodic maintenance dredging on Mendenhall Lake. Through the use of BMPs and stormwater management for large impervious surface areas, as well as stringent controls on boat operations, Alternative 2 would have a **minor effect** on water quality within the MGRA.

Flood Events and Floodplains

Most project components in Alternative 2 would be developed outside of the 1-percent AEP area mapped by FEMA for the Mendenhall River (Figure 3-13). However, a 400-foot section of the Moose Lake Connector Trail would be located within FEMA's 1-percent AEP area. This section would be designed to comply with FEMA regulations and would require a flood hazard development permit from the CBJ and associated analysis to demonstrate that the trail would not cause a rise in the published base flood elevation. The trail is not expected to flood at moderate river flood stages corresponding to a lake level of 8 feet and a river flow of 7,850 cfs, but at higher flood stages, corresponding to a lake level of 12 feet and a river flow of 20,700 cfs, it may be inundated in some locations. The proposed trail is located in areas where river velocities are generally low, and significant scour from river flow is not expected (AWR 2021). The Lakeshore Trail Bridge abutments would be located outside the floodplain, and the bridge would be designed to meet the level of the 1-percent AEP flows with room for debris and sediment movement.

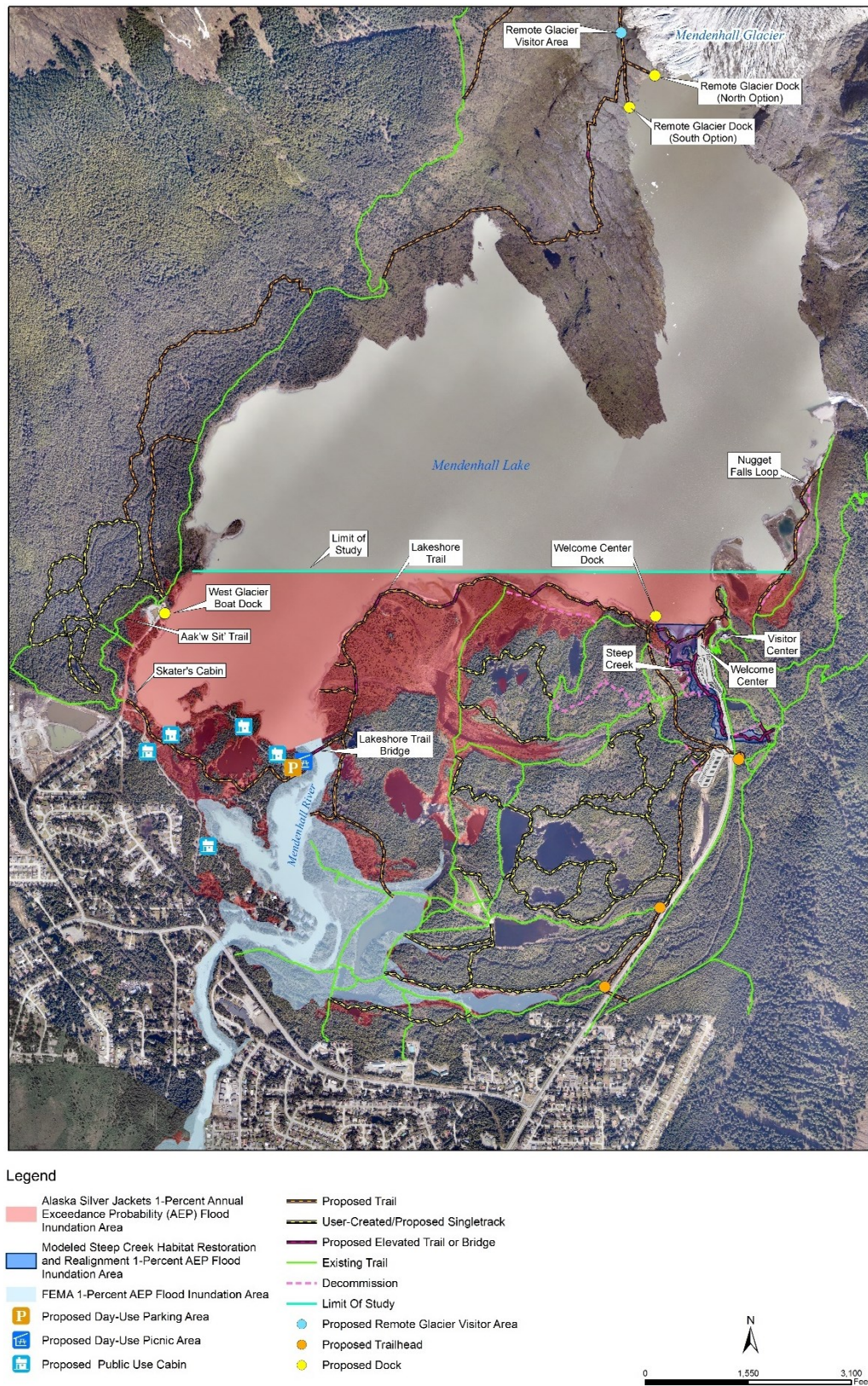
Although FEMA mapping within the MGRA is limited to the area around Mendenhall River, potential 1-percent AEP rain events and glacial lake outburst flood events were modeled for Steep Creek and other areas along the southern shore of Mendenhall Lake to determine impacts from other types of flooding that occur in the MGRA. The bridge over Steep Creek at Glacier Spur Road would be sized to accommodate 1-percent AEP flood flows. By replacing the culvert complex, the hydrologic capacity of the creek under the road would be increased. This would

result in a reduction in flooding as a result of the new bridge and no impact to flooding from the proposed pedestrian underpass, which would be constructed outside bankfull width of the creek. Most of Steep Creek Trail would be elevated on pilings to allow for water flow. The proposed trail is located in areas where creek velocities are generally low, and significant scour from creek flow is not expected (AWR 2021).

The expanded parking area would be located in the existing Steep Creek floodplain; however, because hydrologic capacity of the creek would be increased by the proposed bridge at Glacier Spur Road, the parking area is designed to be outside the modeled Steep Creek 1-percent AEP floodplain. The expanded parking area would not be expected to reduce the primary flow area for the main creek channel or the overall functionality of the creek floodplain and adverse impacts to existing development or adjacent properties are not expected (AWR 2021).

Modeling of the 1-percent AEP and glacial lake outburst flooding shows that the at-grade segments of the following trails may be temporarily inundated at certain times during the year: Photo Point Trail, Nugget Falls Trail, Lakeshore Trail, segments of the Dredge Lakes Outer Loop (most likely Moose Lake Connector), some Dredge Lake Multi-Use Trails, and lower elevation segments of the West Glacier Unit Multi-Use Trails. In total, approximately 16,000 linear feet (3 miles) of proposed trails would be susceptible to flooding from glacial lake outburst flooding or 1-percent AEP rain events. Based on previous flood events, the Lakeshore Trail may experience flooding an average of seven days a year from either glacial lake outburst or heavy rain events. Trails within flood areas would be either elevated on pilings or have culverts placed at appropriate intervals to maintain natural drainage patterns and allow for movement of flood flows. All trails would be designed with erosion control measures such as riprap armoring to withstand periodic flooding but some trail surface erosion could occur during high water events on unpaved trails. Placement of riprap along trail side slopes also has the potential to impact the aquatic environment through increased speed of water flow, downstream erosion, lost rocks during fast flows, interruption of riparian areas, or decreased habitat for fish. In addition to riprap reinforcement for trail side slope protection during high water events, riprap would also be used for shoreline stabilization for the Steep Creek vehicular bridge abutments, Lakeshore Trail Bridge abutments, Welcome Center Dock, and West Glacier Dock. Pile-supported docks (Welcome Center and West Glacier) would be designed to handle glacial lake outbursts flood events and to allow movement of floodwaters.

Figure 3-13. Alternative 2 Flood Inundation Areas



3.8.6.4 Alternative 3

Table 3-33 gives a summary of the estimated wetlands and RMA impacts, new impervious surface area, and stream crossings from all components of Alternative 3.

Table 3-33. Summary of Impacts to Aquatic Resources – Alternative 3

Impact type	Total Crossings	Area (acres)	Percentage of Study Area
Wetlands	N/A	13.8	1.3
RMAs	N/A	8.7	1.6
Water crossings	41	N/A	N/A
New impervious surface area	N/A	8.3	0.14

Wetlands and Waterbodies

There would be a total of approximately 13.8 acres of permanent disturbance (excavating, dredging, or filling) in wetlands and waters from implementation of Alternative 3, representing 1.3 percent of existing wetlands in the MGRA study area (Table 3-34). Rather than filling all of Zig Zag Pond as in Alternative 2, the expanded parking area would fill approximately 12 percent (2,500 sq ft) of the pond, resulting in fewer acres of rearing habitat impacted. The parking area and the Welcome Center Plaza, including fill placed within a portion of rearing habitat in Zig Zag Pond, would permanently impact around 16,000 sq ft of wetlands near Mendenhall Lake and the mouth of Steep Creek.

Under Alternative 3, trail expansions and additions would impact around 11.5 acres of wetlands, less than the 12.8 acres of wetlands impacts from trails proposed in Alternative 2. The two proposed dock facility variations proposed in Alternative 3 would result in permanent loss of 25,000 sq ft (0.58 acre) of mostly lacustrine wetlands. About 6,200 cubic yards of dredging within the lake would be required at the West Glacier Dock to accommodate boat operations. Maintaining the required depth for boat operations would require ongoing, periodic dredging that would temporarily impact wetlands in the area at both the Welcome Center Dock and West Glacier Dock.

In addition to these impacts, additional wetlands and waters would be temporarily impacted during construction, which would be restored and/or revegetated after completion of work, or from visitors venturing off of established trails, which could spread invasive species or damage existing wetlands. Although some effects from this alternative would be beneficial, stemming from improvements to important fish habitat within Steep Creek, this alternative would have a **moderate effect** on wetlands and waterbodies.

Table 3-34. Area of Wetlands and Waters Impacts by Type, Square Feet (Acres) – Alternative 3^a

Project Component	Rivers	Ponds	Emergent	Scrub-Shrub	Forested	Lake	Total^b sq ft (acres)
Parking and Access Expansion	0	2,500	320	0	40	0	2,860 (0.07)
Welcome Center Complex	0	2,200	0	11,000	0	0	13,200 (0.30)
Visitor Center Improvements	0	0	0	0	0	0	0
Glacier Spur Road Trailheads	0	0	2,000	0	22,000	0	24,000 (0.55)
Lakeshore Trail	40	0	0	34,070	30,400	0	64,510 (1.48)
Campground Day Use Area	0	0	0	0	9,000	0	9,000 (0.21)
Dredge Lakes Outer Loop	920	4,000	2,000	62,600	201,400	17,300	288,220 (6.60)
Public Use Cabins	0	0	0	0	3,300	0	3,300 (0.08)
Nugget Falls Trail Expansion	530	0	0	0	0	2,300	2,830 (0.06)
Steep Creek Habitat Restoration	0 ^c	0	0	3,500	25,000	0	28,500 (0.65)
Steep Creek Trail Expansion	700	50	0	750	0	0	1,500 (0.03)
Dredge Lakes Multi-Use Trails	0	0	1,500	1,500	24,000	0	27,000 (0.62)
Welcome Center Dock	1,500	0	0	1,500	0	9,000	12,000 (0.28)
West Glacier Dock	0	0	0	9,000	0	4,060	13,060 (0.30)
Remote Glacier Visitor Area	50	50	0	0	0	0	100 (0.002)
West Glacier Unit Trails	3,500	2,000	0	500	107,000	0	113,000 (2.59)
Total^b sq ft (acres)	7,240 (0.16)	10,800 (0.25)	5,820 (0.13)	124,420 (2.86)	422,140 (9.69)	32,660 (0.75)	603,080 (13.8)

^a **Source: ABR 2021a:** wetlands types included in categories: Rivers (R2UBH, R3UBH, R2USC); Ponds (PUBH, PUBHb); Emergent (PEM1F, PEM2E, PEM1E); Scrub-Shrub (PEM1/SS1E, PSS1E, PSS1C, PSS1B); Forested (PFO4B); Lake (L1UBH, L2USC2C).

^b Totals may not add up because of independent rounding

^c Steep Creek impacts to the river wetlands type are essentially null since the creek is being relocated, not removed

Riparian Management Areas

Disturbance to riparian areas would be reduced as compared to Alternative 2, with 8.7 acres of permanent disturbance within RMAs (Table 3-35).

Direct impacts to riparian areas would be localized and kept to a minimum, except for in the case of the Steep Creek Habitat Restoration (discussed above) and Lakeshore Trail. Placement of the trail along a portion of the shoreline of Mendenhall Lake would permanently impact fewer acres of RMA than Alternative 2 (1.3 acres). Motorized boats near the shoreline could cause increased wave action and damage high value shoreline habitat as in Alternative 2. The total impacts represent approximately 1.6 percent of the total RMAs in the MGRA (**minor effect**).

Table 3-35. RMA Impacts by Stream Class and Total Number of Water Crossings – Alternative 3

Impact Type	Acres	Percentage of Existing Riparian Areas	Total Crossings
Stream Class I & II	4.6	1.6	20
Stream Class III & IV	0.1	0.1	15
Mendenhall Lake/ Other Lakes and Ponds	4.0	2.6	7
Total	8.7	1.6	42

Stream/Water Crossings

Alternative 3 proposes construction of several stream and water crossings and maintenance and/or upgrades for some existing crossings as part of the same components as in Alternative 2 (Lakeshore Trail, Dredge Lakes Outer Loop, Steep Creek Habitat Restoration, expansions of Steep Creek Trail and Nugget Falls Loop, Dredge Lakes Multi-Use Trails, West Glacier Spur Trail, West Glacier Multi-Use Trails, and the Remote Glacier Visitor Area), with a crossing added over Zig Zag Pond as part of the expansion of the Visitor Center parking lot. There would be 4 fewer water crossings under this alternative than Alternative 2, mainly from omission of the portion of Lakeshore Trail crossing in front of the Welcome Center. Stream crossings for Class III or IV streams would be equal to those in Alternative 2 (Table 3-35).

As discussed above, potential impacts from additional water crossings include increased sediment deposit during construction, destabilization of stream banks, increased maintenance needs, potential for future failure of culverts or bridges, and increased beaver activity that would plug new culverts. A maintenance plan would be developed to control beaver activity in the area.

Water Quality

The total area of additional impervious surfaces near waterbodies under Alternative 3 would be around half an acre lower than Alternative 2 (8.3 acres versus 8.96 acres). Combined area of the new parking area and Welcome Center Plaza under Alternative 3 would install approximately 4.5 acres of impervious surfaces near several Class I streams and waterbodies. Zig Zag Pond would remain mostly intact, and vegetative swales and oil-grit separators would aid in stormwater management in order to achieve an 80 percent reduction in average annual TSS prior to discharge. A water quality monitoring program would be developed with ADEC to ensure that installed stormwater runoff control structures are working effectively and that water quality in Steep Creek is not impacted.

Impacts to water quality from increased impervious surface area, runoff potential, vehicle traffic, and foot traffic under this alternative would be similar to those discussed above under Alternative 2.

Water quality is less likely to be impacted by motorized boats under this action alternative, because engines would be electric rather than traditional combustion engines using alternative fuels. Minor impacts to water quality may occur via sediment mixing and shoreline erosion in shallow lake areas if speeds are not limited. The portable, floating restroom facilities located near either location for the glacier landing area would also present a potential risk to water quality, similar to those discussed under Alternative 2.

Construction-related dredging for installation of boat docks and Lakeshore Trail Bridge and periodic maintenance dredging at the West Glacier Dock would also cause lake sedimentation and temporarily diminish water quality. Diesel-powered vessels would likely to be used to support construction operations such as pile driving and dredging for installation of the Welcome Center and West Glacier Docks. Diesel-powered vessels would also likely be used to support certain maintenance activities such as seasonal placement and removal of dock floats and floating restroom facility pumping.

Through the use of BMPs and improved stormwater management for large impervious surface areas, as well as stringent controls on boat operations, Alternative 3 would have a **minor effect** on water quality within the MGRA, and less potential to impact water quality than Alternative 2.

Flood Events and Floodplains

As in Alternative 2, all components under Alternative 3, with the exception of a 400-foot section of the Moose Lake Connector, would be developed outside of FEMA's 1-percent AEP area for the Mendenhall River (Figure 3-14).

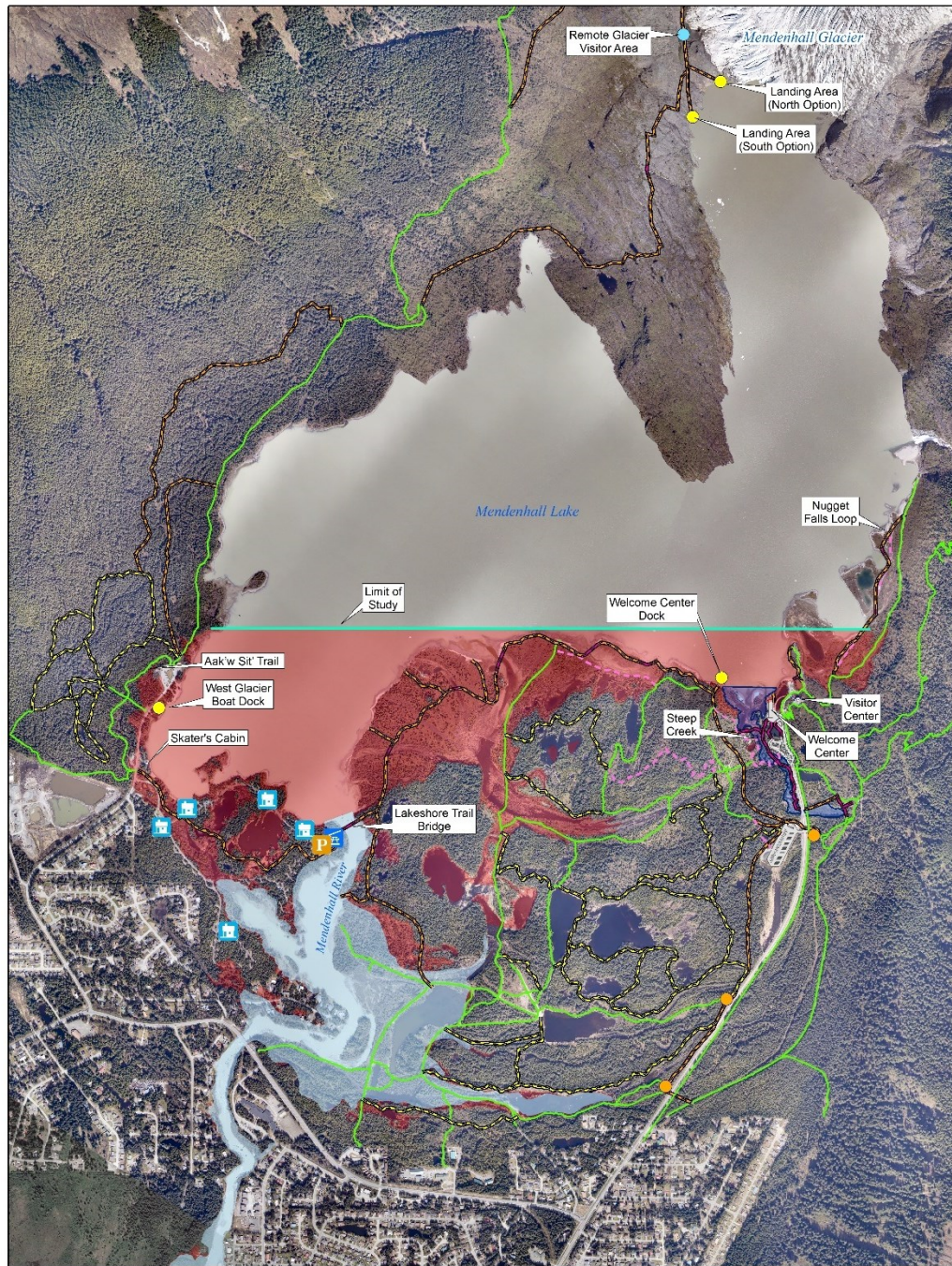
The expanded parking configuration for Alternative 3 would have less encroachment into the existing Steep Creek floodplain since it only partially fills Zig Zag Pond. Similar to Alternative 2, hydrologic capacity under Glacier Spur Road would be restored and the entire parking area would be outside the new Steep Creek floodplain (AWR 2021).

Potential 1-percent AEP rain events and glacial lake outburst flood events may temporarily inundate at-grade portions of the same trails as in Alternative 2: Photo Point Trail, Nugget Falls Trail, Lakeshore Trail, segments of the Dredge Lakes Outer Loop (most likely Moose Lake Connector), some Dredge Lake Multi-Use Trails, and lower elevation segments of the West Glacier Unit Multi-Use Trails. Approximate total length of trails that may be expected to flood under Alternative 3 is 15,000 linear feet (2.8 miles), slightly less than Alternative 2 (16,000 linear feet; 3 miles). The eastern portion of Lakeshore Trail would experience flooding similar to Alternative 2's alignment, averaging around seven days a year from a combination of glacial outburst floods and heavy rain events. Because the western side of Lakeshore Trail would be located farther from the lake, it is likely this side of the trail would experience fewer days of inundation.

Portions of trails within flood areas would be either elevated on pilings or have culverts designed to minimize effects to flood flows and maintain natural drainage patterns. Trails would also be designed with erosion control measures such as riprap armoring to withstand periodic flooding, but some trail surface erosion could occur during high water events on unpaved trails. Placement of riprap along trail side slopes also has the potential to impact the aquatic environment

(increased speed of water flow, downstream erosion, lost rocks during fast flows, interruption of riparian areas, decreased habitat for fish). In addition to riprap reinforcement for trail side slope protection during high water events, riprap would also be used for shoreline stabilization for the Steep Creek vehicular bridge abutments, Lakeshore Trail Bridge abutments, Welcome Center Dock, and West Glacier Dock. Pile-supported docks would be designed to withstand glacial lake outbursts flood events and to allow movement of floodwaters.

Figure 3-14. Alternative 3 Flood Inundation Areas



Legend

- | | |
|---|--------------------------------------|
| Alaska Silver Jackets 1-Percent Annual Exceedance Probability (AEP) Flood Inundation Area | Proposed Trail |
| Modeled Steep Creek Habitat Restoration and Realignment 1-Percent AEP Flood Inundation Area | User-Created/Proposed Singletrack |
| FEMA 1-Percent AEP Flood Inundation | Proposed Elevated Trail or Bridge |
| Proposed Day-Use Parking Area | Existing Trail |
| Proposed Day-Use Picnic Area | Decommission |
| Proposed Public Use Cabin | Limit Of Study |
| | Proposed Remote Glacier Visitor Area |
| | Proposed Trailhead |
| | Proposed Dock or Landing Area |



3.8.6.5 Alternative 4

Alternative 4 proposes the least impacts to aquatic resources of all the action alternatives. Table 3-36 gives a summary of the estimated wetlands and RMA impacts, new impervious surface area, and stream crossings from all components of this alternative.

Table 3-36. Summary of Impacts to Aquatic Resources – Alternative 4

Impact type	Total number	Area (acres)	Percentage of Study Area
Wetlands	N/A	4.6	0.4
RMAs	N/A	5.9	1.1
Water crossings	28	N/A	N/A
New impervious surface area	N/A	4.2	0.07

Wetlands and Waterbodies

Alternative 4 proposes the least amount of wetlands impact of the three action alternatives (Table 3-37). The area of permanently impacted wetlands would be similar to Alternative 3 for the following components: expanded parking area (2,860 sq ft), Welcome Center Complex (13,200 sq ft), Steep Creek Trail (100 sq ft). However, wetlands impacts attributed to the Lakeshore Trail are higher in this alternative than in Alternatives 2 and 3 because of the inland alignment of the Lakeshore Trail in this alternative and the Moose Lake Connector Trail is included in the total impacts for the Lakeshore Trail. In Alternatives 2 and 3, impacts from Moose Lake Connector are added in with the impacts from the Dredge Lakes Outer Loop, which is not proposed under Alternative 4. This alternative omits other proposed components such as the docks, campground parking area, Dredge Lakes Multi-Use Trails, and West Glacier Multi-Use Trails, and therefore total permanent wetlands disturbance is reduced to 4.6 acres. This equates to around 0.4 percent of existing wetlands in the MGRA study area, with some additional temporary impacts from construction, maintenance, upgrades and/or visitors venturing off of established trails. Alternative 4 would have a **minor impact** on wetlands.

Table 3-37. Area of Wetlands and Waters Impacts by Type, Square Feet (Acres) – Alternative 4^a

Project Component	Rivers	Ponds	Emergent	Scrub-Shrub	Forested	Lake	Total^b sq ft (acres)
Parking and Access Expansion	0	2,500	320	0	40	0	2,860 (0.07)
Welcome Center Complex	0	2,200	0	11,000	0	0	13,200 (0.30)
Visitor Center Improvements	0	0	0	0	0	0	0
Glacier Spur Road Trailheads	0	0	2,000	0	22,000	0	24,000 (0.55)
Lakeshore Trail (includes Moose Lake Connector Trail)	4,550	5,000	2,550	28,800	78,200	3,400	122,500 (2.80)
Public Use Cabins	0	0	0	0	3,300	0	3,300 (0.08)
Nugget Falls Trail Expansion	530	0	0	0	0	2,300	2,830 (0.06)
Steep Creek Habitat Restoration	0 ^c	0	0	3,500	25,000	0	28,500 (0.65)
Steep Creek Trail Expansion	0	50	0	50	0	0	100 (0.002)
West Glacier Spur Trail	2,000	2,000	0	500	0	0	4,500 (0.10)
Total^b sq ft (acres)	7,080 (0.16)	11,750 (0.27)	4,870 (0.11)	43,850 (1.01)	128,540 (2.95)	5,700 (0.13)	201,790 (4.6)

^a **Source: ABR 2021a:** wetlands types included in categories: Rivers (R2UBH, R3UBH, R2USC); Ponds (PUBH, PUBHb); Emergent (PEM1F, PEM2E, PEM1E); Scrub-Shrub (PEM1/SS1E, PSS1E, PSS1C, PSS1B); Forested (PFO4B); Lake (L1UBH, L2USC2C).

^b Totals may not add up because of independent rounding

^c Steep Creek impacts to the river wetlands type are essentially null since the creek is being relocated, not removed

Riparian Management Areas

Disturbance would be reduced under this alternative as compared to the other two action alternatives; approximately 5.9 acres of permanent disturbance within riparian areas (Table 3-38).

Placement of the Lakeshore Trail inland from the shoreline of Mendenhall Lake would permanently impact fewer acres of RMA than either of the other action alternatives (1.02 acres). As in the other action alternatives, additional temporary disturbances from construction and maintenance and/or upgrades would occur. Alternative 4 would have a **minor impact** on RMAs.

Table 3-38. RMA Impacts by Stream Class and Total Number of Water Crossings – Alternative 4

Impact Type	Acres	Percentage of Existing Riparian Areas	Total Crossings
Stream Class I & II	2.9	1.0	6
Stream Class III & IV	0.02	0.02	14
Mendenhall Lake/Other Lakes and Ponds	3.0	2.0	8
Total	5.9	1.1	28

Stream/Water Crossings

Under Alternative 4, the total number of new stream or surface water crossings proposed is reduced to 28, and therefore potential impacts from the crossings would be reduced. The following components would involve overwater crossings: expansion of the Visitor Center parking lot, Lakeshore Trail, Moose Lake Connector, Steep Creek Habitat Restoration, expansions of Steep Creek Trail and Nugget Falls Loop, and West Glacier Spur Trail. There would be 14 fewer stream or water crossings under this alternative than Alternative 3, and 18 fewer crossings than Alternative 2 (Table 3-38). Potential impacts from stream or other waterbody crossings (sedimentation, potential for failure, blockage by beavers, etc.) would be reduced as compared to those discussed above in Sections 3.8.6.3 and 3.8.6.4.

Water Quality

Total area of impervious surfaces under Alternative 4 would also be greatly reduced as compared to the other action alternatives. The parking area and Welcome Center Plaza surface area would be similar to other action alternatives (around 4.2 acres in this alternative versus 4.5 acres in Alternative 3 and 5.2 acres in Alternative 2) and would be the only major contributor to impervious surface area under this alternative. The Lakeshore Trail would be constructed as a gravel trail and would not increase imperviousness near the lakeshore. Water quality would not be impacted by motorized boats under this alternative. The omission of docks on Mendenhall Lake would reduce riprap placement, and no construction or maintenance-related dredging would occur.

Water quality could be impacted through increased impervious surface area and additional traffic and motorized transport along the roadways near streams. Through the use of BMPs and improved stormwater management for large impervious surface areas, Alternative 4 would have a **negligible effect** to water quality within the MGRA.

Flood Events and Floodplains

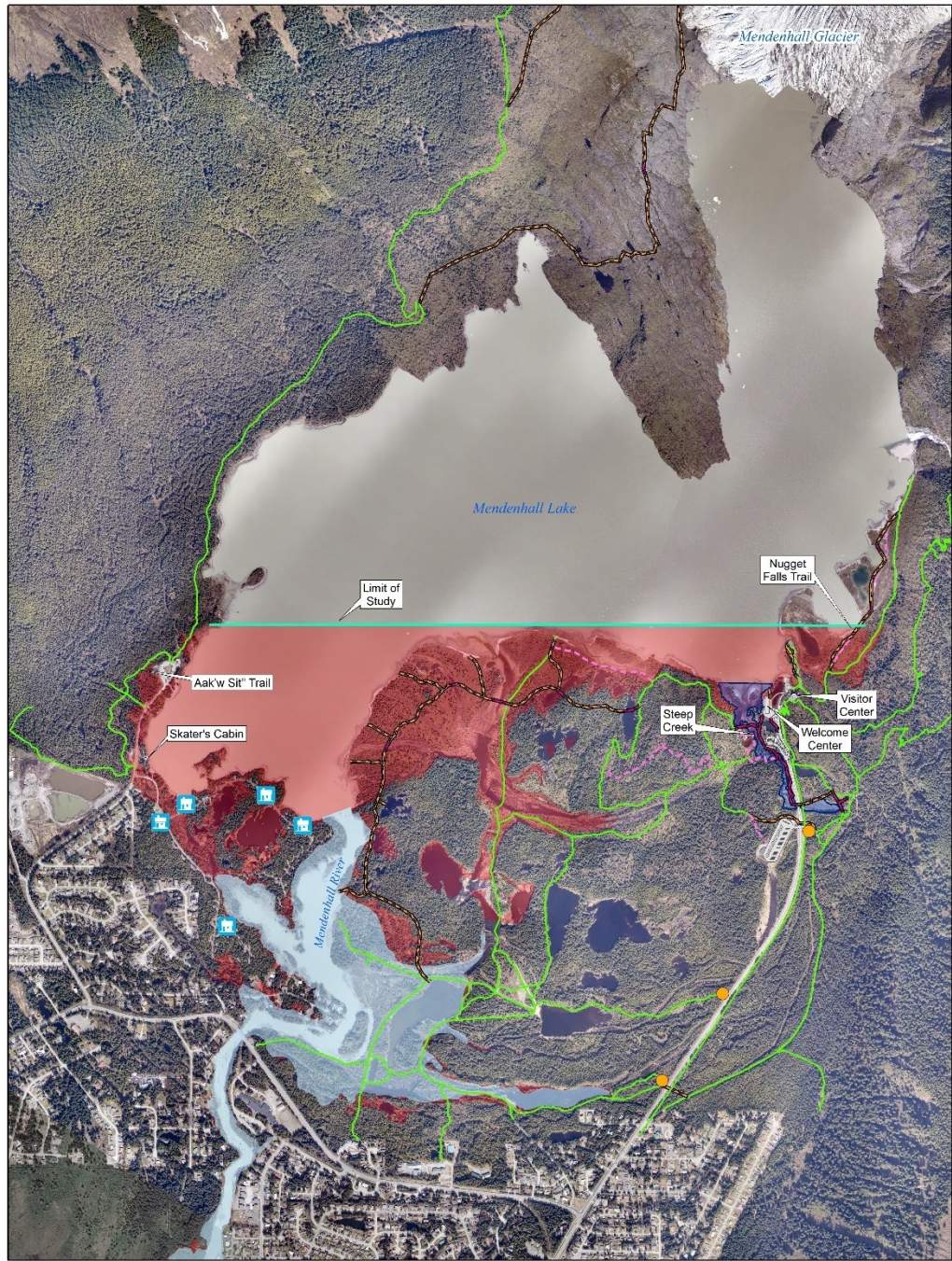
All project components proposed under Alternative 4 would be developed outside of FEMA's 1-percent AEP area for the Mendenhall River, with the exception of a 400-foot section of the Moose Lake Connector, similar to other build alternatives (Figure 3-15).

The expanded parking footprint for Alternative 4 would be almost identical to Alternative 3 and would not encroach into the modeled Steep Creek floodplain (AWR 2021). Similar to Alternatives 2 and 3, Steep Creek's hydrologic capacity would be restored as a result of the culvert replacement under Glacier Spur Road.

Potential 1-percent AEP rain events and glacial lake outburst flood events could temporarily inundate at-grade portions of fewer proposed trails as the other action alternatives. Trails that could experience flooding include Nugget Falls Trail, Lakeshore Trail, and Moose Lake Connector. Approximate total length of trails that may be expected to flood under Alternative 4 is 12,000 linear feet (2.3 miles), slightly less than Alternative 2 (16,000 linear feet; 3 miles) and Alternative 3 (15,000 linear feet; 2.8 miles). Photo Point Trail's more inland alignment would shift the trail out of the area that would experience lake level rise from glacial lake outburst flooding. Much of Lakeshore Trail's alignment would be shifted south away from the lake which would result in fewer days of flood inundation.

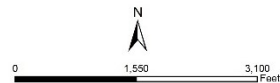
Portions of trails within the potential 1-percent AEP or glacial lake outburst flood area would be either elevated on pilings or have culverts placed at appropriate intervals to minimize flood effects and allow for the movement of floodwaters. Trails would also be designed with erosion control measures such as riprap armoring to withstand periodic flooding, but some trail surface erosion could occur during high water events on unpaved trails. Placement of riprap along trail side slopes also has the potential to impact the aquatic environment (increased speed of water flow, downstream erosion, lost rocks during fast flows, interruption of riparian areas, decreased habitat for fish). In addition to riprap reinforcement for trail side slope protection during high water events, riprap would also be used for shoreline stabilization for the Steep Creek vehicular bridge abutments.

Figure 3-15. Alternative 4 Flood Inundation Areas



Legend

- Alaska Silver Jackets 1-Percent Annual Exceedance Probability (AEP) Flood Inundation Area
- Modeled Steep Creek Habitat Restoration and Realignment 1-Percent AEP Flood Inundation Area
- FEMA 1-Percent AEP Flood Inundation Area
- Proposed Public Use Cabin
- Limit Of Study
- Proposed Trail
- Proposed Elevated Trail or Bridge
- Existing Trail
- - - Decommission
- Proposed Trailhead



3.8.7 Cumulative Effects

The project area includes two watersheds, the Mendenhall River and the Mendenhall Glacier watersheds. While the upper Mendenhall River watershed is mostly undeveloped, the lower watershed has considerable urban development. Waterways in adjacent watersheds (Duck Creek and Jordan Creek in the Salmon Creek – Frontal Gastineau Channel watershed) in the southern Mendenhall Valley have been impaired from contaminated stormwater associated with urbanization of the valley, but the Mendenhall River watershed remains in good condition (not impaired by water quality standards).

Increased visitor traffic to the MGRA would include more tour bus traffic to roads between the downtown cruise ship docks and the MGRA. More vehicle traffic on these roads would increase the burden on existing stormwater systems and could contribute to additional maintenance or failures. Any reduced efficacy to stormwater management could affect water quality in the relevant watersheds.

Other projects within the Mendenhall River or Mendenhall Glacier watersheds that have the potential to impact aquatic resources are listed below in Table 3-39.

Table 3-39. Projects Considered for Analysis of Cumulative Effects to Watersheds, Wetlands, and Aquatic Habitat

Project Name	Type	Action
Mendenhall Glacier Mineral Withdrawal	Public Land Order Mineral Withdrawal	Present
Back Loop Bridge and Dredge Lakes Trailhead Parking Area Improvements	Trail & Rec Improvements	Present
Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements	Trail & Rec Improvements	Future
Montana Creek Master Plan	Trail & Rec Improvements	Future
Juneau Trails Master Plan	Trail & Rec Improvements	Future
MGRA Hydropower	Infrastructure	Future
Nugget Creek Dam Removal	Infrastructure	Future

The Mendenhall Glacier Mineral Withdrawal proposed for land recently uncovered by the retreating Mendenhall Glacier would protect water resources from potential effects of mining. Runoff from mining activities can be polluted with metal contaminants that, if not treated properly, can later affect water quality and habitat for aquatic plants and animals.

Paving two existing parking areas (Back Loop Bridge and Dredge Lakes Trailhead) would constitute an incremental addition of impervious surface area to the watershed but would not impact wetlands since they are previously-disturbed (gravel pad) areas. The Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements, Montana Creek Master Plan, and Juneau Trails Master Plan have the potential to impact wetlands and EFH through construction of trails or other recreation facilities, and increased user access.

The creation of an educational small-scale hydropower facility on an upstream location along Steep Creek could impact wetlands in the proximity of the facility and downstream water levels, possibly affecting fish habitat. The facility would likely be placed upstream of Class I stream habitat (i.e., above Dipper Falls). It is also possible that the dam on Nugget Creek located above the falls would be removed in the foreseeable future, which could have some, likely temporary, effects on downstream water levels and turbidity.

While the known past, present, or future planned projects have the potential to contribute minor impacts to water resources or aquatic habitat, there are few cumulative impacts expected from these potential projects.

There would also be foreseeable impacts to water resources from climate change during the duration of this project. The Juneau area is expected to see increased levels of precipitated in the coming decades which could escalate the frequency and severity of flood events within the MGRA, affecting salmon spawning habitat availability, salmon egg-to-fry survival, visitor experiences, and infrastructure maintenance needs (Sloat et al. 2017; Shanley and Albert 2014).

3.9 Heritage Resources

Heritage (cultural) resources represent any historic or prehistoric remains or indicators of past human activities, and may consist of archaeological sites, historic-age buildings and structures, and traditional use areas and cultural places important to a group's traditional beliefs, religion, or cultural practices. If any of these resources or traditional uses or places are found to be significant when evaluated against the National Register of Historic Places (NRHP) eligibility criteria found at 36 CFR 60.4, they are called 'historic properties' and determined to be worthy of preservation.

3.9.1 Scope of the Analysis

Project activities have been identified in Alternatives 2, 3, and 4 that have the potential to affect historic or traditional cultural properties located within the project's expected, but yet to be defined, area of potential effect (APE). The APE will be determined prior to project implementation and is expected to consist of the limits of construction disturbance and staging areas for each of the project components. The APE will also include where site setting effects (viewsheds and noise introduction) would be expected and where indirect impacts to historic properties (such as opening areas up to site visitation, vandalism, or erosion) could be expected. Further details on determining the APE are summarized in Section 3.9.2.1.

3.9.2 Regulatory Setting

For activities that are Federally funded or that take place on Federal lands, there are laws, regulations, guidelines, and EO that apply to heritage resource management and protection. A partial list of applicable regulations is included below.

- Antiquities Act of 1906
- Historic Sites Act of 1935
- National Historic Preservation Act of 1966 (NHPA)
- National Environmental Policy Act of 1969 (NEPA)
- Alaska State Historic Preservation Act (1970)
- Alaska Native Claims Settlement Act (ANCSA) of 1971
- The Archaeological and Historic Preservation Act of 1976
- American Indian Religious Freedom Act of 1978
- Archaeological Resources Protection Act of 1979
- Alaska National Interest Lands Conservation Act (ANILCA) of 1980
- Native American Graves Protection and Repatriation Act of 1990
- EO 11593 – Protection and Enhancement of the Cultural Environment
- EO 13007 – American Indian Sacred Sites
- EO 13084 – Consultation and Coordination with Tribal Governments

- EO 13175 – Government-to-Government Consultation

Forest Plan Standards and Guidelines for Heritage Resources and Sacred Sites (HSS) Forest-wide include:

- Heritage Resource Activities: HSS1 (Forest Plan pp. 4-16 to 4-18)
- Sacred Sites Protection Activities: HSS2 (Forest Plan p. 4-19)

The Forest Service is developing a project-specific Programmatic Agreement (PA) with the State Historic Preservation Office (SHPO), the Advisory Council of Historic Preservation (ACHP), and local tribal entities to comply with Section 106 of the NHPA for this project. More information on this agreement is provided below in Section 3.9.2.1.

3.9.2.1 National Historic Preservation Act and Section 106

Section 106 of the NHPA requires Federal agencies to take into account the effects of their actions on historic and traditional cultural properties. The process involves identifying the APE, determining what cultural resources exist within the APE, and evaluating them for eligibility for inclusion on the NRHP.

After identifying historic properties within the APE for each project component, the next step is to assess potential effects to the historic properties that could occur during project implementation. This assessment can result in one of four findings: no potential to affect historic properties, no effect to historic properties, no adverse effect, or adverse effect.

In general, the findings of effects on the historic resources would be:

1. No potential to affect historic properties: If proposed infrastructures' APE does not overlap any historic properties' site boundaries.
2. No effect on historic properties: If proposed ground disturbing activities would be carried out where historic and/or cultural resources not eligible for the NRHP are present or where avoidance is feasible and is implemented.
3. No adverse effect on historic properties: If proposed activities would occur within historic properties' site boundaries, but the effects could be mitigated so that it would not diminish the characteristics that make the historic property significant nor result in a loss of integrity of the property.
4. Adverse effect on historic properties: If proposed activities would occur within historic properties' site boundaries and would cause effects that would diminish the characteristics that make the property significant, resulting in a loss of integrity of the historic property that cannot avoid or be mitigated.

Means by which historic properties could be adversely affected by project activities include, but are not limited to, physical destruction of or damage to all or part of the property; alteration of the property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary of Interior's standards for the treatment of historic properties (36 CFR 68) and applicable guidelines; removal of the property from its historic location; change of the character of the property's use or of physical features within the property's setting that contribute to its

historic significance; or introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features.

Project activities of the kind proposed for this project also have the potential to indirectly affect cultural resources by further developing areas of the MGRA in which cultural resources are located and thereby inviting increased visitor use. Increased visitor use of an area in which cultural resources are located can render the sites vulnerable to both intentional and unintentional damage. Intentional damage can occur through the unauthorized digging in archaeological sites and unauthorized collecting of artifacts from sites. Unintentional damage can result from activities that disturb the ground during dispersed recreational use. Site avoidance is the preferred mitigation action pursuant to the Forest Plan. However, in situations where site avoidance is not feasible, other mitigation measures (such as, but not limited to modification of design features, restriction of proposed activities to existing road/trail prisms, or installation of boulders or barriers to limit visitor access) can be implemented that limit visitor access to archeological sites.

The Forest Service is developing a PA with the SHPO, ACHP and tribal entities to address all aspects of cultural resource management associated with all project components. The PA will outline processes including:

- Defining the APE (including direct, indirect, auditory, visual, cumulative)
- Identifying and evaluating previously unknown historic properties within the APE
- Consultation for maintenance and preservation of the historic Visitor Center and other historic properties
- Development of mitigation measures for any adverse effects to historic properties
- Survey and consultation for trails and infrastructure projects
- Integration with Tribal consultation

Phasing Section 106 requirements adjusts the timeline so that Section 106 may be completed after the NEPA review and prior to project implementation. The Record of Decision (ROD) shall document that 36 CFR 800.4(b)(2) procedures are being followed and that Section 106 procedures are not concluded with the signing of the ROD. Each undertaking, when identified on the ground, will require a Forest Service Heritage Specialist to apply criteria from the PA to determine whether a streamlined approach to Section 106 or other stipulation of the PA is appropriate for that undertaking. Areas not covered under previous cultural resource inventory could require additional fieldwork. Additionally, a project area may require additional survey if a past survey does not meet current professional standards. All effects to cultural resources will be avoided or minimized to the extent possible, as agreed upon in the PA. In cases where there may be an adverse effect on historic properties, the requirements specific to the undertaking would be used to mitigate those effects.

3.9.2.2 Tribal Consultation

The Forest Service sent project scoping letters to the following Federally-recognized tribes and native corporations within the project area:

- Douglas Indian Association

- Central Council Tlingit and Haida Indian Tribes of Alaska
- Goldbelt, Inc.
- Sealaska

Forest Service staff met with representatives from Aak’w Kwaan and Central Council Tlingit and Haida Indian Tribes of Alaska and the Sealaska Heritage Institute regarding the project and to solicit input in the development of the interpretive plan. Douglas Indian Association was invited to participate in the interpretive effort but deferred to the local clan.

3.9.3 Issues and Indicators

The issue statement below was drafted to address concerns and needed analysis related heritage resources brought up during public scoping and under the regulatory setting.

Issue Statement: *Proposed developments could impact the MGRA’s potentially eligible historic resources, including the historic Visitor Center and historic trails, and a Native Alaskan tribe’s culturally important glacier.*

Measurement Indicator:

- Qualitative comparison of extent of ground-disturbing activities that have the potential to disturb heritage resources and development near the glacier

3.9.4 Affected Environment

The following sections are excerpts from the Mendenhall Glacier Valley Heritage Resource Review and the interpretive plan developed in association with this project (Cultural Resource Consultants 2020; AldrichPears 2022).

3.9.4.1 Cultural Context

The Mendenhall Glacier Valley is part of the traditional territory of the Aak’w Kwaan Tlingit that reached from Berners Bay to the Taku Inlet. Their permanent village was at Auke Lake, a few miles north of Juneau and about 3 miles southwest of present-day MGRA. The Aak’w Kwaan, and the Tlingit as a whole are closely tied to glaciers. The Mendenhall Glacier has long been a defining feature in the cultural landscape of the Aak’w Kwaan and is treated with deep respect (AldrichPears Associates 2022).

In the late 1880s, the arch-shaped, 2.5-mile-wide terminus of the Mendenhall Glacier was about 1.1 miles south of where it is today. Mendenhall Lake did not exist, although several streams and channels carried meltwater from the glacier to the nearby ocean. Because a glacier covered the area during that time, it is unlikely that the Aak’w Kwaan were found in within the MGRA; however, there is proof of the Aak’w Kwaan residing nearby in the Mendenhall Valley. In 1989, a basket-style fish trap dating to approximately 1310 A.D. was found at Montana Creek in a fluvial gravel bar. The Mendenhall Glacier was likely near its 1750 A.D. position before 1310 and the face of the glacier was just 1.2 miles from the fish trap when it was buried.

A gold strike on July 4, 1900, at Nugget Creek on the eastern side of the glacier started a short-lived gold rush to the Mendenhall Valley. Even though only a few gold discoveries were made after the initial strike, the rush kicked off development in the valley. Access to the eastern side of

the Mendenhall Glacier was by a road and a rough trail. The Treadwell Mine on Douglas Island (across Gastineau Channel) developed a hydroelectric power plant to connect their complex to Nugget Creek in the 1910s. In the 1920s, with the arrival of the automobile and increased steamship traffic, tourists began visiting the Mendenhall Valley.

A Civilian Conservation Corps (CCC) program began in Alaska in early 1933 under the direction of the Forest Service. The CCC employed a large number of men who carried out a diverse array of projects. In Southeast Alaska an emphasis was placed on building and conservation of roads, trails, and bridges that would make recreation more available for locals and tourists. Several CCC projects were completed in the Mendenhall Valley and in the area of the present-day MGRA, increasing the popularity of the MGRA for hiking, camping, skating, riflery, and boating (USDA Forest Service 2014). Regional Forester Frank Heintzleman signed an order in 1947 creating the 5,815-acre Mendenhall Recreation Area. After realizing the need for facilities to serve the visiting public, the Forest Service awarded a contract for the construction of the Mendenhall Glacier Visitor Center in 1961. The building was the first visitor center on NFS lands in the United States. As noted by Forest Service Chief Edward Cliff during the dedication, “This is part of an effort on a national scale to make the recreation experience more meaningful” for the American public.

3.9.4.2 Previous Investigations and Existing Sites

Historic resource surveys have been conducted in the Mendenhall Valley and the MGRA since the 1980s (Table 3-40).

Table 3-40. Previous Heritage Resource Studies Within the MGRA

Year	Study Lead	Survey Description
1981	Linda Zaeger	Documented Mendenhall Glacier Registry Booth/Cobble Shelter (JUN-00598)— a three-sided log exhibit shelter built by the CCC near the Mendenhall Glacier Visitors Center. Recorded a carved rock trail sign and a carved ice limit sign and a 22-foot-long section of puncheon and a footbridge to the west (East Glacier Loop Trail (JUN-00617), Nugget Creek Trail (JUN-00618), and the Vista Creek Shelter (JUN-00619)
1985	Karen Swanson	Completed a site inventory and a determination of eligibility for Nugget Creek Power Complex (JUN-00241) and recommended that the extensive site was eligible for inclusion on the NRHP
1987	Carl Burgeson	Conducted a survey to expand parking facilities and did not note any cultural resource concerns
1987	Forest Service archaeologists	Archaeological inventory for a special use permit request for an administrative site for use by the FAA
1992	Karen Iwamoto	Completed a literature review for the construction of a new parking area and Steep Creek viewing platforms, concluding that due to the recent retreat of the Mendenhall Glacier, the likelihood of additional cultural resource discovery is low
1993	Katharine Brown	Visited and assigned Alaska Heritage Resource Survey (AHRs) number to Mendenhall Glacier Registry Booth/Cobble Shelter (JUN-00598)

Year	Study Lead	Survey Description
1993	Chris Campbell and Douglas Campbell	Recommended the Mendenhall Glacier Visitor Center (JUN-00597) for inclusion on the NRHP after completion of a historic assessment of the building
2005	Rachel Myron and Nichole Lantz	Conducted a survey for reconstruction of the West Glacier Trailhead/Skater's Cabin access road and adjacent bike path; aside from two stone pedestals and the Skater's Cabin (JUN-00242), they found no cultural resources
2005	Rachel Myron and Nichole Lantz	Surveyed a project to reconstruct the West Glacier Trailhead and lake access parking area and facilities and found no historic properties
2006	Nicole Lantz	Completed a survey of the lower Steep Creek area and concluded only known and documented heritage resources in the area (Mendenhall Glacier Trail of Time [JUN-01114] and Nugget Creek Power Project [JUN-00241])
2007	Nicole Lantz	Surveyed the planned route of the proposed Nugget Falls Trail and found no historic features
June, 2010-August 2012	Forest Service archaeologists	Recorded and documented the Skater's Cabin, Mendenhall Rifle Range (JUN-1182), Mendenhall Lake Trail (JUN-1183), Tolch Rock (JUN-1184), and West Glacier Trail (aka Mendenhall Glacier Trail, JUN-1185)
2013	Rachel Myron and Myra Gilliam	Archaeological inventory for a proposed sign replacement location
2014	Forest Service archaeologists	Forest Service Heritage staff, working with Forest Service engineering staff, conducted an inventory of a historic dam at Nugget Creek

Additional survey work may be needed in areas of ground disturbance for proposed project components, based on the requirements agreed upon in the PA.

Previous heritage resource survey work has resulted in the discovery of 10 sites in MGRA that are listed in the AHRS. Seven of these have been determined to be eligible for listing on the NRHP. All seven are eligible under NHRP Criterion A for their association with historical events. Two are also eligible under additional criteria. To protect the resources and comply with the requirements of NHPA and State of Alaska statutes, these sites are described only in general terms in the following paragraphs. These are the Mendenhall Glacier Registry Booth (JUN-00598), East Glacier Loop Trail (JUN-00617), Trail of Time (JUN-01114), West Glacier Trail (JUN-1185), Skater's Cabin (JUN-00242), Nugget Creek Power Project (JUN-00241), and Mendenhall Glacier Visitor Center (JUN-00597).

The Mendenhall Glacier Registry Booth (JUN-00598), also known as the Cobble Shelter, was constructed between November 1936 and July 1937. It was part of a complex of visitor amenities built by the Juneau-based division of the CCC in the late 1930s on the eastern side of the Mendenhall Glacier. The shelter, which was rehabilitated in 2010, was determined eligible for the NRHP under Criterion A for its association with significant historical events and Criterion C for embodying distinctive characteristics of an architectural type.

The East Glacier Loop Trail (JUN-00617) is a 3-mile loop with views of Mendenhall Glacier. The upper portion of the trail was originally part of the Nugget Creek Trail, constructed, along with the Registry Booth, by the CCC in the late 1930s to early 1940s. The trail was determined eligible for the NRHP under Criterion A for its association with significant historical events.

Portions of the Trail of Time (JUN-01114) were constructed in 1922 and numerous features along the route were constructed by the CCC during the 1930s. The trail begins at the foundation of the Nugget Creek Powerhouse foundation and ends at the Mendenhall Glacier Visitor Center. The trail was determined eligible for inclusion on the NRHP under Criteria A and D for its association with significant historical events and for one contributing site's potential to yield information important to history.

The West Glacier Trail or Mendenhall Glacier Trail (JUN-1185), built by the CCC in 1936, is a 3.4-mile-long foot trail that begins at the parking area at the terminus of the Skaters Cabin Access Road. It initially follows the lakeshore and then ascends to a point approximately 1,450 feet in elevation overlooking Mendenhall Glacier. The trail was determined eligible for the NRHP under Criterion A for its association with the CCC.

The Skater's Cabin (JUN-00242) was constructed by members of the CCC between about 1934 and 1936. It was designed for use as a warming cabin in winter and a picnic shelter in summer. It is one of the few remaining such structures in southeast Alaska. The cabin was destroyed by a fire in May 1988 but was reconstructed that same year. The cabin was determined eligible for the NRHP under Criterion A for its direct historical association with the CCC, and as the best single structural representation of the CCC program in the Juneau area.

The Nugget Creek Power Project (JUN-00241) was associated with the Treadwell Mining Company. Remaining features from the power project include remnants of the powerhouse, the pipeline/tramline from the waterfalls down to the powerhouse, the tunnel from the dam to the falls, and two construction camps. This site has been determined to be eligible for the NRHP for its association with early industry and extraction in the area.

Designed by Linn Forest Architects, the Mendenhall Glacier Visitor Center (JUN-00597) was constructed between 1961 and 1962. The Visitor Center was determined eligible for the NRHP under Criterion A for its association with significant historical events. It was the first formal visitor center built by the Forest Service in the United States and the first that interprets glacial phenomena in the Americas. The center is an excellent example of the Pacific Northwest 1960s vernacular style that used natural materials. The recent Mendenhall Glacier Visitor Center Historic Architectural Report (ECI 2020) found that the Visitor Center remains eligible for the NRHP under Criterion A.

3.9.5 Analysis Methods

An estimation of general effects to historic properties for each alternative is presented in the following sections. Actual formal findings of effects would be undertaken through consultation and coordination with the SHPO, ACHP and tribal entities prior to implementation of any project component and use the PA developed through prior coordination.

3.9.6 Direct and Indirect Effects

3.9.6.1 Alternative 1 – No Action

The No Action Alternative would not involve any ground-disturbing activities or change in management and capacity and has the least potential to affect existing heritage resources. Historic properties within the APE would continue to be affected by natural processes and existing (and increasing) visitation and recreation use. Since these types of activities are already taking place within the APE, the extent and scope of adverse effects of these activities to heritage resources are unknown. Opportunities for interpretative development and/or stabilization will not occur.

3.9.6.2 Alternative 2 – Proposed Action

Alternative 2 has the greatest potential to affect heritage resources. Impacts including, but not limited to, surface and subsurface disturbance associated with development of recreational facilities, expansion of the parking area, and vegetation removal have the potential to affect known historic properties and could affect undiscovered historic properties. Previous cultural resource surveys in areas of proposed disturbance and recent glacial retreat, however, indicates that the discovery of additional undiscovered historic properties at these locations is not anticipated. However, the Mendenhall Glacier has long been a defining feature in the cultural landscape of the Aak’w Kwaan. Alternative 2 proposes the most development near the glacier in the form of the Remote Glacier Dock, Remote Glacier Visitor Area, associated primitive restroom facilities, and greatest number of potential visitors.

Direct impacts to the NRHP-eligible Visitor Center due to the infill at the lower floor and addition of a cover to the external staircases are proposed and will be included in the PA discussed above. Direct impacts are also likely where the proposed expansion of Steep Creek Trail connects to the NRHP-eligible Trail of Time. The Dipper Falls Viewing Area would also directly impact the Trail of Time, since it would be connected to the trail. Direct impacts to the NRHP-eligible West Glacier Trail would occur where the new trail spur is planned. Although Alternative 2 has the potential to directly impact known historic properties, it is expected that the impacts would be minor and are not expected to exclude each site’s reason for listing on the NRHP because proposed infrastructure would be designed to keep with the historic nature of the existing historic properties. Under the PA, the Forest Service will work closely with the SHPO, ACHP, and tribal entities during design and implementation of each component.

The proposed Welcome Center Complex (including the Welcome Center building, bridge over Kettle Pond, hardscape plaza area, amphitheater, Photo Point Trail expansion, and associated connector trails), Lakeshore Trail, Nugget Falls Trail, boat docks, and boat operations on the lake would be in the viewshed of eligible historic properties, including the Visitor Center, Skater’s Cabin, Trail of Time, East Glacier Loop Trail, and West Glacier Trail. Depending on which location was chosen for the Remote Glacier Dock, it may also be visible from the Visitor Center. If the south option were to be chosen, it would be shielded from view by the rock peninsula. If the north option were to be chosen, the dock and associated restroom facilities would be visible from the Visitor Center. In the future, both the Remote Glacier Dock and the Remote Glacier Visitor Area could be in the viewshed of the Visitor Center if they are relocated to follow the retreating glacier. The setting of certain heritage resources may also be altered by acoustic

disturbances, as more vehicles, people, and motorized boats on the lake increase anthropogenic noise at the site. Measures to avoid, reduce, or mitigate these adverse effects will be identified in the project PA.

Historic sites would also be vulnerable to indirect or inadvertent effects resulting from increased capacity, visitation, and accessibility afforded by Alternative 2, particularly in the Visitor Center Unit, where the increased visitation would be the most notable. This alternative proposes the greatest increase in capacity and outfitter/guide allocations and would have the greatest potential for visitor-induced damage to heritage resources out of all action alternatives. However, most of the historic sites in the MGRA are designed to be used by visitors and, in the case of historic trails, are also recreational resources where human use is expected. Measures to avoid, reduce, or mitigate these adverse effects will be identified in the project PA.

3.9.6.3 Alternative 3

Alternative 3 has a similar potential to impact known and unknown heritage resources as Alternative 2; however, with a smaller area of ground disturbance, the potential for adversely impacting historic properties is reduced. Development near the face of the glacier would also be reduced with the addition of a landing area for boats rather than a dock facility. Although fewer visitors would gain access to the glacier via motorized boats in this alternative than in Alternative 2, the Remote Glacier Visitor Area and associated floating restroom facilities would have similar impacts to heritage resources.

Direct impacts to the historic Visitor Center, Trail of Time, and West Glacier Trail would occur due to proposed infrastructure associated with these historic components; however, the impacts would be minor and would not exclude each sites' reason for listing on the NRHP because proposed infrastructure would be designed to keep with the historic nature of the existing facilities. The Forest Service will follow the project PA and work with the SHPO, ACHP, and tribal entities during the design implementation of each component.

With the modification to the proposed hardscape trails in the Welcome Center Complex area and shift of the Lakeshore Trail to a more inland alignment, impacts to the viewshed of historic properties (particularly the Visitor Center and Skater's Cabin) would be slightly reduced in this alternative. The Visitor Center Dock and West Glacier Dock configurations and locations under this alternative would be more visually impactful to the settings of historic sites. As above, if the north option were chosen for the landing area near the glacier, boat operations and associated floating restroom facilities would be visible from the Visitor Center. In the future, the landing area, restroom facilities, and Remote Glacier Visitor Area may all be visible from the Visitor Center if they are relocated, regardless of the initial location. Other visual, acoustic, and capacity-related impacts would be indistinguishable from Alternative 2.

3.9.6.4 Alternative 4

Alternative 4 has the smallest proposed acreage of ground disturbance of all the action alternatives and the least potential to adversely impact historic properties. While similar direct impacts to the historic Visitor Center and Trail of Time would occur as in Alternatives 2 and 3, there would be no direct impacts to West Glacier Trail. There would also not be any development of, or easier access to, the face of Mendenhall Glacier.

Visual/setting impacts would be reduced with the elimination of the Welcome Center Plaza area directly in front of the Visitor Center, boat docks and motorized boats, Remote Glacier Visitor Area, and mostly inland alignment of the Lakeshore Trail in this alternative. Capacity reduction proposed in Alternative 4 would reduce inadvertent impacts from increased visitation.

3.9.7 Cumulative Effects

The projects relevant to the discussion of cumulative impacts to cultural resources within the Mendenhall Valley are listed below in Table 3-41. These projects have the potential to impact known or undiscovered historic properties during implementation.

Table 3-41. Projects Considered for Analysis of Cumulative Effects to Heritage Resources

Project Name	Type	Action
MGRA East and West Glacier Trails Maintenance	Maintenance	Present
MGRA Visitor Center Maintenance	Maintenance	Present
Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements	Trail & Rec Improvements	Future
Montana Creek Master Plan	Trail & Rec Improvements	Future
Juneau Trails Master Plan	Trail & Rec Improvements	Future

The MGRA Visitor Center Maintenance and the East and West Glacier Trails Maintenance projects would be implemented under the 2017 Programmatic Agreement Among the USDA Forest Service Alaska Region, the Advisory Council on Historic Preservation and the Alaska State Historic Preservation Officer Regarding Heritage Program Manager on National Forests in the State of Alaska for activities taking place on NFS lands and appropriate procedures would be applied to ensure that the projects would meet the requirements of NHPA Section 106 (USDA Forest Service 2017). The three proposed recreation projects have the potential to disturb previously-undiscovered heritage resources in the Mendenhall Valley through trail improvements and creation of new recreational facilities. However, given the extent of previously conducted cultural and historic resource inventories in the Mendenhall Valley the likelihood of new discoveries is low. Further, climate change is accelerating glacier recession and uncovering new ground; however, the potential for new discoveries of historic properties on land where ice once occurred is low. When considered together with the current proposal, there would be no cumulative effects to cultural resources.

3.10 Air Quality

3.10.1 Scope of the Analysis

This section includes a summary of applicable regulations, a discussion of existing air quality conditions and monitoring efforts, and an analysis of potential short-term and long-term air quality impacts that could result from implementation of the proposed action or alternatives. The relationship between air quality and climate change was incorporated into the analysis in the cumulative effects discussion (see Section 3.10.7).

3.10.2 Regulatory Setting

3.10.2.1 Federal Regulations

Clean Air Act and National Ambient Air Quality Standards

Under the Clean Air Act, the EPA is tasked with setting limits on certain air pollutants (criteria air pollutants) that have potential to harm the environment and public health. The EPA works with and supports state, local, and tribal governments to reduce existing and control future air pollution. The EPA sets acceptable levels, known as the National Ambient Air Quality Standards (NAAQS), for six criteria air pollutants. NAAQS are published for nitrogen dioxide (NO₂), ozone (O₃), carbon monoxide (CO), lead (Pb), sulfur dioxide (SO₂), and particulate matter (PM_{2.5} and PM₁₀). Geographic areas with lower levels of the criteria air pollutants than the NAAQS are considered to be “attainment” areas; those with concentration higher than NAAQS for any one criteria air pollutant are “nonattainment” areas.

3.10.2.2 State and Local Regulations

ADEC Division of Air Quality

The Clean Air Act requires State and local governments to develop strategies to control air pollution on a local level. The ADEC Division of Air Quality establishes regulations, work practice standards, permit requirements, and strategies to minimize emissions of the six criteria pollutants. Additionally, there are extra control measures and strategies for identified nonattainment areas. These State regulations and strategies are contained in a State Implementation Plan (SIP). Alaska’s SIP was originally drafted in 1972 and has undergone several updates and revisions as needed to address local needs or meet updated State or Federal requirements. The SIP was revised in 1994 to include a nonattainment plan to control air quality violations in Juneau’s Mendenhall Valley.

City and Borough of Juneau

The ADEC monitors air quality in Juneau and works with the CBJ to respond to local air quality impacts in real time. The CBJ enacted a local ordinance in 2008 that created an emergency response system to interpret air quality data in the Mendenhall Valley and react immediately to pollutant levels that could be a detriment to human health in the community. During an air emergency, all wood stove burning is prohibited in the Mendenhall Valley.

3.10.3 Issues and Indicators

The issue statement below was drafted to address concerns and needed analysis related to air quality topics brought up during public scoping and under the regulatory setting.

Issue Statement: *Proposed increase in number of tour buses and the addition of motorized boats at the MGRA could contribute to periods of poor air quality in the Mendenhall Valley.*

Measurement Indicators:

- Estimate of increased levels of PM pollution over existing that would be generated from additional motorized vehicles by alternative

3.10.4 Affected Environment

The ambient concentrations of criteria pollutants are determined by the amount of pollutants emitted and the rate at which the pollutants are diluted and dispersed from the area. Natural factors that affect transport and dilution include topography, wind, atmospheric conditions, and the presence of sunlight.

3.10.4.1 Climate, Meteorology, and Topography

Southeast Alaska is generally characterized as a coastal rainforest, and Juneau receives wet weather patterns year-round from the Gulf of Alaska. As these patterns encounter the mountains surrounding Juneau, they are forced upwards towards cooler air and the moisture condenses into clouds and precipitation. As a result, the Mendenhall Valley often experiences cloudy and cool weather with an average of 58 inches of precipitation each year at the airport (Kelly et al. 2007). Weather patterns also often bring gusty, high winds to the Juneau area, but these winds are generally not experienced within the Mendenhall Valley.

The MGRA is located at the north end of the Mendenhall Valley, an area bounded on three sides by steep ridges and the Juneau icefield. The Mendenhall Valley is the largest residential area in Juneau, and the city's airport is situated at the south end.

On windless winter days, the valley can sometimes experience a temperature inversion where a layer of warmer air acts like a lid and traps colder air closer to the ground. This phenomenon also traps pollutants at ground level and can lead to decreased air quality in the valley until wind or precipitation clear the air (CBJ 2021).

3.10.4.2 Air Quality in the Mendenhall Valley

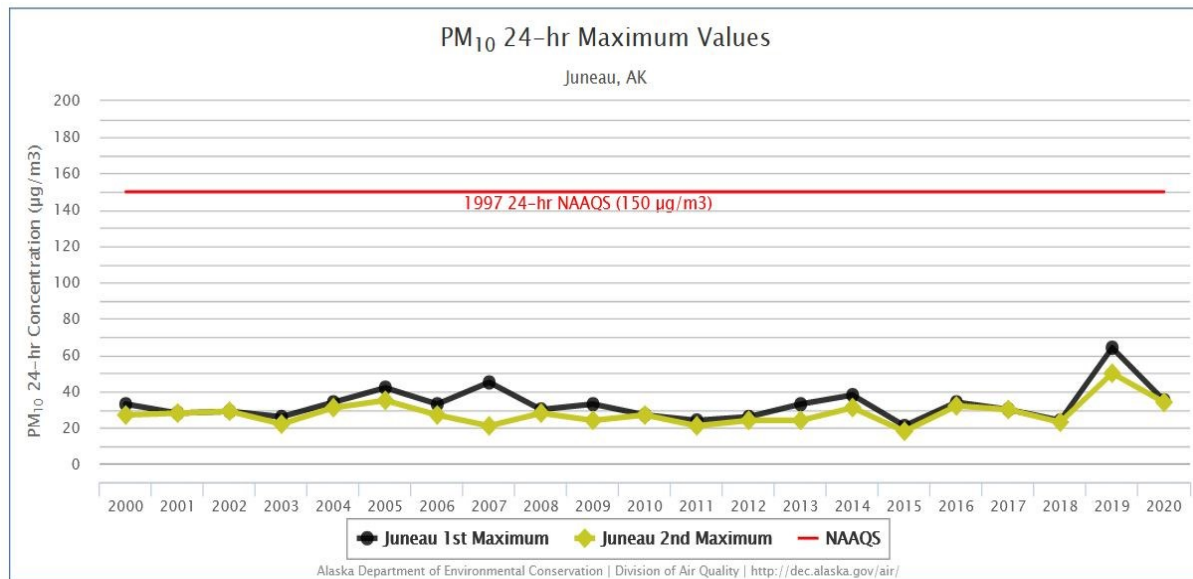
Although air quality in the Mendenhall Valley is generally good, the climate and topography coupled with a densely-populated residential zone where woodstoves are more likely to be used to heat homes can create air quality concerns. Particle pollution or particulate matter (PM), caused by fine dust, soot, smoke, and fuel burning (wood stoves, vehicles) can get into lungs and cause respiratory illness or chronic bronchitis, aggravate asthma, or reduce lung function (EPA 2007). Airborne particles smaller than 10 micrometers in diameter (PM₁₀) and those smaller than 2.5 micrometers in diameter (PM_{2.5}) are the most likely to harm human health. A significant portion of particle pollution (especially PM_{2.5}) is black carbon, a by-product of fossil fuel burning. In addition to deleterious health effects, black carbon in the air can be deposited on glaciers and icefields. Since dark particles absorb light and heat much more efficiently than

white snow, black carbon has been shown to accelerate glacier melting rates beyond what would be expected from rising global temperatures (Nagorski et al. 2019).

The Mendenhall Valley was designated as a nonattainment area in 1990 by the EPA for violations of the NAAQS by one criteria pollutant (PM₁₀) in the late 1980s. The PM₁₀ level in the Mendenhall Valley was higher than NAAQS (150 micrograms per cubic meter [µg/m³] – 24-hour average) in the 3 years of monitoring prior to the designation of nonattainment, and per EPA regulations, the ADEC was required to enact an air quality attainment and monitoring plan for this area.

Control of fugitive dust through roadway paving, regulations regarding open burning, and prohibition on woodstove burning during periods of poor air quality have helped the CBJ to meet the NAAQS for PM₁₀. The ADEC enacted a Limited Maintenance Plan (LMP) to demonstrate continued compliance with PM₁₀ standards (ADEC 2009). There have been no measured violations of the NAAQS for PM₁₀ in the Mendenhall Valley since 1994, and the EPA redesignated the area to attainment, effective July 8, 2013 (78 FR 27071). A second 10-year LMP to renew the area's attainment status was adopted by the ADEC on July 22, 2020 (ADEC 2020b).

Ongoing monitoring within the Mendenhall Valley maintenance area for the nonattainment criteria pollutant is required to retain attainment status, and the ADEC must demonstrate that measured levels are below the NAAQS level. To that end, one PM₁₀ monitoring site remains in Juneau, located at Floyd Dryden Middle School, approximately 1 mile south of the MGRA boundary and 2 miles south of the Visitor Center parking area. Figure 3-16 shows the maximum 24-hour PM₁₀ concentrations at the Floyd Dryden site for the monitoring years 2000 to 2020. The NAAQS 24-hour standard for PM₁₀ has not been exceeded during this time period, although the two highest data points during that time period (64 and 50 µg/m³) were experienced over two consecutive days in July 2019 (ADEC 2021b). This spike was most likely correlated to an unusually high number of wildfires that occurred near Juneau from May through September of 2019, resulting in air quality alerts issued for Southeast Alaska on July 5 through July 8 (ADEC 2021c).

Figure 3-16. Historical (2000 – 2020) Mendenhall Valley PM₁₀ Monitoring Data

Source: ADEC 2021b

The Floyd Dryden Middle School site also monitors levels of fine particulate matter less than 2.5 micrometers in diameter (PM_{2.5}); a contaminant caused by burning fuels, such as from woodstoves and motor vehicle emissions. The NAAQS 24-hour standard for PM_{2.5} is 35 µg/m³, and the annual mean standard is 12 µg/m³. In Juneau, PM_{2.5} concentrations reach their peak in winter and minimum in summer, stemming mainly from wood burning for residential heating. According to the 2016 monitoring report for the Floyd Dryden Middle School site, the PM_{2.5} 24-hour standard was exceeded six times between 2010 and 2015, all in the month of December when wood stove use was high. Yearly annual means were well below the NAAQS standard for this monitoring period, with the highest in 2010 at 8.7 µg/m³ (ADEC 2016).

3.10.4.3 Air Quality Monitoring at the MGRA

Emissions from vehicles driving into the MGRA, especially to the Visitor Center parking area, constitute a substantial percentage of particulate matter emitted in the area. Peak visitation days have caused observed (not monitored) episodic impacts to local air quality from bus exhaust fumes in the parking area. During 2018 and 2019, specialists from the University of Alaska Southeast and Forest Service Region 5 (California) and Region 10 (Alaska) air program staff performed an air quality assessment at the Visitor Center to determine if a correlation could be made between air quality and levels of visitor use at the MGRA. They measured the deposition of ammonium, nitrate, and sulfate (components of PM_{2.5} contamination) at three sites close to or within the Visitor Center's main parking area in the summer and winter months. Additionally, they monitored the ambient concentrations of particulate matter (PM_{2.5} in summer 2018, PM₁₀ in summer 2019) and ozone (O₃ in summers 2018 and 2019) at one location in the Visitor Center parking area.

The results of the deposition monitoring effort showed an increase in nitrate and sulfate deposition at the parking lot site during the summer versus the winter months. The increased deposition of these compounds is a good indicator of air pollution from vehicular traffic, with increases in sulfate levels in particular most likely coming directly from diesel-powered vehicles.

The summertime increase in both compounds was not detectable 1/4 mile away from the parking area (Fenn 2020). The data from the ambient air pollution monitor in the parking area also indicated a small weak correlation between the highest visitation days and localized PM₁₀ increases. The increase in PM₁₀ reached statistical significance on days when there were 142 or more bus trips to the Visitor Center, when three or more cruise ships were in Juneau, or when 4,000 or more passengers were on the cruise ships docked in Juneau, correlating to 9 µg/m³, 8 µg/m³, and 7 µg/m³ increases in PM₁₀ concentration, respectively (Schweizer 2020).

Reports from Forest Service staff estimate that on the busiest days of the summer there are approximately 300 bus trips to the Visitor Center. Queuing buses and vehicles idling along Glacier Spur Road add to localized air quality impacts. On busy days, 10 or more buses have been observed lined up waiting to drop or pick up passengers (Machek et al. 2007). The air quality monitoring studies showed while there is a slight correlation in visitor numbers and measured pollutants at the Visitor Center, the air quality index (AQI) for all three indicators (O₃, PM_{2.5}, and PM₁₀) was considered to be within the 0-50 AQI range (categorized as “good” air quality; Table 3-42) per EPA’s 2015 AQI standards throughout the two summers of the study. The 24-hour average PM₁₀ concentration was below 15 µg/m³, even on the highest concentration days. A 24-hour average PM₁₀ concentration of under 54 µg/m³ is considered to be in the “good” AQI range. In the worst month for PM₁₀ concentration in the study period (July), the monthly average for monitored PM₁₀ levels at the parking area was at 20 µg/m³ (Schweizer 2020). All other months in the study period (April, May, June, August, September, and October) had monthly averages below 10 µg/m³.

Table 3-42. Criteria Pollutant Concentrations Related to EPA’s Air Quality Indices and Category

Category	AQI	O ₃ (parts per million) 8-hour	PM _{2.5} (µg/m ³) 24-hour	PM ₁₀ (µg/m ³) 24-hour
Good	0-50	0.0 – 0.054	0.0 – 12.0	0 – 54
Moderate	51-100	0.055 – 0.070	12.1 – 35.4	55 – 154
Unhealthy for Sensitive Groups	101-150	0.071 – 0.085	35.5 – 55.4	155 – 254
Unhealthy	151-200	0.086 – 0.105	55.5 – 150.4	255 – 354
Very Unhealthy	201-300	0.106 – 0.200	150.5 – 250.4	355 – 424
Hazardous	301-500	0.200 – 0.600	250.5 – 500.4	425 – 604

Source: EPA 2013

3.10.5 Analysis Methods

For this analysis, an indicator and levels of effect have been set for the issues identified in Chapter 1 (see Section 1.5.1). Conclusions, such as whether an effect or impact is negligible, minor, moderate, or major are based upon the professional’s judgment of the magnitude of the change, the context and extent of the impact, and the timing and nature of activities taking place.

3.10.6 Direct and Indirect Effects

3.10.6.1 Alternative 1 – No Action Alternative

With the No Action Alternative, vehicle emissions at the MGRA would remain at the current level and air quality would generally be considered to be within the “good” AQI category for criteria pollutants. However, existing traffic congestion would continue on high volume days, with buses and personal vehicles waiting at the parking area and along Glacier Spur Road to drop off or pick up passengers or to locate a parking space. As tourism increases in Juneau, it is possible that more transportation service providers will maximize their underused service days, leading to more buses at the Visitor Center main parking area and increased localized pollutant concentrations. It is unlikely that an incremental change such as this would cause air quality at the Visitor Center parking area to exceed the EPA’s air quality indices to drop below the “good” threshold. Alternative 1 would have a **negligible effect** on air quality in the MGRA and Mendenhall Valley.

3.10.6.2 Effects Common to All Action Alternatives

The relationship between concentrations of air quality constituents and emissions from specific sources is extremely variable and complex, and this analysis correctly focuses on emissions. Beyond that, quantifying projected emissions is a complicated analytical process that would be undertaken in a NEPA review only if it were necessary to determine whether an air quality impact was significant or not. In this case, as discussed in Sections 3.10.4.2 and 3.10.4.3, there is a wide margin between the current criteria pollutant measurements for the MGRA parking area and the Mendenhall Valley and the poor rating threshold. As a result, this analysis can take a broader, less quantified approach and provide a sufficient basis for the significance determination.

Construction Impacts

Ground-disturbing activities during construction of project components would temporarily result in dust and emissions from heavy equipment. Construction site BMPs would be used to control fugitive dust in the project area and along access roads during construction in accordance with Federal, State, and local requirements. Additionally, excavation and grading activities would be suspended when an air quality emergency has been called for the Mendenhall Valley or when high winds and visible dust persists that creates a health hazard to neighboring property owners and/or visibility impacts to local vehicular traffic.

Glacier Spur Road Trailheads

The addition of three new parking areas along Glacier Spur Road would decrease the number of personal vehicles driving the additional distance to the main parking area and potentially idling on Glacier Spur Road waiting for a parking space. This would improve traffic flow in the main Visitor Center parking area, in turn decreasing vehicle congestion that can lead to localized air quality impacts.

3.10.6.3 Alternative 2 – Proposed Action

The project component with the greatest potential to impact local air quality is the increase in special use permit service days, specifically those that allow gas and diesel-powered transportation vehicles into the MGRA Visitor Center. Alternative 2 would allow for a gradual,

step-wise increase based on criteria met as outlined in the adaptive management plan which would eventually equate to higher numbers of tour buses arriving, circulating, and idling at the main parking area (Appendix B). Alternative 2's maximum proposed permitted transportation service days (estimated implementation at year 15) would be around 690,670, an increase of 226,860 service days or 49 percent over existing allocation (462,010). See Table 3-43 for the proposed percent increase in transportation service days at the Visitor Center main parking area under each alternative.

As shown in the study data from the air quality monitoring at the Visitor Center, localized air quality impacts were observed when there were 142 or more bus trips in one 24-hour period, correlating to an increase in 24-hour PM_{10} of $9 \mu g/m^3$ (Schweizer 2020). In the highest month for PM_{10} concentration in the study period (July), monitored 24-hour PM_{10} levels at the parking area averaged $20 \mu g/m^3$. Reports from Forest Service staff estimate that on the busiest days of the summer there are approximately 150 round trips completed by buses, equating to 300 bus trips to and from the Visitor Center. If the number of daily bus trips on the busiest days were increased by 50% based on the maximum number of transportation permit service days allowed under Alternative 2 (an additional 150 bus trips), it is assumed that average daily PM_{10} levels could rise another $9 \mu g/m^3$ to an estimated $29 \mu g/m^3$ on busy days (142 bus trips equals an approximate $9 \mu g/m^3$ increase in 24-hour PM_{10} levels).

This estimate is still well within the AQI of 0 to 54 $\mu g/m^3$ for 24-hour PM_{10} levels in the “good” category (Table 3-42). As visitation patterns are not static and change throughout the high use season, this is an estimation of air quality impacts that might occur on the busiest days of the summer and not a prediction of air quality impacts that would persist throughout the summer.

It should be noted that design of the Visitor Center parking area focuses on improving traffic flow and decreasing delays caused by a full parking area combined with visitors getting on and off tour buses. Under Alternative 2, buses would be able to park in designated spaces and shut off engines while loading and unloading passengers, rather than lining up on the roadway. Personal vehicles seeking parking spots would avoid having to wait outside the parking area or circling back to park along Glacier Spur Road. More available parking will greatly decrease traffic congestion at the parking area, reduce the potential for vehicle delays or backups along Glacier Spur Road, and reduce the likelihood of local air quality impacts from vehicle exhaust.

Under Alternative 2, the addition of a new parking area within the existing campground creates a new access point to the area's trail network with easy connections to other units in the MGRA. The campground parking area together with the Lakeshore Trail would allow visitors to park at the campground and walk to the Visitor Center and proposed Welcome Center Complex additions while avoiding the often-congested Visitor Center parking area altogether. This would help to alleviate concentration of vehicle emissions at a single location. While air quality at the Visitor Center parking area may be impacted on certain days (more than three cruise ships docked in Juneau; more than 142 bus trips to the Visitor Center), the impact would not be likely to extend beyond the parking area itself. The MGRA would experience a greater number of days under Alternative 2 and a greater number of total days in which local air quality may be impacted. The improved distribution of traffic to other areas of the MGRA, additional available parking, and improvement of traffic flow in the main parking area offered by Alternative 2 could also help to clear the air at the Visitor Center and offset negative impacts from increased traffic.

Table 3-43. Estimated Maximum Visitor Center Unit Transportation Permit Service Days to be Authorized Under Each Alternative

Alternative	Maximum Estimated Transportation Permit Service Days	Additional Service Days Compared to Alt 1	Increase in Service Days Over Alt 1
Alt 1	462,010	n/a	n/a
Alt 2	690,670	228,660	49%
Alt 3	554,340	92,330	20%
Alt 4	533,140	71,130	15%

Source: Appendix B

The proposal to add motorized boat tours on Mendenhall Lake under Alternative 2 has the potential to impact local air quality, as conventional motorized vehicles are a significant source of harmful air pollutant emissions such as PM_{2.5} and PM₁₀. Alternative 2 would require the boats to be powered by an alternative fuel source. Alternative fuels such as blends of diesel with biodiesel, made from raw vegetable oils, used cooking oils, yellow grease, and animal fats; or ethanol, made from the sugars found in grains such as corn, sorghum, and barley, show a reduction in pollutants such as PM depending on the percentage of alternative fuel in the blend (O'Malley and Searle 2021; Karavalakis et al. 2014). However, ethanol and biodiesels may increase the formation of nitrogen oxides. It is unlikely that boats powered by alternative fuel would introduce measurable air quality impacts from PM to the MGRA or the Mendenhall Valley.

Overall, Alternative 2 would have a localized, **minor effect** on air quality from additional motorized vehicles in the Visitor Center parking area and boats on the lake.

3.10.6.4 Alternative 3

Alternative 3's maximum proposed permitted transportation service days (estimated implementation at year 15) would be around 554,340 or an additional 92,330 service days, a 20 percent increase over existing allocation (462,010; Table 3-43). Increasing the number of bus trips by 20 percent on the busiest days (estimated 300 bus trips) represents an additional 60 buses trips to and from the Visitor Center parking area. Using the assumptions from the MGRA air quality study, this would cause average 24-hour PM₁₀ levels to rise another 4 µg/m³ to an estimated 24 µg/m³ (142 bus trips equals an approximate 9 µg/m³ increase in 24-hour PM₁₀ levels; 60 additional trips represent 42 percent of 142 bus trips, or a 4 µg/m³ increase). This level would be well within the "good" AQI for PM₁₀.

The new parking configuration would improve traffic flow and decrease delays that are currently experienced on days with high visitation, although to a slightly lesser degree (10 fewer personal parking spots) than the parking configuration proposed under Alternative 2.⁸ More available parking will greatly decrease traffic congestion at the parking area, reduce the potential for vehicle backups along Glacier Spur Road, and reduce the likelihood of local air quality impacts

⁸ Proposed total number of parking spaces:
 Alternative 2: 13 bus, 84 personal vehicle, 7 rideshare;
 Alternative 3: 13 bus, 74 personal vehicle, 7 rideshare; and
 Alternative 4: 10 bus, 74 personal vehicle, 7 rideshare.

from bus exhaust. Also similar to Alternative 2, the addition of a new parking area within the existing campground would create a new access point to the area's trail network with easy connections to other units in the MGRA. This would help to alleviate concentration of vehicle emissions at a single location.

The introduction of motorized boats on Mendenhall Lake under Alternative 3 would not introduce any new impacts to local air quality. Although conventional motorized vehicles are a significant source of harmful air pollutant emissions such as PM_{2.5} and PM₁₀, this alternative requires electric-powered boats, which generate no emissions. As such, the addition of motorized boats under Alternative 3 would not introduce measurable air quality impacts to the MGRA or the Mendenhall Valley.

Alternative 3 would also have a localized, **minor effect** on air quality since vehicle traffic could impact air quality at the Visitor Center; however, there would be **negligible effects** on air quality due to electric-powered boats.

3.10.6.5 Alternative 4

Alternative 4 would have the least potential to impact local air quality out of all three action alternatives. Alternative 4's maximum proposed permitted transportation service days (estimated implementation at year 15) would be around 533,140, a 15 percent increase over existing allocation (462,010; Table 3-43). Increasing the number of bus trips by 15 percent on the busiest days (around 45 more bus trips), using the assumptions from the MGRA air quality study as shown in Sections 3.10.6.3 and 3.10.6.4, average 24-hour PM₁₀ levels would rise another 3 µg/m³ to an estimated 23 µg/m³ and would remain within the "good" AQI for PM₁₀. Similar to Alternatives 2 and 3, although to a lesser degree as three fewer bus parking spaces would be constructed than in the other two action alternatives, the new parking configuration would improve traffic flow and decrease delays that are currently experienced on days with high visitation.⁸ Unlike the other action alternatives, Alternative 4 would not have additional parking area at the existing campground or the pedestrian crossing over the Mendenhall River to lessen impacts from vehicle emissions at the Welcome Center parking area.

The number of transportation service days would only be slightly increased over current conditions leading to fewer localized, **minor effects** to air quality than Alternatives 2 or 3. Impacts to local air quality from an increased number of buses would be alleviated by improved traffic flow and more available parking in the main parking area and provided by the Glacier Spur Road Trailheads.

This alternative does not introduce motorized boats to Mendenhall Lake; therefore, there would be a **negligible effect** on air quality from boat operations.

3.10.7 Cumulative Effects

The analysis of cumulative effects on air quality from this project takes into consideration air quality impacts from current and future proposals in the Mendenhall Valley and the greater Juneau area, as shown in Table 3-44. Additionally, climate change was incorporated into the analysis on air quality and is addressed at the end of this section.

Table 3-44. Projects Considered for Analysis of Cumulative Effects to Air Quality

Project Name	Type	Action
Mendenhall Glacier Mineral Withdrawal	Public Land Order Withdrawal	Present
Mendenhall Loop Road Capacity Improvements	Infrastructure	Present
Mendenhall Loop Road Resurfacing: Egan Drive to Stephen Richards	Maintenance	Present
Juneau Cruise Ship Dock Electrification	Infrastructure	Future
Small Cruise Ship Dock Construction	Infrastructure	Future
A.J. Dock Cruise Ship Berth Expansion	Infrastructure	Future
Franklin Dock Floating Berth Improvements	Infrastructure	Future
Norwegian Cruise Ship Berth (Aak'w [Auke] Landing) Construction	Infrastructure	Future

As the project occurs within the Mendenhall Valley and it is the area with the most sensitive air quality concerns, the analysis focuses on projects in that geographical region. The MGRA Mineral Withdrawal would protect air quality in the region by excluding mining claims and mining activities in areas recently uncovered by the retreating Mendenhall Glacier. There are no major infrastructure projects planned for the Mendenhall Valley that would decrease air quality in the area. Some planned road improvements on Mendenhall Loop Road would temporarily reduce air quality during construction, but it would not have air quality impacts after construction.

Many vehicle trips to the MGRA originate in downtown Juneau near the cruise ship docks each year, and air quality impacts have been a growing concern for the downtown area. Proposals to increase the capacity of ship facilities are being considered that would allow larger ships with a greater number of passengers to dock in Juneau. As ship size increases, the potential for air quality impact increases. Additionally, more passengers mean more tour buses shuttling visitors from the downtown docks to the MGRA and other locations. As the road system is limited in Juneau, these impacts have a higher likelihood of impacting sensitive regions such as the Mendenhall Valley.

The ADEC monitored air quality impacts from cruise ships throughout downtown Juneau during the summer of 2019. The monitoring study found that while air quality impacts could be detected and attributed to cruise ships, emissions events were typically brief and lasted only one to two hours. Although no significant impacts were found, cruise line groups have enacted emission mitigation plans in Juneau to address local air quality concerns stemming from ship emission plumes (ADEC 2021c). In addition, the ADEC regularly monitors air emissions (visual measurements of level of opacity) from cruise ships and ADEC staff respond to public complaints. All marine vessels, including cruise ships and ferries, must comply with Alaska's marine vessel emission standard (listed in 18 AAC 50.070). The standard states that visible emissions (opacity) from vessel smoke stacks must not cause greater than 20 percent reduction in visibility through the exhaust effluent, with limited time exemptions while maneuvering and in

port (ADEC 2021d). However, larger ships and more visitors using mass transportation to the MGRA and beyond could contribute to decreased air quality for Juneau in the future. If CBJ pursues dock electrification, many of the air quality impacts of larger and more cruise ships would be alleviated, as up to 1,585 hours of onboard power plant operation during mooring and consumption of up to 357,000 gallons of fuel would be replaced with shore power generated from CBJ hydropower facilities.

Local air quality may also be impacted by ongoing changes in atmospheric conditions as a result of climate change, leading to increased baseline levels of EPA criteria pollutants like ozone and PM. Atmospheric warming can lead to increases in ground-level ozone (EPA 2021). Although not generally a concern in rainy Southeast Alaska, climate change is having an effect on wildfires. Warmer temperatures, earlier snow melt, longer summers, and drier vegetation have led to longer and more active wildfire seasons. Emissions from wildfire contribute to ozone formation (smog) and are a major contributor of PM pollution (Reidmiller et al. 2018). The 2019 summer season saw wildfires impacting measured PM levels at the Floyd Dryden Middle School monitoring site over a few days in July, and it is expected that rare events like these could increase in the future.

Air quality impacts and increased PM pollution, especially black carbon, within the Mendenhall Valley may also contribute to accelerated warming of the Mendenhall Glacier and the Juneau Icefield through reduction of the albedo (ability of a surface to reflect sunlight) of the ice surfaces where it lands. Although black carbon deposition in Alaska can come from far away sources such as east Asia, sampling done at on the Juneau Icefield and Mendenhall Glacier indicate local source contributions from areas where municipal and vessel activity is the highest (Nagorski et al. 2019). The impacts of black carbon are also discussed in Section 3.11.4.3.

3.11 Climate Change and Greenhouse Gas Emissions

3.11.1 Scope of the Analysis

This section includes a discussion of the current state of climate change science and greenhouse gas (GHG) emission sources in Southeast Alaska, which includes the historical, current, and anticipated climate conditions within the MGRA; a summary of applicable Federal, state, and local regulations; and an analysis of GHG- and climate change-related impacts that could occur with implementation of the alternatives.

Researchers at the University of Alaska Southeast conducted a glaciology study of the Mendenhall Glacier in association with the proposed project to analyze the current and expected rate of glacial recession. Their analysis extends 30 years into the future; therefore, the temporal extent of the analysis of this resource also extends 30 years into the future. The spatial boundary of this discussion is Southeast Alaska, but includes consideration of the global nature of climate change.

3.11.2 Regulatory Setting

3.11.2.1 Federal Regulations

This project follows the Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and Effects of Climate Change in National Environmental Policy Act Reviews (issued by the Council on Environmental Quality [CEQ] in April 2016). This policy directs consideration, and wherever feasible calculation, of project-based carbon emissions.

For activities that are Federally funded or that take place on Federal lands, there are laws, regulations, guidelines, and EOs that apply to climate change. A partial list of applicable regulations is included below.

- EO 11988 – Floodplain Management
- EO 13690 – Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input
- EO 13693 – Planning for Federal Sustainability in the Next Decade
- EO 13990 – Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis
- EO 14008 – Tackling the Climate Crisis at Home and Abroad

3.11.2.2 Agency Guidance and Consistency with the 2016 Tongass Forest Plan

The Forest Service's Climate Change Considerations in Project Level NEPA Analysis dated January 13, 2009 guides consideration of the effect of a proposed project on climate change, including GHG emissions, and the effect of climate change on a proposed project, e.g., seasonal weather changes and the increased likelihood of extreme weather events. Additionally, FSH 1909.12 Land Management Planning includes methodology to assess existing carbon stocks and influences on carbon sequestration and storage.

The 2016 Forest Plan outlines implementation consistent with objectives provided by the USDA Forest Service Strategic Plan: FY 2015 to 2020 which includes a strategic goal to “sustain our nation’s forests and grasslands” with the associated objective to “foster resilient, adaptive ecosystems to mitigate climate change” (USDA Forest Service 2016; p. 6-1).

3.11.3 Issues and Indicators

The issue statements below were drafted to address concerns and needed analysis related to GHG emissions and climate change brought up during public scoping and under the regulatory setting.

Issue Statement: *Projected changes in climate and continued retreat of the Mendenhall Glacier may have effects on the proposed project and the MGRA.*

Issue Statement: *Greenhouse gas emissions from a greater number of tour buses and the addition of gas-powered boats on the lake could hasten the effects of climate change.*

Measurement Indicators:

- Projected changes in climate are addressed in the cumulative effects analysis for each issue in this draft EIS: wildlife and vegetation; recreation and visitor experience; watersheds, wetlands, and aquatic habitat; heritage resources; air quality; and socioeconomics and environmental justice
- Estimate of annual GHG emissions over existing that would be generated from transportation and boat access

3.11.4 Affected Environment

Climate change is an ongoing global phenomenon. The earth’s average temperature is increasing in direct response to a higher concentration of atmospheric levels of GHGs from burning fossil fuels (e.g., coal, petroleum, and natural gas) for energy consumption used for heating, transportation, electricity, and manufacturing. GHGs lead to an artificial exacerbation of the naturally occurring greenhouse effect. Under normal conditions, the greenhouse effect facilitates the planet’s habitable conditions, maintaining a livable temperature and levels of atmospheric oxygen capable of supporting life.

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Scientific consensus has demonstrated that human activities are responsible for an increase in GHG emissions above ambient conditions documented over the past 200 years (Intergovernmental Panel on Climate Change [IPCC] 2021). The increasing concentrations of atmospheric GHGs is causing an increase in the earth’s surface temperature, resulting in drastic environmental and climatic changes in the form of sea level rise, increasingly powerful storm systems, and changes in weather patterns and ocean conditions that are affecting the livelihoods of people globally.

3.11.4.1 Climate Change in Southeast Alaska

Southeast Alaska is experiencing the effects of climate change (USDA Forest Service 2016a; Ecodapt 2014). General regional trends include warmer air temperatures, heavier rain events, increased flooding frequency, ocean acidification, warmer water temperatures, increased

concentrations of toxins in the marine environment, more invasive species, variations in seasonal snowfall, and early or warm springs followed by frost affecting wild berry production (Holen 2017; USDA Forest Service 2016a). Additional analysis specific to the Tongass National Forest is available in “A Climate Change Vulnerability Assessment for Aquatic Resources in the Tongass National Forest” (EcoAdapt 2014).

Under the IPCC’s more conservative climate change modeling scenario, temperatures in Southeast Alaska are projected to increase by 2.9 to 5.4 degrees F by the 2040s and precipitation is projected to increase by 8.9 to 11.4 percent in the 2040s when compared to average conditions from 1970 to 1999⁹ (Littell 2016). Despite increased precipitation, total snowfall at low elevations in Southeast Alaska is projected to decline as a result of climate change (Lader et al. 2019; Ecoadapt 2014). IPCC modeling suggests the snowfall equivalent from October to March for low elevations of the central Southeast Alaska, including Juneau, is expected to decline by approximately 29.1 percent by the 2050s (Littell et al. 2018). Other predictions indicate temperatures may no longer dip below freezing during much of the winter by 2100 in lower elevations of the region (Ecoadapt 2014).

Most of the glaciers in Southeast Alaska are measurably retreating and shrinking. Data has demonstrated that rates of glacial ice loss in Southeast Alaska have been increasing in recent decades, exceeding 10 feet per year at some lower elevations (CBJ Scientific Panel on Climate Change 2007). Recent losses of glacial ice have a demonstrated association with climate warming and warmer seasonal trends, and recession can be exacerbated by additional changes in precipitation regimes and reduced snowfall (EcoAdapt 2014).

On a global scale, migratory birds are affected by reduced habitat availability along migration routes (King and Finch 2013), and salmon stocks are impacted by increasingly adverse ocean conditions like warming and acidification (EcoAdapt 2014). Wildlife in Southeast Alaska are affected by unseasonable weather events tied to climate change; late frosts and early warm weather can change the availability of key foraging resources such as wild berries, putting animals out of sync with critical food sources (Holen 2017). As a result of increased precipitation, regional salmon stocks are experiencing changing hydrologic conditions within freshwater spawning and rearing habitat. More frequent flooding is expected to limit egg-to-fry survival by scouring eggs from spawning gravels (Shanley and Albert 2014).

3.11.4.2 Climate Change in Juneau and the MGRA

Climate projections specific to the Juneau area include warmer temperatures, especially in the fall and winter, and increased annual precipitation with a shift to more rainfall than snowfall in comparison to historic conditions. From the 1950s to the mid-2000s, Juneau’s average temperature rose by 1.5 to 3 degrees F. Meanwhile, the average total winter snowfall decreased from 109 inches to 93 inches. The overall average winter precipitation (rain and snow combined) increased by at least 2.6 inches over that same time period (CBJ Scientific Panel on Climate Change 2007). For context, the climate in the Juneau area between 2000 and 2020 saw an

⁹ IPCC modeling is based on GHG concentration trajectories known as Representative Concentration Pathways (RCPs). The RCPs are based on possible radiative forcing values for the year 2100, and the most conservative RCP assumes radiative forcing value of 8.5 watts per square meter. Radiative forcing is the ability of the earth to retain the sun’s radiative heat, largely based on the concentration of atmospheric GHGs.

average temperature of 42.2 degrees F and an average total annual precipitation of 66.18 inches (National Weather Service 2021 and 2021a).

Notable local effects from climate change are an increased rate of glacial recession, extreme precipitation events, and glacial lake outbursts (see Section 3.8.4.7). These changes have increased the intensity and duration of flooding events within the MGRA. Based on an average from multiple moderate global climate prediction models, the Juneau area could see an increase in mean annual flood size of 15 to 20 percent by 2040 and 25 to 30 percent by 2080 relative to flood magnitudes from 1979 to 2000 (Sloat et al. 2017). Under those conditions, flooding could be associated with a 10 to 20 percent loss of Coho Salmon spawning habitat in the Mendenhall River subwatershed (Sloat et al. 2017). Additional discussion of glacier recession and flooding events is provided below (see also Section 3.8.4.7).

3.11.4.3 Mendenhall Glacier

Mendenhall Glacier is a lake-terminating, temperate maritime glacier within the Juneau Icefield, a network of 38 glaciers comprising the fifth largest icefield in North America. As of 2019, Mendenhall Glacier was 15.3 miles long and covered approximately 38 square miles (Kienholz et al. 2020). At its peak in the late 1700s during the Little Ice Age, the glacier covered Mendenhall Lake and terminated near the existing Back Loop Road (CBJ Scientific Panel on Climate Change 2007). Mendenhall Glacier is the most popular visitor attraction at the MGRA because it provides a uniquely accessible view of glacier activity. As one of the most accessible glaciers in Alaska, Mendenhall Glacier also provides an opportunity to educate people from around the world firsthand about the effects of climate change and glacier retreat.

Mendenhall Glacier has been receding for the last 200 years, but the rate has been increasing in the last few decades. It has retreated more than a mile since the Visitor Center was built in 1962, and half of that retreat occurred over the last two decades (Kienholz 2020). From 1998 to 2018, Mendenhall Glacier retreated an average of 170 feet per year (Amundson et al. 2020). By 2050, the glacier is expected to be land-terminating and could retreat out of sight of the Visitor Center.

As Southeast Alaska experiences warmer seasonal weather patterns from climate change, glacier recession has accelerated. The period from 2014 to 2019 was especially warm and Mendenhall Glacier experienced considerably higher thinning rates than observed over the previous 20 years. To account for climate variability and uncertainty in climate projections, glaciologists with the University of Alaska Southeast in Juneau modeled three scenarios to assess the potential range of change at Mendenhall Glacier from 2020 to 2050 (Amundson et al. 2020). The three thinning rate scenarios are derivations based on the accelerated thinning rate observed from 2014 to 2019. Under the “low” thinning rate, the glacier would retreat an average of 69 feet per year. The “medium” thinning rate would expect that the glacier retreats 190 feet per year. The worst-case scenario is the “high” thinning rate where the glacier would retreat approximately 276 feet per year.

Under all three modeling scenarios, the glacier retreats beyond the lake and becomes a land-terminating glacier within the study period. The retreat rate would likely slow as a land-terminating glacier; however, that decrease would be offset by projected warming trends. Given these conditions, current understanding of the glacier’s recession suggests the medium thinning rate is most accurate (Amundson et al. 2020). In all three scenarios, the glacier would be visible from the Visitor Center through 2030 and likely 2040. Under the high thinning rate, the glacier

could be entirely out of view of the Visitor Center area by 2050, causing a noticeable change to the visitor experience.

Since 2011, the MGRA and surrounding areas have experienced regular, periodic flooding due to glacial lake outbursts (discussed above in Section 3.8.4.7). By chance, glacial lake outburst flood events have not yet coincided with a heavy rain event, suggesting that larger flows are possible in the near future. The largest recorded glacial outburst events took place in 2014 and 2016, with flows above the 50-year flood magnitude of 447 cubic meters per second (Kienholz et al. 2020). Based on the current ice thickness at the entrance of Suicide Basin, glacial outburst events are expected to continue for another decade or two. Over that time, the glacier is expected to continue thinning and would likely retreat to the point that it is unable to form a substantial ice dam at Suicide Basin, and glacial outburst flood events would cease.

The thinning rate of the Mendenhall Glacier is also being influenced by the deposition of black carbon particulates, caused by the burning of fossil fuels, onto the surface of the Juneau Icefield. These particulates come from both long-range and local emissions sources. Burning fossil fuels emits black carbon particulates into the air. These particulates are deposited onto the surface of glaciers from local emissions and long-range sources. Black carbon deposits absorb light and heat more effectively than unpolluted snow, which accelerates glacier melting rates beyond melting expected from rising temperatures. Black carbon has been shown to accumulate on Mendenhall Glacier and at other locations on the Juneau Icefield during the summer season, with higher concentrations downwind (north) of Juneau's urban center (Nagorski et al. 2019). Localized black carbon sources could include cruise ship traffic, airport traffic, icefield helicopter tours, vehicle traffic, and building emissions.

3.11.4.4 Greenhouse Gas Emissions and Sustainability in Juneau

The CBJ has committed to reducing the municipality's carbon emissions by 25 percent by 2032 through the city's Climate Action and Implementation Plan (Juneau Commission on Sustainability [JCOS] 2011). In 2018, CBJ set an additional goal to reach 80 percent of Juneau's energy use powered by renewable energy sources as part of the Juneau Renewable Energy Strategy (JCOS 2018). Additional sustainability guidance comes from CBJ's Comprehensive Plan (2013) and the Juneau Economic Development Plan (2015). There are various ongoing and impending actions to meet sustainability standards outlined in these plans. Associated actions include reducing heating oil used in buildings, expanding renewable electricity infrastructure (e.g., hydropower and biomass), transitioning all transit sectors to electric vehicles, and providing cruise ships in port with shore power.

As part of achieving sustainability initiatives, CBJ received a Federal grant to purchase electric city buses and charging stations and have been working to gradually replace its aging fleet with electric buses (Jenkins 2020). CBJ added the first electric bus to its Capital Transit fleet in 2021 and is in the process of securing additional funding to purchase additional electric vehicles (Zigmund 2022). There are also incentives for personal electric vehicle ownership. CBJ offers free charging stations throughout the community for personal electric vehicles through a public/private partnership, and Alaska Electric Light and Power offers a reduced rate for nighttime vehicle charging (Renewable Juneau 2022).

The MGRA's current energy consumption is similar to the rest of the Juneau area. Most of Juneau's electricity is sourced from hydropower plants; however, electricity accounts for only 20

percent of the total energy used in the CBJ. Approximately 75 percent of buildings in Juneau, including the MGRA's Visitor Center, rely on oil for heat; however, available heating sources are expanding. As a product of Renewable Juneau efforts and the Juneau Carbon Offset Fund, air source heat pumps are increasingly popular for heating throughout the city (Yañez-Barnuevo 2021).

Cruise ship traffic is a significant source of GHGs. Southeast Alaska and Juneau are popular cruising destinations and additional and larger cruise ships are anticipated in the coming years to meet increasing demand. CBJ has approved funding to offer a second large cruise ship dock with access to hydroelectric shore power, and CBJ intends to provide shore power for all cruise ships in the future. Offering shore power reduces GHGs and local air quality impacts while cruise ships are in port (JCOS 2019).

In 2015, the Visitor Center received a Net Zero Fellowship from the Forest Service to pursue sustainability goals around energy, water, vehicle fleet, and waste. The fellowship was used as an opportunity to consider sustainability initiatives to guide the Master Plan for this project. Results of the fellowship included a water and energy assessment from the National Renewable Energy Laboratory and various facility improvements (USDA Forest Service 2015a).

Additional sustainability measures have been enacted around the goal to reduce overall consumables and waste produced by visitors and staff at the MGRA. Currently, the commercial overflow lot offers an electric vehicle charging station to buses accessing the MGRA. However, there are no electric vehicle charging stations available to the general public. Lighting inside the Visitor Center is supplied by low-energy light-emitting diodes and controlled by occupancy sensors to reduce energy consumption. The Forest Service provides facilities to separate compostable and recyclable materials within the waste stream. To reduce paper and water consumption, visitor bathrooms have electric hand dryers rather than paper towel dispensers and contain fixtures designed to reduce water use, such as waterless urinals. Additionally, the Visitor Center offers two water bottle fill stations to encourage the use of reusable materials rather than disposable plastics.

3.11.5 Analysis Methods

For this analysis, indicators have been set for the issues identified in Chapter 1 (see Section 1.5.1). Specific issue statements and indicators for this resource are listed in Section 3.11.3. The CEQ final guidance on consideration of GHG emissions and climate change in NEPA reviews recommends agencies use the projected GHG emissions associated with proposed actions as a proxy for assessing proposed actions' potential effects on climate change (CEQ 2016). Climate change results from the incremental addition of GHG emissions from different sources, which collectively have a large impact on a global scale (CEQ 2016). Therefore, conclusions are not provided as to whether an effect or impact is negligible, minor, moderate, or major in this analysis. Instead, GHG emissions estimates are compared among alternatives.

3.11.6 Direct and Indirect Effects

In this analysis, direct and indirect impacts of the project on climate change are considered to be contributions of the project, such as GHG emissions, energy consumption, and waste, to the ongoing climate change phenomena. The table below summarizes GHG emissions by alternative, which serve as the primary indicator for comparison (Table 3-45).

Table 3-45. Summary of Annual GHG Emissions by Alternative

Source	Alt 1(tons)	Alt 2 (tons)	Alt 3 (tons)	Alt 4 (tons)
Operations CO ₂ ^a	66.5	70.5	70.5	70.5
Transport CO ₂ ^b	1,334	2,244	1,927	1,777
Transport CH ₄	7.2 x 10 ⁻³	1.9 x 10 ⁻²	1.9 x 10 ⁻²	1.9 x 10 ⁻²
Transport N ₂ O	3.9 x 10 ⁻³	7.6 x 10 ⁻³	7.6 x 10 ⁻³	7.6 x 10 ⁻³
Boat CO ₂ ^c	0	357	0.25	0
Boat CH ₄	0	3.8 x 10 ⁻⁴	0	0
Boat N ₂ O	0	5.3 x 10 ⁻³	0	0

^a Operations includes heating of the Visitor Center, driving vehicles for operations and maintenance, and electricity use for the Visitor Center and Welcome Center. Welcome Center heating is not included in these estimates.

^b Estimated GHG emissions from all types of visitor transportation are based on the management unit capacities and commercial use allocations provided in the capacity analysis in Appendix A and adaptive management plan in Appendix B.

^c Emissions estimates for boats in Alternative 2 summary are based on use of 100% biodiesel. Use of 100% ethanol would result in lower CO₂ emissions.

3.11.6.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, changes in seasonal weather patterns, extreme weather events, and glacier recession would be expected for the foreseeable future. The various impacts of climate change on the MGRA are addressed within the applicable resource section and considered within cumulative effects.

Total global CO₂ emissions in 2019 from all sources in the world were approximately 36.8 gigatons (nearly 40 trillion U.S. tons [tons] of CO₂; Friedlingstein et al. 2019). In that context, operation of the MGRA does not contribute measurably to global GHG emissions or to changes to the area's immediate microclimate. However, there are GHG emissions associated with operations at the MGRA, from vehicles accessing the site and facility emissions from heating and electricity.

Under the No Action Alternative, existing facility emissions from operation of the Visitor Center and other MGRA facilities, such as outdoor lighting and vehicle use during maintenance operations would continue at current levels. Most GHG emissions within the MGRA come from heating oil used to heat the Visitor Center. Based on the results of a 2020 Visitor Center Building Assessment (USDA Forest Service 2020b), heating the Visitor Center would be expected to continue producing approximately 59 tons of CO₂ emissions each year (U.S. Energy Information Administration 2021). In 2014, the Forest Service vehicle fleet emitted 3.5 tons of CO₂ from driving associated with operations and maintenance (USDA Forest Service 2015a).

Electricity used in the MGRA comes primarily from hydropower provided by Alaska Electric Light and Power. Hydropower has no onsite (at the location of energy use) carbon emissions and fewer offsite (at the location of energy production) carbon emissions per kilowatt hour than fossil fuel-based energy sources, which have both onsite and offsite GHG emissions. While there are offsite emissions associated with development and maintenance of hydropower plants to consider (International Hydropower Association [IHA] 2021), offsite emissions per kilowatt hour from hydropower production can vary depending on design of hydropower facilities and

reservoirs (IPCC 2014). Based on the median rate of hydropower emissions (0.05 pounds of CO₂ per kilowatt hour; IHA 2021), the MGRA would emit approximately 4 tons of CO₂ annually (USDA Forest Service 2020b).

A rough estimate of anticipated GHG emissions of CO₂, CH₄, and N₂O from vehicles accessing the MGRA under the No Action Alternative is provided based on the existing management unit resource capacities and commercial use allocations compiled from the 2019 Supplemental Information Report (USDA Forest Service 2019), the capacity analysis provided in Appendix A, and the adaptive management plan provided in Appendix B. As a reference, a conservative estimate of annual CO₂ emissions from visitor transportation (i.e., emissions produced by visitor vehicles driving to and from the MGRA) under the No Action Alternative would be approximately 1,334 tons of CO₂ emissions each year. Annual emissions of CH₄, and N₂O would be nominal, less than one-hundredth of a ton each. Estimated GHG emissions by vehicle type and MGRA management unit are provided in Table 3-46.

Vehicle traffic and building emissions at the MGRA would also emit black carbon particulates, which contribute to surface melt and glacier recession on the Juneau Icefield, including at Mendenhall Glacier. Additional research on black carbon accumulation on the Juneau Icefield, area wind patterns, and emissions sources throughout Juneau are needed to quantify the effect of localized black carbon emissions (Nagorski et al. 2019).

Although this analysis could not quantify all emissions, an approximate estimate of the total GHG emissions under the No Action Alternative from vehicles accessing the MGRA and ongoing operation and maintenance activities would be approximately 1,400 tons. Additionally, as discussed above and outlined in the MGRA's Net Zero plan, there are ongoing energy conservation efforts and sustainability initiatives within the MGRA. These conditions would continue under the No Action Alternative.

Table 3-46. Estimated Annual Transportation GHG Emissions by Vehicle Type^a - No Action Alternative

Management Unit	Bus ^b CO ₂ (tons)	Van ^c CO ₂ (tons)	Passenger Vehicle ^d CO ₂ (tons)	Bus ^b CH ₄ ^e (tons)	Van ^c CH ₄ ^e (tons)	Passenger Vehicle ^d CH ₄ ^e (tons)	Bus ^b N ₂ O ^e (tons)	Van ^c N ₂ O ^e (tons)	Passenger Vehicle ^d N ₂ O ^e (tons)
Visitor Center Unit	790	123	56.4	1.5 x 10 ⁻³	1.4 x 10 ⁻³	2.4 x 10 ⁻³	1.4 x 10 ⁻³	5.6 x 10 ⁻⁴	5.0 x 10 ⁻⁴
West Glacier Unit	203	61	100	3.0 x 10 ⁻⁴	6.9 x 10 ⁻⁴	8.9 x 10 ⁻⁴	2.8 x 10 ⁻⁴	2.8 x 10 ⁻⁴	8.9 x 10 ⁻⁴
Total by Emissions Type	994	183	157	1.8 x 10 ⁻³	2.1 x 10 ⁻³	3.3 x 10 ⁻³	1.7 x 10 ⁻³	8.4 x 10 ⁻⁴	1.4 x 10 ⁻³
MGRA Total	1,334			7.2 x 10⁻³			3.9 x 10⁻³		

Notes:

^a Estimates are based on visitor numbers and service days provided in the capacity analysis (Appendix A) and adaptive management plan (Appendix B); assumes buses and vans drive 25 miles round trip to and from the boat harbor in downtown Juneau; and assumes passenger vehicles drive 10 miles round trip when accessing the MGRA.

^b Bus assumes diesel fuel, carrying 39 passengers each in the Visitor Center Unit (Machek et al. 2007), 30 passengers each in the West Glacier Unit (USDA Forest Service 2014), and includes motorcoaches, school buses, and tour buses; source of conversion factor: O'Dea 2018.

^c Van assumes gasoline fuel, carrying 15 passengers each, and includes sprinter vans and other small shuttles; source of conversion factor: M.J. Bradley and Associates 2019.

^d Passenger Vehicle assumes gasoline fuel, carrying 2 people each, and includes all non-commercial visitation; source of conversion factor: EPA 2021a.

^e EPA 2014

3.11.6.2 Effects Common to All Action Alternatives

Under all action alternatives, the proposed project could be adversely affected by changes in seasonal weather patterns, extreme weather events, and glacier recession associated with climate change. The various impacts of climate change on the MGRA are addressed within the applicable resource sections and considered within cumulative effects. The relationship between climate change and wildlife habitat availability is addressed within Wildlife and Vegetation (see Section 3.6.7). Impacts to visitor experiences from glacier recession are addressed within Recreation (see Section 3.7.7). Impacts to MGRA facilities from flooding events and changes to salmon habitat connected to climate change are addressed in Watersheds, Wetlands, and Aquatic Habitat (see Section 3.8.7).

There would be various impacts to climate change that would be common to all action alternatives, including impacts from construction of trails and facilities and operation of the Welcome Center and the Visitor Center. Although the extent of construction would vary between alternatives, the sources of GHG emissions from construction would be similar across all action alternatives.

Construction-related activities that would generate GHG emissions from vehicle and equipment exhaust include worker commute trips; haul trucks carrying supplies and materials to, from, and within the project site; and construction equipment (e.g., dozers, loaders, excavators, other heavy machinery). In addition to emissions from operating equipment, there would be onsite GHG emissions from paving and laying concrete for parking areas, paved walkways, and building components (Ramsden 2020). Construction may require an onsite and temporary construction office that would require electricity.

Construction of project components would involve tree clearing, resulting in some localized losses of sequestered CO₂. Impacts from removing trees and estimated acres of altered terrestrial habitat are identified in Section 3.6.6. There would also be some GHG emissions from ongoing maintenance projects over the long-term use of project infrastructure.

The Welcome Center would have an energy use intensity (combined heating and electricity demand) of approximately 17.6 kilowatt hours per square foot within the 12,845 square feet of air-conditioned area in the building (Alaska Energy Engineering, LLC 2021). Electricity would be provided by hydropower and annual CO₂ emissions from the building's electricity generation would be expected to be comparable to emissions from electric power at the Visitor Center (4 tons). The total level of GHG emissions associated with heating the Welcome Center would depend on the energy source - a fuel oil boiler system, electric boiler system, ground source heat pump system, and air source heat pump system are all under consideration (Alaska Energy Engineering, LLC 2021).

GHG emissions for the Visitor Center for all action alternatives would be consistent with those outlined for the No Action Alternative. Annual CO₂ emissions from heating the Visitor Center would produce approximately 59 tons of CO₂ emissions each year. Annual CO₂ emissions from electricity used at the Visitor Center would produce approximately 4 tons of CO₂ annually.

The proposed Welcome Center building would be anticipated to qualify for a Leadership in Energy and Environmental Design (LEED) Silver rating based on energy innovations and sustainability features, such as energy efficient insulation and combining radiant heat with thermal mass concrete flooring. Sustainability features of the Visitor Center would be consistent

with those outlined above for all action alternatives. In addition, the proposed parking expansion would provide a minimum of two electric vehicle charging spaces for passenger vehicles. Additional electric charging stations for tour/guide outfitter buses would be possible at the commercial overflow lot, depending on demand.

3.11.6.3 Alternative 2 – Proposed Action

GHG emissions unique to Alternative 2 would come from an increased number of vehicles accessing the MGRA and operation of motorized boats on Mendenhall Lake. The requirement for boats to use alternative (non-petroleum) fuel sources or low-emission motors would have the effect of lowering overall GHG emissions when compared to traditional diesel or gasoline-powered engines; however, depending on the fuel source selected, benefits may only be realized when analyzing the total life-cycle emissions. For example, the CO₂ emitted from an ethanol motor may be offset by CO₂ captured from crops grown to produce the fuel (U.S. Department of Energy 2021). As a reference, estimated annual onsite emissions for proposed 49-passenger motorized boats with half a mile per gallon fuel efficiency powered by 100 percent biodiesel and 100 percent ethanol are provided in Table 3-47. These estimates do not take into account any offsetting carbon captured from the production of alternative fuels and applicable project emissions would depend on an operator's selection from approved fuel types. There would be additional emissions associated with maintenance operations (such as maintenance dredging) not captured in the estimates provided below.

Table 3-47. Estimated GHG Emissions from Motorized Boat Operations – Alternative 2

Alternative Fuel	CO ₂ Emissions (tons)	CH ₄ Emissions (tons)	N ₂ O Emissions (tons)
100% Biodiesel	357	3.8 x 10 ⁻⁴	5.3 x 10 ⁻³
100% Ethanol	217	3.8 x 10 ⁻⁴	3.4 x 10 ⁻³

Source: EPA 2014

Assumptions: 20 trips per day, 214 days, 4 miles round trip, 0.5 mile per gallon (estimated from Brix Marine 2021)

Estimated GHG emissions from all types of visitor transportation are based on the management unit resource capacities and commercial use allocations provided in the capacity analysis in Appendix A and adaptive management plan in Appendix B. A conservative estimate of CO₂ emissions from visitor transportation would be approximately 2,244 tons of CO₂ emissions each year. Annual emissions of CH₄ and N₂O would be nominal, less than one-tenth and one-hundredth of a ton, respectively. Estimated GHG emissions by vehicle type and MGRA management unit are provided in Table 3-48. It is likely that over the duration of the project, some passenger vehicles and buses accessing the MGRA would be electric, lowering transportation emissions from these sources. Compared to the No Action Alternative, Alternative 2 would increase the amount of tangible GHG emissions (CO₂) produced by visitor transportation by 68 percent.

As a by-product of elevated GHG emissions from visitor transportation and motorized boat traffic, Alternative 2 would increase black carbon particulate emissions from the MGRA. This particulate emission could contribute to surface melt and glacier recession on the Juneau Icefield, including at Mendenhall Glacier.

Table 3-48. Estimated Annual Transportation GHG Emissions by Vehicle Type^a – Alternative 2

Management Unit	Bus ^b CO ₂ (tons)	Van ^c CO ₂ (tons)	Passenger Vehicle ^d CO ₂ (tons)	Bus ^b CH ₄ ^e (tons)	Van ^c CH ₄ ^e (tons)	Passenger Vehicle ^d CH ₄ ^e (tons)	Bus ^b N ₂ O ^e (tons)	Van ^c N ₂ O ^e (tons)	Passenger Vehicle ^d N ₂ O ^e (tons)
Visitor Center Unit	1177	183	289	2.2 x 10 ⁻³	2.1 x 10 ⁻³	1.2 x 10 ⁻²	2.1 x 10 ⁻³	8.4 x 10 ⁻³	2.6 x 10 ⁻³
West Glacier Unit	284	85	226	4.2 x 10 ⁻⁴	9.6 x 10 ⁻⁴	1.2 x 10 ⁻³	3.9 x 10 ⁻⁴	3.9 x 10 ⁻⁴	1.2 x 10 ⁻³
Total by Emissions Type	1462	267	515	2.7 x 10 ⁻³	3.0 x 10 ⁻³	1.4 x 10 ⁻²	2.5 x 10 ⁻³	1.2 x 10 ⁻³	3.8 x 10 ⁻³
MGRA Total	2,244			1.9 x 10⁻²			7.6 x 10⁻³		

Notes:

^a Estimates are based on visitor numbers and service days provided in the capacity analysis (Appendix A) and adaptive management plan (Appendix B); assumes buses and vans drive 25 miles round trip to and from the boat harbor in downtown Juneau; and assumes passenger vehicles drive 10 miles round trip when accessing the MGRA.

^b Bus assumes diesel fuel, carrying 39 passengers each in the Visitor Center Unit (Machek et al. 2007), 30 passengers each in the West Glacier Unit (USDA Forest Service 2014), and includes motorcoaches, school buses, and tour buses; source of conversion factor: O'Dea 2018.

^c Van assumes gasoline fuel, carrying 15 passengers each, and includes sprinter vans and other small shuttles; source of conversion factor: M.J. Bradley and Associates 2019.

^d Passenger Vehicle assumes gasoline fuel, carrying 2 people each, and includes all non-commercial visitation; source of conversion factor: EPA 2021a.

^e EPA 2014

3.11.6.4 Alternative 3

GHG emissions specific to Alternative 3 would come from vehicles accessing the MGRA and operation of electric boats. Under Alternative 3, motorized boats would be required to be electric, lowering the overall GHG emissions of this alternative. There would be some offsite emissions associated with hydropower electricity used to charge and power electric boats at the docks. Although hydropower emissions vary by producer, a conservative assumption of one hour per boat round trip and the maximum trips as outlined in Appendix B (assuming two boats each charging 12 hours a day for 214 days) would emit less than 0.25 tons of CO₂ annually from operating electric boats.¹⁰ There would also be some emissions and environmental impacts (mineral extraction for battery development) from production of electric boats. However, a life-cycle assessment of electric and gasoline powered boats indicates that electric boats have lower GHG emissions over their lifetime than gasoline-powered boats (Hemez et al. 2020).

Estimated GHG emissions from visitor transportation are based on the management unit resource capacities and commercial use allocations provided in the capacity analysis in Appendix A and adaptive management plan in Appendix B. A conservative estimate of CO₂ emissions from visitor transportation would be approximately 1,927 tons of CO₂ emissions each year. Annual emissions of CH₄, and N₂O would be nominal, less than one-tenth and one-hundredth of a ton, respectively. Estimated GHG emissions by vehicle type and MGRA management unit are provided in Table 3-49. Similar to Alternative 2, it is likely that over the duration of the project, some passenger vehicles and buses accessing the MGRA would be electric, lowering emissions from these sources. Compared to the No Action Alternative, Alternative 3 would increase the amount of tangible GHG emissions (CO₂) produced by visitor transportation by 44 percent.

Although less than Alternative 2 because electric boats would be used, Alternative 3 would increase black carbon particulate emissions from the MGRA and could contribute to surface melt and glacier recession on the Juneau Icefield, including at Mendenhall Glacier.

¹⁰ Calculation assumes 1 kilowatt hour per hour of charging and is based on 0.05 pounds of CO₂ emitted per kilowatt hour of hydropower electricity (IHA 2021).

Table 3-49. Estimated Annual Transportation GHG Emissions by Vehicle Type^a – Alternative 3

Management Unit	Bus ^b CO ₂ (tons)	Van ^c CO ₂ (tons)	Passenger Vehicle ^d CO ₂ (tons)	Bus ^b CH ₄ ^e (tons)	Van ^c CH ₄ ^e (tons)	Passenger Vehicle ^d CH ₄ ^e (tons)	Bus ^b N ₂ O ^e (tons)	Van ^c N ₂ O ^e (tons)	Passenger Vehicle ^d N ₂ O ^e (tons)
Visitor Center Unit	945	147	240	2.2 x 10 ⁻³	2.1 x 10 ⁻³	1.2 x 10 ⁻²	2.1 x 10 ⁻³	8.4 x 10 ⁻⁴	2.6 x 10 ⁻³
West Glacier Unit	284	85	226	4.2 x 10 ⁻⁴	9.6 x 10 ⁻⁴	1.2 x 10 ⁻³	3.9 x 10 ⁻⁴	3.9 x 10 ⁻⁴	1.2 x 10 ⁻³
Total by Emissions Type	1229	231	466	2.7 x 10 ⁻³	3.0 x 10 ⁻³	1.4 x 10 ⁻²	2.5 x 10 ⁻³	1.2 x 10 ⁻³	3.8 x 10 ⁻³
MGRA Total	1,927			1.9 x 10⁻²			7.6 x 10⁻³		

Notes:

^a Estimates are based on visitor numbers and service days provided in the capacity analysis (Appendix A) and adaptive management plan (Appendix B); assumes buses and vans drive 25 miles round trip to and from the boat harbor in downtown Juneau; and assumes passenger vehicles drive 10 miles round trip when accessing the MGRA.

^b Bus assumes diesel fuel, carrying 39 passengers each in the Visitor Center Unit (Machek et al. 2007), 30 passengers each in the West Glacier Unit (USDA Forest Service 2014), and includes motorcoaches, school buses, and tour buses; source of conversion factor: O'Dea 2018.

^c Van assumes gasoline fuel, carrying 15 passengers each, and includes sprinter vans and other small shuttles; source of conversion factor: M.J. Bradley and Associates 2019.

^d Passenger Vehicle assumes gasoline fuel, carrying 2 people each, and includes all non-commercial visitation; source of conversion factor: EPA 2021a.

^e EPA 2014

3.11.6.5 Alternative 4

Since there would be no motorized boats associated with Alternative 4, GHG emissions specific to this alternative would come from vehicles accessing the MGRA. Estimated GHG emissions from visitor transportation are based on the management unit resource capacities and commercial use allocations provided in the capacity analysis for the MGRA provided in Appendix A and the adaptive management plan for the MGRA provided in Appendix B. A conservative estimate of CO₂ emissions from visitor transportation would be approximately 1,777 tons of CO₂ emissions each year. As with all other alternatives, annual emissions of CH₄, and N₂O would be nominal, less than one-tenth and one-hundredth of a ton, respectively. Estimated GHG emissions by vehicle type and MGRA management unit are provided in Table 3-50. As with the other action alternatives, it is likely that over the duration of the project, some passenger vehicles and buses accessing the MGRA would be electric, lowering transportation emissions attributable to this alternative.

There would be fewer overall infrastructure components associated with Alternative 4; therefore, although difficult to quantify, construction-related activities that would generate GHG emissions from vehicle and equipment exhaust would be less. Localized losses of sequestered CO₂ would be less than under other build alternatives because there would be less tree clearing. Further, there would also be fewer GHG emissions from ongoing maintenance because less project infrastructure would be constructed.

Overall, Alternative 4 would increase the amount of tangible GHG (CO₂) emissions produced by visitor transportation by 33 percent when compared to the No Action Alternative and would have fewer GHG emissions than other action alternatives. Alternative 4 would also increase black carbon particulate emissions from the MGRA and could contribute to surface melt and glacier recession at Mendenhall Glacier, although more slowly than other action alternatives.

Table 3-50. Estimated Annual Transportation GHG Emissions by Vehicle Type^a – Alternative 4

Management Unit	Bus ^b CO ₂ (tons)	Van ^c CO ₂ (tons)	Passenger Vehicle ^d CO ₂ (tons)	Bus ^b CH ₄ ^e (tons)	Van ^c CH ₄ ^e (tons)	Passenger Vehicle ^d CH ₄ ^e (tons)	Bus ^b N ₂ O ^e (tons)	Van ^c N ₂ O ^e (tons)	Passenger Vehicle ^d N ₂ O ^e (tons)
Visitor Center Unit	909	141	218	2.2 x 10 ⁻³	2.1 x 10 ⁻³	1.2 x 10 ⁻²	2.1 x 10 ⁻³	8.4 x 10 ⁻⁴	2.6 x 10 ⁻³
West Glacier Unit	284	85	140	4.2 x 10 ⁻⁴	9.6 x 10 ⁻⁴	1.2 x 10 ⁻³	3.9 x 10 ⁻⁴	3.9 x 10 ⁻⁴	1.2 x 10 ⁻³
Total by Emissions Type	1193	226	358	2.7 x 10 ⁻³	3.0 x 10 ⁻³	1.4 x 10 ⁻²	2.5 x 10 ⁻³	1.2 x 10 ⁻³	3.8 x 10 ⁻³
MGRA Total	1,777			1.9 x 10⁻²			7.6 x 10⁻³		

Notes:

^a Estimates are based on visitor numbers and service days provided in the capacity analysis (Appendix A) and adaptive management plan (Appendix B); assumes buses and vans drive 25 miles round trip to and from the boat harbor in downtown Juneau; and assumes passenger vehicles drive 10 miles round trip when accessing the MGRA.

^b Bus assumes diesel fuel, carrying 39 passengers each in the Visitor Center Unit (Machek et al. 2007), 30 passengers each in the West Glacier Unit (USDA Forest Service 2014), and includes motorcoaches, school buses, and tour buses; source of conversion factor: O'Dea 2018.

^c Van assumes gasoline fuel, carrying 15 passengers each, and includes sprinter vans and other small shuttles; source of conversion factor: M.J. Bradley and Associates 2019.

^d Passenger Vehicle assumes gasoline fuel, carrying 2 people each, and includes all non-commercial visitation; source of conversion factor: EPA 2021a.

^e EPA 2014

3.11.7 Cumulative Effects

The analysis of cumulative effects on climate from this project takes into consideration how current and future proposals in the Mendenhall Valley and the greater Juneau area, as shown in Table 3-51, could contribute to climate change. Additionally, climate change would be expected to have impacts on the proposed project.

Table 3-51. Projects Considered for Analysis of Cumulative Effects to Climate Change

Project Name	Type	Action
Helicopter Landing Tours on the Juneau Icefield	Management	Past/Ongoing
MGRA Visitor Center Maintenance	Maintenance	Present
MGRA East and West Glacier Trails Maintenance	Maintenance	Present
Mendenhall Glacier Mineral Withdrawal	Public Land Order Withdrawal	Present
MGRA Point-to-Point Transport Special Use Permitting	Management	Present
Mendenhall Campground Repaving	Trail & Rec Improvements	Present
Back Loop Bridge and Dredge Lakes Trailhead Parking Area Improvements	Trail & Rec Improvements	Present
Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements	Trail & Rec Improvements	Future
Montana Creek Master Plan	Trail & Rec Improvements	Future
Juneau Trails Master Plan	Trail & Rec Improvements	Future
JCOS Climate Action and Implementation Plan ^a	Infrastructure	Present/Future
Juneau Cruise Ship Dock Electrification	Infrastructure	Present/Future
MGRA Hydropower	Infrastructure	Future
Small Cruise Ship Dock Construction	Infrastructure	Future
A.J. Dock Cruise Ship Berth Expansion	Infrastructure	Future
Franklin Dock Floating Berth Improvements	Infrastructure	Future
Norwegian Cruise Ship Berth (Aak'w [Auke] Landing) Construction	Infrastructure	Future

^a Components of this plan and associated actions are described in more detail in Section 3.11.4.4.

As discussed, total global CO₂ emissions in 2019 were approximately 36.8 gigatons (nearly 40 trillion tons of CO₂; Friedlingstein et al. 2019). In that context, the proposed project taken in consideration of other projects planned or currently occurring within the Mendenhall Valley and Juneau area would not contribute measurably to total global emissions. However, climate change is inherently cumulative, and these projects would collectively contribute incrementally to the global phenomena of climate change.

There would be GHG emissions associated with helicopter landing tours within the Juneau Icefield. There would also be some GHG emissions from construction associated with the various maintenance projects, trail and recreation improvements, and infrastructure proposals. The Mendenhall Glacier Mineral Withdrawal would exclude mining claims and mining activities in areas recently uncovered by the retreating Mendenhall Glacier, avoiding additional GHG emissions from increased mining operations.

Some trail improvement projects within or connected to the Mendenhall Valley, such as the Montana Creek Master Plan and the Kaxdigoowu Heen Dei (Brotherhood Bridge Trail) Improvements, could improve non-motorized access to the MGRA. More visitors accessing the MGRA via trails on bikes or on foot would incrementally reduce GHG emissions associated with non-commercial visitor access.

Through the Juneau Climate Action and Implementation Plan and associated actions, the CBJ has committed to reducing Juneau's GHG emissions. Actions identified in the plan include converting buildings to use alternatives to heating oil and transitioning Juneau to use electric-powered transit and freight vehicles. The proposed project would be compatible with foreseeable sustainability innovations to meet the plan's GHG emissions goals, such as electric tour buses or expanded electric-powered public transit options. These changes would reduce GHG emissions within the MGRA over the life of the project.

The creation of an educational small-scale hydropower facility on an upstream location along Steep Creek would enhance the interpretive opportunities around climate change available at the MGRA. The potential contribution to the MGRA's energy supply would be dependent on the facility's final design and implementation. There is no formal proposal to incorporate such a facility into the MGRA at this time.

Cruise ships have a high carbon footprint as compared to other modes of transportation (University of Colorado Boulder 2016). The proposed cruise ship infrastructure projects would allow access for larger cruise ships, and as a result, bring more visitors to Juneau. A conservative estimate would be that large cruise ships use 250 tons of diesel fuel per day, or more than 80,000 gallons (University of Colorado Boulder 2016). Based on the 2019 cruise ship schedule and assuming cruise ships spend an average of 10 hours in the Juneau port during each trip (Cruise Port Insider 2019), cruise ships could emit more than 200,000 tons of CO₂ annually while in port in Juneau (EPA 2014). GHG emissions from increased cruise ship traffic would also emit more black carbon particulates upwind of the MGRA.

Although this estimate does not take into account cruise ships using the existing shore power infrastructure to access the hydropower grid, it also does not consider the larger travel associated with cruise ships visiting Juneau (e.g., length of cruise, flights to/from port of origin). There would be additional shore power expected to be available over the course of the project, and it would be possible for some cruise ships to transition to electric power or alternative fuels with lower emissions, such as hydrogen fuel cells.

3.12 Socioeconomics and Environmental Justice

3.12.1 Scope of the Analysis

Implementation of the alternatives has the potential to affect not only the physical environment but also the social and economic (socioeconomic) environment. Socioeconomic resources are the combination of economic and social dynamics and conditions of the relevant population. Socioeconomics considers income, demographic, education, employment, and occupational statuses of the population associated with the study area. Environmental justice analyzes disproportionate impacts to a sector of the community, such as low-income populations or minority populations.

This section includes a description of the population adjacent to the MGRA in the Mendenhall Valley (2.5-mile radius) and the existing socioeconomic conditions of the larger community of Juneau. The analysis extends 30 years into the future to encompass projected design capacity.

3.12.2 Regulatory Setting

3.12.2.1 Federal Regulations

EO 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

EO 12898 instructs all Federal agencies to identify and address the disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations to the greatest extent practicable. As defined by the EPA, environmental justice promotes the fair and equitable treatment of all people, with respect to the degree of protection from environmental and health hazards, regardless of race, color, national origin, language spoken, or income (EPA 2021b).

CEQ provides the following definitions to guide compliance with environmental justice requirements in NEPA (CEQ 1997):

- “Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.”
- “Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census’ Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.”

3.12.2.2 Consistency with the 2016 Tongass Forest Plan

The Forest Plan recognizes the magnitude of effect the Tongass National Forest has on industry in Southeast Alaska, particularly tourism, and sets standards and guidelines for Forest Service

staff to work cooperatively with the tourism industry. Key standards and guidelines related to socioeconomic resources are listed in Chapter 4 of the Forest Plan. They include: identify important tourism resources such as visitor attractions and activities; track changing industry trends; develop infrastructure to support the needs of the tourism industry; and offer commercial recreation opportunities to recreation service partners through the use of special use permits (USDA Forest Service 2016, pp. 4-42 to 4-47). Special use permits are discussed in more detail in Section 3.7, Recreation and Visitor Experience.

3.12.3 Issues and Indicators

The issue statements below were drafted to address concerns and analysis needs related to socioeconomic topics brought up during public scoping and under the regulatory setting.

Issue Statement: *Proposed developments could impact minority and/or low-income populations at a higher level than the general public.*

Issue Statement: *Proposed activities may impede local traffic flows and impact resident quality of life.*

Issue Statement: *The Forest Service has a duty to help people share and enjoy the forest that it might not be meeting at the MGRA due to crowded conditions and limited infrastructure.*

Measurement Indicators:

- Analysis of proposed facilities and increases in visitor capacity and commercial use increases could impact minority and/or low-income populations
- Qualitative analysis of impact from commercial use increases on local traffic volumes
- Qualitative analysis of proposed project's support of the both the regional and local economy and visitor industry

3.12.4 Affected Environment

3.12.4.1 Community Overview and Demographics

As Alaska's State capital, Juneau supports a population of around 32,255 residents, with the top employing industries being public administration, healthcare, education, retail, accommodation and food services, and transportation (U.S. Census Bureau 2019). The Mendenhall Valley has been the most rapidly growing suburban area in Juneau over the past 30 years. Around 13,000 residents (40 percent of Juneau's population) live in the Mendenhall Valley, which has become a residential and recreational hub for Juneau (Alaska Department of Labor and Workforce Development 2020). Approximately 75 percent of Juneau residents, and 74 percent of the Mendenhall Valley residents, identify as white or as two or more races (Table 3-52).

Table 3-52. Demographics for Alaska, Juneau, and the Mendenhall Valley

Geographic Area	Population	White	American Indian/Alaska Native	Asian	Black	Pacific Islander	Some Other Race	Two or More Races
Alaska	733,391	59%	15%	6%	3%	1.7%	2.5%	12%
CBJ	32,255	62%	11%	6.5%	1%	1.5%	2%	15%
East Mendenhall Valley	5,983	55%	13.5%	8.3%	1%	3%	1.6%	17%
West Mendenhall Valley	7,064	59%	10%	8%	1%	2%	2.7%	17%

Source: U.S. Census Bureau 2020

In the recent census, Juneau had a higher estimated median household income (\$88,390) and a lower percentage of low-income residents (17 percent; defined as households where the household income is less than or equal to twice the Federal poverty level) when compared to estimates for Alaska (\$77,640; 25 percent) and the United States (\$62,843; 33 percent) (Table 3-53; U.S. Census Bureau 2019; EPA 2021c). In the Mendenhall Valley, the proportion of the low-income population specifically within 2.5 miles of the MGRA is 9 percent, less than the average of all three geographic areas (Juneau, Alaska, and the United States).

Table 3-53. Median Household Income and Percentage of Low-Income Population

Geographic Area	Median Household Income	Percentage of Low-Income Population ^a
United States	\$62,843	33
Alaska	\$77,640	25
CBJ	\$88,390	17
Mendenhall Valley	not defined ^b	9

Source: U.S. Census Bureau 2019; EPA 2021c

^a Low income is defined as a household where the household income is less than or equal to twice the Federal poverty level.

^b A meaningful source of data for this parameter at the census tract level was not identified.

In the study area, there are no minority populations greater than 50 percent of the Mendenhall Valley's population or meaningfully greater than the minority population percentage in the general population of the CBJ. Similarly, no areas with a large low-income population are identified in the study area.

Although only accessible by air or water transportation, Juneau is a service and recreation hub for residents and visitors. The summer visitor season provides economic uplift via visitor spending and sales tax revenues, but it does not support year-round full-time employment for Juneau residents. The visitor surge does cause seasonal impacts to recreation destinations,

roadway congestion, and noise levels in neighborhoods and the downtown area (McKinley Research Group 2021).

Some key roadway intersections, particularly in the Mendenhall Valley, have become overburdened with traffic and are inadequate to support increased development. Comments from the public during the scoping period for this project indicate some neighbors directly adjacent to the MGRA experience annoyance and decreased quality of life from high traffic volumes and associated traffic noise. Traffic studies have indicated that many of the un-signalized intersections in the valley experience what the Alaska Department of Transportation and Public Facilities (DOT&PF) consider noticeable to unacceptable delays during peak periods (CBJ 2013). The east side of Mendenhall Loop Road, from Egan Drive to Glacier Spur Road, is classified as a minor arterial by DOT&PF, with an average annual daily traffic of 7,792 vehicles in 2019 (DOT&PF 2021). A 2014 traffic study identified several operational issues with this roadway section including long delays and vehicle queuing at certain intersections (Kittleson & Associates 2014). The traffic study reviewed crash data for this corridor over a 5-year period and found that while crashes do occur along the corridor, all study intersections were below threshold safety indices defined by DOT&PF, and below statewide crash averages. However, one intersection was flagged for having two or more injury crashes over 5 years (Mendenhall Boulevard/Valley Boulevard intersection; Kittleson & Associates 2014). DOT&PF recently completed upgrades to the Mendenhall Loop Road in the form of additional roundabouts to combat the existing traffic issues (DOT&PF 2021a).

As the main access route to the MGRA, tour buses and personal vehicles visiting Mendenhall Glacier add to the congestion in the Mendenhall Valley. Average annual daily traffic in 2019 for Glacier Spur Road just north of Mendenhall Loop Road was 1,736 vehicles (DOT&PF 2021). Traffic data for Glacier Spur Road were analyzed for three separate weeks in the summers of 2018 and 2019 to obtain a more accurate picture of traffic contribution from MGRA users and permitted transportation services such as tour buses. Counts ranged from 1,323 to 2,138 vehicles per day during the study period, with an average of 1,787 vehicles, and buses averaged 80 per day (DOT&PF 2018 and 2019). It is assumed during the summer, approximately 23 percent of the average annual daily traffic of the east side of Mendenhall Loop Road (daily summer average of 1,787 vehicles on Glacier Spur Road as a percentage of the daily average of 7,792 vehicles on the east side of Mendenhall Loop Road) and closer to 30 percent of the daily traffic on peak summer days (2,138 vehicles as a percentage of 7,792 vehicles) is attributed to vehicles traveling to or from the MGRA.

3.12.4.2 Regional and Local Economy

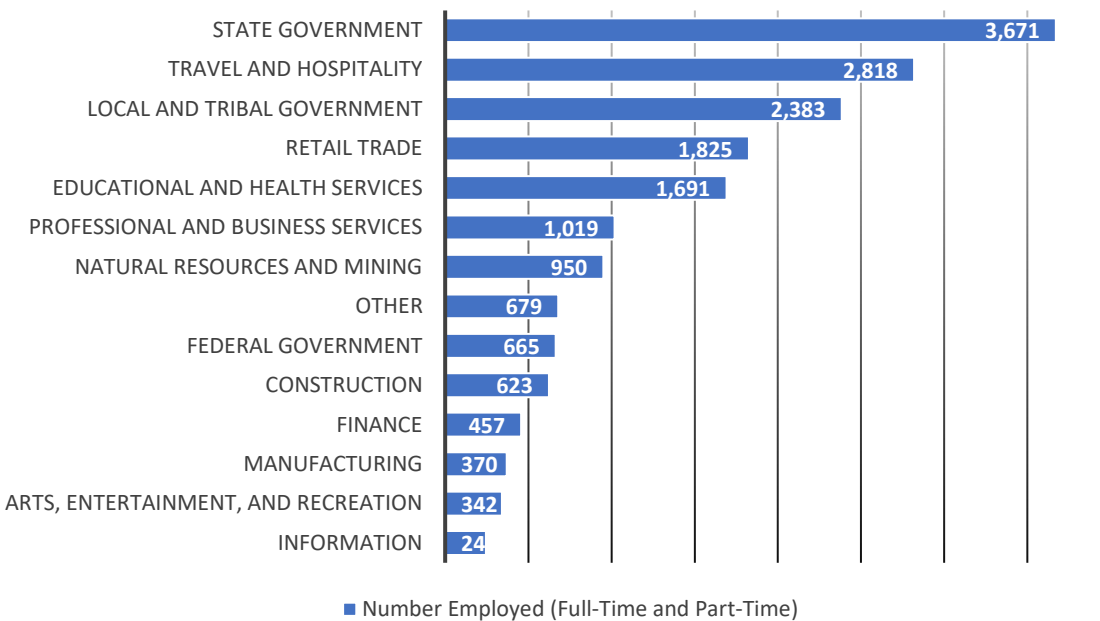
Southeast Alaska and Juneau have been historically dependent on the extraction of natural resources (mining, fishing, and timber harvesting) for economic development; in recent years, tourism has emerged as an economic driver for the region. Tourism supports local (Juneau resident) employment, which in turn contributes to household incomes and adds to local government revenue streams. However, in 2019, approximately 28 percent of Juneau's workforce was made up of Alaska residents from somewhere other than Juneau and/or out-of-State workers. The tourism industry's workforce demographics alone skew even more towards nonresidents (almost 50 percent non-Juneau workers; Alaska Department of Labor and Workforce Development 2021). Tourism's potential impact on local employment through support of outfitter/guide businesses and related jobs is considered throughout this section. In

Juneau, the tourism industry generates considerable revenue for the municipality through a variety of taxes and fees, including a head tax on all cruise ship passengers that disembark in Juneau, accounting for more than one-fifth of all CBJ sales tax revenue. Sales tax makes up approximately 55 percent of all CBJ tax revenues (USDA Forest Service 2014). But the tourism industry also has a high degree of economic leakage, where a large portion of dollars spent do not remain in the local community. In Juneau and Southeast Alaska, cruise ship and other multinational companies such as hotel chains also benefit from the millions of tourism dollars generated.

Based on cruise ship schedules and weather, tourism in Southeast Alaska is highly seasonal. Around 90 percent of visitors arrive via cruise ships, which operate from April to October in Southeast Alaska (Rain Coast Data 2019). As a result, in the summer, crowding becomes an issue in Juneau. In the summer of 2018, Juneau's year-round population of just over 30,000 was far exceeded by over 1,000,000 cruise ship visitors (Rain Coast Data 2019).

Given its prominence in the region, the tourism industry is critical for Southeast Alaska's economic stability. The industry's influence is evidenced by the dramatic downturn of the visitor industry and prohibition of cruise ships in 2020 caused by the COVID-19 pandemic. In 2020, Southeast Alaska lost almost 6,000 jobs and \$190 million in wages overall (9 percent of total wages earned in the region). Jobs directly related to tourism accounted for \$119 million of those lost wages (Rain Coast Data 2021). Prior to the shutdown, the number of cruise ship passengers visiting Southeast Alaska was steadily increasing, up 14 percent in 2019 over the prior year, and most local tour companies, guides, restaurants, lodging, and small retail businesses made the bulk of their yearly income from the summer months (Rain Coast Data 2020).

The Forest Service supports the guided and non-guided tourism and recreation industry in Southeast Alaska through management actions and the allocation of special use permits that allow transporters and guides continued use and access of NFS lands. In Juneau alone, the tourism industry accounted for an average \$86 million in wages earned by residents annually in the years 2015 to 2019 (Juneau Economic Development Council 2020). While it is difficult to extrapolate an exact number of jobs that may be attributed to the tourism industry, the travel and hospitality employers (including restaurants, hotels, sightseeing tour providers, and recreation services) represented 2,818 Juneau jobs in 2019 (Figure 3-17; Alaska Department of Labor and Workforce Development 2020a). The MGRA is a substantial draw for the industry. About half of cruise ship passengers coming to Juneau each year visit the MGRA on a tour (USDA Forest Service 2018).

Figure 3-17. Juneau Average Monthly Employment by Industry; January – December 2019

Source: Alaska Department of Labor and Workforce Development 2020a

Beyond being a lure for visitors and supporting Southeast Alaska's economy, the MGRA generates revenue for the local economy with several independent companies providing transportation and/or tour offerings at the site. Out of the 27 companies with permitted service days in 2021, 19 of those were local Juneau companies and were allocated over half (56 percent) of the available service days.

On average, cruise passengers spend \$95 per person on tours and activities when in Juneau. Tours to the MGRA are offered alone or in combination with other sites or experiences ranging in price from under \$100 to more than \$500 per person for more tailored or private tours incorporating the Juneau Icefield via helicopter or floatplane (McDowell 2017 and 2020).

While tourism has the potential to create jobs, stimulate business growth, and increase income for local governments, it also has the potential to impact recreational opportunities for local residents by crowding local places and spaces. Most communities, including Juneau, see tourism as a necessary component of a healthy economy. Some residents also have concerns about the impact of increasing levels of tourism on the quality of life and the environment. Although communities want the benefits of jobs and business opportunities that tourism brings, many residents do not want to sacrifice community culture and identity, access to resident recreation, environmental quality, or privacy (McKinley Research Group 2021; Kruger 2005).

3.12.5 Analysis Methods

For this analysis, indicators and levels of effect have been set for the issues identified in Chapter 1 (see Section 1.5.1). Certain components may also have a beneficial effect on a particular issue or resource. Conclusions, such as whether an effect or impact is negligible, minor, moderate, or major are based upon the professional's judgment of the magnitude of the change, the context and extent of the impact, and the timing and nature of activities taking place.

3.12.6 Direct and Indirect Effects

3.12.6.1 Alternative 1 – No Action

Analysis of resident demographics in the Mendenhall Valley indicates there are no existing populations in the vicinity of the project area identified where either (a) the minority population of the area exceeds 50 percent or is otherwise meaningfully greater than the percentage in Juneau or the State of Alaska; or (b) a significant portion of the population in the study area is identified as low income. The No Action Alternative would have a **negligible effect** on minority and low-income populations.

Under the No Action Alternative, impacts to traffic patterns and volumes, support of the local economy, and economic growth would remain similar to existing conditions. Transport service providers and outfitter/guides would continue to add to the volume of traffic and wear and tear on roadways in the Mendenhall Valley, particularly along Mendenhall Loop Road, Glacier Spur Road, Montana Creek Road, and Skater’s Cabin Road, but buses and vans with permitted service days would not increase markedly over current levels. Therefore, the No Action Alternative would have a **negligible effect** on traffic.

The MGRA would continue to be an attraction for visitors and would continue to support the local economy, but could not adequately accommodate the growth that is expected in this sector. Special use permit service days offered to transporters, guides, and outfitters supports local business, and under the No Action Alternative, economic growth would be limited to the maximum existing service days available to each commercial provider. Local use is likely to continue to experience slow growth, providing a small measure of economic support through day-use fee collection. This would not meet the purpose and need of the project to meet the demand of the visitor industry and support the economy of Southeast Alaska. The No Action Alternative would have a **moderate effect** on the local economy and visitor industry.

3.12.6.2 Effects Common to All Action Alternatives

During construction, traffic on Mendenhall Loop Road may be impacted as construction equipment and materials are hauled to and from existing materials sites, disposal sites, and the MGRA. The local Juneau economy may also be assisted by the creation of construction jobs during implementation of the action alternatives, likely 5 to 15 years into the future.

Food is not currently available for sale within the MGRA and the Visitor Center contains a small retail store. Under all action alternatives, there would be more retail opportunities and food would be available for purchase and consumption at the Welcome Center. Welcome Center retail and food concessionaires may benefit the local economy if selected vendors are local Juneau companies.

As stated above in 3.12.6.1, there are no existing populations in the vicinity of the project area identified where either (a) the minority population of the area exceeds 50 percent or is otherwise meaningfully greater than the percentage in Juneau or the State of Alaska; or (b) a significant portion of the population in the study area is identified as low income. Therefore, there would be no disproportionately high and adverse human health or environmental effects to minority or low-income populations as a result of implementation of any of the action alternatives (**negligible effect**).

3.12.6.3 Alternative 2 – Proposed Action

Increased permitted service days under this alternative would gradually add to traffic volumes and congestion from April to October and contribute to wear and tear on Mendenhall Valley roadways, particularly on all the main access routes to the MGRA including Mendenhall Loop Road, Glacier Spur Road, Montana Creek Road, and Skater's Cabin Road. Table 3-16 estimates an increase of approximately 50 percent over existing allowable transportation service days at the Visitor Center, which would not occur until all criteria were met as per the adaptive management plan (minimum 15 years into the future; Appendix B). In general, an increase in the number of transportation service days equates to an increase in tour buses of all types. If a 50 percent increase in the number of buses is assumed, peak days could see an average of 120 buses daily and traffic volume on Glacier Spur Road may reach 1,776 vehicles daily, up from 1,736; traffic volume on Mendenhall Loop Road may reach 7,832 vehicles daily, up less than 1 percent over existing average (7,792).¹¹ Peak days will generally correlate with days when more than 4 large cruise ships are in port and more than 10,000 visitors arrive in Juneau. Peaks are not likely to extend through the whole primary use season as cruise ship traffic is lower at the beginning and ends of the season with the height of visitation towards the middle of the season. Peak days represented 31 days of the primary use season in 2019, with most of those occurring in June and July (Cruise Line Agencies of Alaska 2019). However, it is difficult to predict the actual temporal distribution of visitors and estimate volume and timing of peaks as they are dependent on cruise ship schedules that are not static from year to year. Although the average represents a small percentage increase in traffic volume, on peak days the increase would likely be felt acutely by those residents in the Thunder Mountain area directly adjacent to Glacier Spur Road (e.g., Eyelet Court, Threadneedle Street, Counterpane Lane, Garnet Street, and Gladstone Street) through traffic and noise impacts. Additional intersections along Mendenhall Loop Road could experience poor levels of service (ranging from noticeable to unacceptable), and those already experiencing poor level of service could be degraded further if existing traffic problems are not addressed.

The Back Loop area adjacent to Montana Creek Road and Skater's Cabin Road would also experience increased traffic congestion with more tour operators traveling to the west side of the MGRA to access the new dock near the West Glacier Trailhead. Additionally, more local and independent visitors would be using the new parking area within the campground to avoid the Visitor Center parking area altogether, since access the Dredge Lakes trail network and the east side of the MGRA would be accessible by the Lakeshore Trail.

As a result of these new access points and trailheads adjacent to existing residential homes and neighborhoods, an increase in noise, traffic, and activity may occur at these locations. While these impacts are generally confined to the trailheads themselves, they could spill over to neighboring properties. It is likely that Alternative 2 would have a **moderate effect** on local traffic volumes.

With Alternative 2, growth in the regional and local visitor industry would be supported by increased special use permit service days offered to commercial providers with a projected 15 years being the earliest date the maximum number of service days analyzed in this EIS could be

¹¹ Based on average bus traffic recorded by DOT&PF over three weeks in the summers of 2018 and 2019 (DOT&PF 2018 and 2019 *Multi-Class by Direction Report*) to estimate maximum average volumes. During the study period, the number of buses traveling on Glacier Spur Road each day ranged from 22 to 178 buses with an average of 80 buses daily. More recent years were not included in averages due to low volumes of tourist traffic over those years.

reached. The improved experience offered by this alternative through a reduction in crowding in the parking areas and Visitor Center would also support this growth as a gradual increase over the next 5 to 15 years. New experiences such as trails, Welcome Center, and motorized boat access across the lake would likely draw additional tourists and locals to the site. Local use may increase at a greater rate than with the No Action Alternative, since amenities would be added that would improve their experience like an upgraded trail network, Glacier Spur Road Trailheads, and improved overall traffic flow offered by the expanded parking area. Locals who generally avoid the MGRA during the summer to avoid the visitor crowds may begin visiting during those months.

Alternative 2 would include new commercial boat access on the Mendenhall Lake and more opportunities for commercial guides in the currently remote areas of the MGRA, including near the glacier. New commercial boat access opportunities may create additional local jobs if a Juneau tour operator was selected and boost revenue for tour operators. Based on the economic study which helped to inform design of the recreational and interpretive facilities at the MGRA, demand for a commercial boat experience is projected to equal around 15 percent of visitors initially, with revenue estimates ranging from \$2.7 to \$3.4 million annually (85,000 passengers; McDowell 2020). Capacity for motorized boat tours would be capped at 214,000 people, representing potential increased revenue opportunities in future years.

Under Alternative 2, new and improved trails would create more opportunities for additional guided hiking and mountain biking tours, which would create additional jobs and local revenue. According to interviews with existing commercial operators (McDowell 2020), improvements could lead to more varied guiding opportunities and associated fees. As an example, improved west side trails could warrant higher fees. Alternative 2 would contribute the most in support of the local and regional economy. This alternative is the most responsive to the need to meet the demand of the visitor industry in Southeast Alaska, while still maintaining the desired condition of the Special Interest Area (providing opportunities for public study, use, and enjoyment that are suitable to its natural characteristics) and its draw as a tourism destination.

Alternative 2 would have **moderate, beneficial effect** on the local and regional economy and visitor industry.

3.12.6.4 Alternative 3

Increases in traffic volumes and roadway use from implementation of Alternative 3 would be very similar to that from Alternative 2, but would peak at a slightly lower level of special use permitted service days available (equating to fewer numbers of visitors arriving with commercial transporters or on guided tours), also at around a projected 15 years. Traffic would be impacted by additional large tour buses as a result of a 20 percent increase in transportation service days over existing allocated transportation service days at the Visitor Center, equating to an average of 96 buses daily traveling on Glacier Spur Road in the busier months of the year. Although it is difficult to predict the timing and volume of peak days as they are dependent on cruise ship schedules, they are likely to correlate closely with days when multiple cruise ships are in port. This could cause traffic delays and decrease levels of service for intersections and roadways bordering Glacier Spur Road and Mendenhall Loop Road. Neighboring residents may experience traffic delays and increased noise on peak days, but these impacts would be unlikely to extend over the entire primary use season because peak days are generally concentrated in the middle of the season. Further, impacts from new trailheads may be experienced by those property owners

and residents living closest to the proposed trailhead sites (off Glacier Spur Road) and the campground (Back Loop neighborhood). It is likely that Alternative 3 would have a **moderate effect** on local traffic, but to a slightly lesser degree than Alternative 2.

Support of the local and regional economy while maintaining the desired condition of the Special Interest Area and its draw as a tourism destination as stated in the purpose and need for the project would also be similar to Alternative 2. An improved experience, traffic flow, and access points would draw more local visitors during more seasons of the year. Annual capacity for motorized boats would be capped at 100,000, so potential for employment and revenue gains would be more limited under this alternative compared to Alternative 2. Similar to Alternative 2, Alternative 3 would have **moderate, beneficial effect** on the local and regional economy and visitor industry.

3.12.6.5 Alternative 4

Increases in traffic and roadway use would peak around 15 percent over existing allowable transportation service days at the Visitor Center, or an average of 92 buses daily traveling on Glacier Spur Road in the busier months of the year. Neighboring residents may experience traffic delays and increased noise on peak days, but these impacts would be unlikely to extend over the entire primary use season, based on peak cruise ship visitation during the season.

Impacts from new trailheads may be experienced by those property owners and residents living closest to the proposed trailhead sites (off Glacier Spur Road). Under Alternative 4, the Lakeshore Trail would not connect over Mendenhall River to the campground area and additional parking would not be provided in the campground. Those residents and property owners in the Back Loop neighborhood would not experience increased traffic or other trailhead-related impacts such as noise or increased crime. It is likely that Alternative 4 would have a **minor effect** on traffic volumes.

Alternative 4's responsiveness to the project's purpose and need to support the local and regional economy and maintain the MGRA as a tourism destination would peak at a lesser degree than the other two action alternatives, with only a minor increase beyond existing in special use permitted service days over the (minimum) 15-year period. This alternative would also provide opportunities for the public's enjoyment of the while maintaining more of the existing natural characteristics of the unique Special Use Area. Configuration improvements at the Visitor Center parking area and additional trailhead parking areas along Glacier Spur Road would serve to improve traffic flow and may encourage local residents to visit during even the busiest months. However, there would be few new tour opportunities or revenue sources with a more limited trail system and no motorized boats or facilities at the glacier. Alternative 4 is the most responsive to local resident users concerns about increases in and distribution of commercial use. This alternative focuses most visitor use effectively on the east side of the MGRA, leaving the west side fundamentally in its current condition. Alternative 3 would have **minor, beneficial effect** on the local and regional economy and visitor industry.

3.12.7 Cumulative Effects

The analysis of cumulative effects to regional and local economies from this project takes into consideration current and future proposals in the Mendenhall Valley and the greater Juneau area,

as shown in Table 3-54. Impacts from climate change were also considered with relation to socioeconomics.

Table 3-54. Projects Considered for Analysis of Cumulative Effects to Socioeconomics

Project Name	Type	Action
Mendenhall Glacier Mineral Withdrawal	Public Land Order Mineral Withdrawal	Present
Mendenhall Loop Road Capacity Improvements	Infrastructure	Present
Mendenhall Loop Road Resurfacing: Egan Drive to Stephen Richards	Maintenance	Present
Juneau Cruise Ship Dock Electrification	Infrastructure	Future
Small Cruise Ship Dock Construction	Infrastructure	Future
A.J. Dock Cruise Ship Berth Expansion	Infrastructure	Future
Franklin Dock Floating Berth Improvements	Infrastructure	Future
Norwegian Cruise Ship Berth (Aak'w [Auke] Landing) Construction	Infrastructure	Future

Implementation of Alternatives 2, 3, and 4 would lend support to the local (Juneau) and regional (Southeast Alaska) tourism industry. The local and regional economy would also be boosted by the proposed small and large cruise ship berth infrastructure projects and the proposal for electrification of cruise ship docks. This project would prepare the MGRA to better accommodate the expected increase in visitors provided by these proposals, and lead to greater economic benefits realized through expansion of available opportunities.

The Mendenhall Glacier Visitor Facility Improvements Project would also cause a general increase in road traffic in the Mendenhall Valley. Considering the expansion of cruise ship berth infrastructure in downtown Juneau that would allow access to larger ships carrying more passengers, traffic would likely be impacted in multiple areas of Juneau. Some key intersections in the Mendenhall Valley are already experiencing unacceptable traffic volumes that exceed design capacity for the road or intersection at certain busy times of the day, and this could be exacerbated by the proposed project. However, recent projects undertaken by DOT&PF have addressed or will address traffic congestion and delays experienced in the Mendenhall Valley during peak periods at several intersections and improve the area's traffic flow. However, it is possible that other projects may need to be undertaken in the future by DOT&PF and/or the CBJ to alleviate traffic issues that could arise. In the short term, Juneau residents could experience delays and frustration before such projects could be implemented.

The Mendenhall Glacier Mineral Withdrawal would exclude recently-deglaciated areas near the Mendenhall Glacier from mining. Mining operations contribute high paying jobs, raw materials, and diversification to the economy in which they are located. By closing this area off to potential mining expansion, Juneau may be missing an opportunity for economic growth. However, through preservation of the area, the MGRA's value as a visitor attraction and a support for the local visitor industry is retained.

The social and economic impacts from climate change are difficult to predict, but in general, climate change has the potential to impact local and regional economies and quality of life.

Glacial outburst floods, rising sea levels, and increased frequency and magnitude of heavy rain events can damage property and community infrastructure, accumulating financial burdens on those living in coastal communities. The proposed project may exacerbate these financial and quality of life burdens on the community by contributing additional traffic and wear and tear on roadway infrastructure whose repair and maintenance depends on local taxes. Southeast Alaska's tourism industry could also be impacted by warmer global temperatures leading to rapid glacial recession. The MGRA Visitor Facility Improvements Project would support the local and regional economy but impacts from climate change may transform the tourism industry in the future.

Chapter 4. Consultation and Coordination

4.1 Preparers and Contributors

The USDA Forest Service (Forest Service) consulted the following individuals, Federal, State, and local agencies, tribes and other organization and individuals during the development of this environmental impact statement:

4.1.1 Interdisciplinary Team Members

Jim Baichtal	Position: Forest Geologist Experience: 39 years Education: Lower Columbia Community College, Longview, WA, A.S. 1977, Washington State University, Pullman, WA, B.S. Geology 1980, Washington State University, Pullman, WA, M.S. Geology 1982, University of Alaska Southeast, Honorary Doctorate of Science, 2013
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Monique Nelson	Position: Land Management Planner Experience: 15 years Forest Service Education: BS, Natural Resource Management, North Carolina State University; MS, Ecology, Colorado State University
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Matthew Reece	Position: Minerals Program Manager Experience: 25 years Education: MS, Geology, Mississippi State University
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Terry Suminski	Position: Subsistence Program Manager, Tongass National Forest Experience: 34 years Education: BS, Fish and Wildlife Management, Michigan State University
John Suomala	Position: Recreation & Wilderness Program Manager Experience: 14 years Forest Service Education: BS Forestry, Northern Arizona University 2008

Hillary Woods

Position: Realty Specialist

Experience: 15 years, (4 years BLM, 11 years Forest Service)

Education: BS, Business Management

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4.1.4 Consultant Team

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4.1.5 Participating Tribes and Tribal Organizations

Douglas Indian Association

Central Council Tlingit and Haida Indian Tribes of Alaska

Goldbelt, Inc.

Sealaska Corporation

4.1.6 Participating Federal, State, and Local Agencies

Alaska Department of Natural Resources (ADNR), Division of Mining, Land, and Water

Alaska State Department of Transportation & Public Facilities (DOT&PF)

Alaska State Department of Fish and Game (ADF&G)

City and Borough of Juneau (CBJ), Parks & Recreation Department

National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries), Habitat Conservation Division, Alaska Region

US Coast Guard (USCG), District 17

US Army Corps of Engineers (Corps), Juneau Regulatory Field Office

US Environmental Protection Agency (EPA), Region 10

4.2 Distribution of the Draft Environmental Impact Statement

This draft environmental impact statement has been distributed to individuals who specifically requested a copy of the document. In addition, copies have been sent to the following Federal agencies, Federally-recognized tribes, State and local governments, and organizations representing a wide range of views.

4.2.1 Agencies

4.2.1.1 Federal and State Agencies

Advisory Council on Historic Preservation, Director of Planning, Washington, DC

ADEC, Non-point Source Program, Juneau, AK

ADEC, Stormwater Program, Anchorage, AK

ADF&G, Division of Habitat, Juneau, AK

ADNR, Regional Manager, Juneau, AK

ADNR, Division of Mining, Land, and Water, Juneau, AK

Alaska Office of the Governor, Juneau, AK

Alaska State Department of Environmental Conservation (ADEC), Division of Air Quality, Juneau, AK

Alaska State Historic Preservation Officer, Anchorage, AK

Corps, Alaska District, Joint Base Elmendorf-Richardson, AK

Corps, Regulatory Field Office, Juneau AK
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EPA, NEPA Reviewer Anchorage, AK
EPA, EIS Review Coordinator, Seattle, WA
EPA, EIS Filing Section, Washington, DC
Natural Resources Conservation Service, National Environmental Coordinator, Washington, DC
NOAA Fisheries, Regional Administrator Juneau, AK
NOAA Fisheries, Habitat Conservation Division, Juneau, AK
USCG, Environmental Management CG-443, Washington, DC
US Department of Energy, Office of NEPA Policy and Compliance, Washington, DC
US Department of Agriculture Office of Civil Rights, Washington, DC
US Department of Interior (USDI) Alaska Affairs, Washington, DC
USDI Bureau of Land Management, Alaska State Office, Anchorage, AK
USDI Fish & Wildlife Service (USFWS), Conservation Planning, Juneau, AK
USDI USFWS, Ecological Services, Juneau, AK
USDI Office of Environmental Policy & Compliance, Washington, DC

4.2.2 Libraries

Juneau Public Library-Downtown Branch
Juneau Public Library-Valley Branch
Juneau Public Library – Douglas Branch

4.2.3 Media

KTOO

4.2.4 Organizations and Businesses

Brent Bitterman, Owner, Alaska Luxury Tours
Dan Blanchard, President, UnCruise
Jamey Cagle, Senior Vice President, Allen Marine
Maryann Cummings, President, M&M Tours
Shawn Eisele, Executive Director, Discovery Southeast
Jeff Fanning, Owner, Liquid Alaska Tours
Sierra Gadare, Manager, Gastineau Guiding Company
Bill Hagevig, Juneau Manager, Holland America Princess (HAP)

Kim Harris, Dispatcher, Juneau Taxi & Tours
Serene Hutchinson, Owner, Juneau Tours
Anthony Mallott, CEO, Sealaska Corporation
John McConnochie, Owner, Cycle Alaska
Chris Meier, President, Alaska Travel Adventures
Jennifer Miller, Manager Shore Excursions, Holland America Group
McHugh Pierre, President/CEO, Goldbelt Inc.
Liz Perry, President/CEO, Travel Juneau
Robert Steinke, General Manager, Dolphin Jet Boat Tours
Tom Stewart, Owner, Alaska Weddings
Jeff Wright, Owner, Juneau Limo

4.2.5 Tribes, Tribal Entities, City Governments, and Publicly Elected Officials

4.2.5.1 Tribes and Tribal Entities

Douglas Indian Association
Central Council Tlingit and Haida Indian Tribes of Alaska
Goldbelt, Inc.
Sealaska Corporation

4.2.5.2 Federal, State, and Local Officials

Borough Manager, CBJ, Juneau, AK
Honorable Don Young, US House of Representatives, Anchorage, AK
Honorable Mayor Beth Weldon, CBJ, Juneau, AK
Senator Dan Sullivan, US Senate, Juneau, AK
Senator Lisa Murkowski, US Senate, Juneau, AK
Senator Jesse Kiehl, Legislative Information Office, Juneau, AK
Representative Sara Hannan, Legislative Information Office, Juneau, AK
Representative Andi Story, Legislative Information Office, Juneau, AK

4.2.6 Individuals

The Tongass National Forest emailed a notification with a link to the draft EIS electronically via GovDelivery to a list of individuals who have requested to receive emails. Some individuals also requested a hard copy of the document. The list of individual email addresses and names is available in the Mendenhall Glacier Visitor Facility Improvements project record.

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Chapter 6. Glossary

Accipiter: A genus of birds of prey from the family Accipitridae, includes true hawks.

Adaptive management: A system of management practices based on clearly-identified intended outcomes and monitoring to determine if management actions are meeting those outcomes; and if not, to facilitate management changes that will best ensure that those outcomes are met or reevaluated.

Affected environment: The physical, biological, social, and economic environment that would or may be changed by actions proposed and the relationship of people to that environment.

Alaska Department of Environmental Conservation (ADEC): A State of Alaska agency responsible for conserving, improving, and protecting Alaska's natural resources and environment to enhance the health, safety, and economic and social well-being of Alaskans.

Alaska Department of Fish and Game (ADF&G): A State of Alaska agency responsible for protecting, maintaining, improving, and managing the use of the fish, game, and aquatic plant resources.

Alaska Department of Natural Resources (ADNR): A State of Alaska agency responsible for managing all state-owned land, water and natural resources, except for fish and game.

Alaska Department of Transportation and Public Facilities (ADOT&PF): A State of Alaska agency responsible for designing, constructing, operating and maintaining the state's transportation infrastructure systems, buildings, and other facilities used by Alaskans and visitors.

Alluvial fan: A fan-shaped mass of gravel, sand, and smaller sediments, collectively known as alluvium, deposited as the flow of river decreases in velocity. *See also: Riparian Management Area*

Anadromous: Refers to species of fish that are born in freshwater, spend most of their lives in saltwater, and return to freshwater to spawn, includes all species of salmon.

Base flood elevation (BFE): The elevation of surface water resulting from a flood that has a 1 percent chance of equaling or exceeding that level in any given year.

Bear-human conflicts: Any interaction between one or more humans and bears which results in an adverse experience for and poses harm to humans, individual bears, or property.

Biodiesel: A renewable fuel that may be manufactured from vegetable oils, animal fats, or recycled restaurant grease with properties similar to diesel fuel that can be used in diesel vehicles or equipment that operates on diesel fuel.

Black carbon: Particulate emissions from burning fossil fuels that accelerate melting when deposited on the surface of glaciers.

Capacity: As used in this document, the number of people who can use any given facility or resource while achieving and maintaining desired resource conditions and visitor experiences. It

is established based on a number of factors that may include but are not limited to the ability to sustainably manage the resource so that it does not deteriorate over time, the design of a facility to accommodate visitors, and thresholds established within the Recreation Opportunity Spectrum system for an acceptable number of encounters on trails or waterways.

Carbon sequestration: The process of capturing and storing atmospheric carbon dioxide through biological storage in plants, soils, and oceans and geologic storage in rocks or industrial materials (e.g., cement).

Carbon stock: The amount of carbon sequestered within the biomass, soil, and other materials a particular ecosystem.

Chronic exposure levels: Averaged concentration of a pollutant over a four-day period that would have toxicity for aquatic life.

Clean Water Act (CWA): An act that was enacted by the U.S. Congress in 1977 to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. This act was formerly known as the Federal Water Pollution Control Act (33 U.S.C. § 1344).

Commercial Allocation: The number of special use permits issued to commercial transport, guide, or outfitter service providers (may be a combination of these) for any given facility or resource. *See also: special use permit, service day.*

Corridor: A contiguous strip of habitat suitable to facilitate animal dispersal or migration. Also, a linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act (NEPA) of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cultural landscape: An area that includes both cultural and natural elements (either structural or modified natural areas) associated with a historic event, activity, or person or exhibits other cultural or aesthetic values.

Cumulative effect (impact): The impacts on the environment resulting from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions occurring over time.

Direct effect (impact): Environmental effects that occur at the same time and place as the initial cause or action.

Early Successional Habitat: An area undergoing the first stages of ecology succession in which uniquely adapted plants and animals colonize a newly created environment.

Endangered species: An official designation for any species of plant or animal that is in danger of extinction throughout all or a significant portion of its range. An endangered species must be designated in the Federal Register by the appropriate Federal Agency Secretary.

Environmental consequences (effects, impacts): A modification of or change in the existing environment brought about by the action taken. Effects can vary in degree, ranging from only a

slightly discernible change to a drastic alteration in the environment. Effects are direct, indirect, or cumulative and may be temporary (short term) or permanent (long term).

Environmental impact statement (EIS): A disclosure document required by NEPA that documents the anticipated environmental effects of a proposed action and alternatives to that action that may significantly affect the quality of the human environment.

Environmental Justice (EJ): The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental Protection Agency (EPA): The federal agency charged with lead enforcement of multiple environmental laws, including review of environmental impact statements.

Erosion control: Materials, structure, and techniques designed to reduce erosion. Erosion control may include rapid revegetation, avoidance of steep or highly erosive sites, and installation of cross-slope drainage structures.

Erosion: The detachment and movement of soil from the land surface by wind, water, ice, or gravity.

Essential Fish Habitat (EFH): Defined under the Magnuson-Stevens Fisheries Conservation and Management Act as those waters and substrate necessary to all federally-managed fish species for spawning, breeding, feeding or growth to maturity.

Ethanol: A renewable fuel made from plant material collectively known as “biomass” which can be used on its own to power compatible engines and is also blended with gasoline to provide oxygenation and reduce air pollution.

Existing scenic integrity (ESI): The current state of the landscape, considering previous human alterations.

Fledgling: A juvenile bird in between the development stages of hatching and being capable of flight.

Floodplain: The area adjacent to a river subject to flooding, typically low-lying ground composed of river sediments. *See also: Riparian Management Area*

Forb: A category of herbaceous plants that are not included in the grass, shrub, or tree categories; generally smaller flowering plants.

Forest Plan: A comprehensive management plan prepared under the National Forest Management Act of 1976 that provides standards and guidelines for management activities specific to each National Forest. The Forest Plan for the Tongass (Tongass National Forest Land and Resource Management Plan) was updated and revised in 2016.

Forest Service: The agency of the United States Department of Agriculture responsible for managing National Forests and Grasslands.

Forest Supervisor: The official responsible for administering the NFS land in a Forest Service administrative unit who reports to the Regional Forester.

GIS: Geographic information system, a computer mapping system composed of hardware and software.

Greenhouse effect: The heat-trapping atmospheric greenhouse gases with chemical properties that retain some of the sun's heat, facilitating the planet's habitable conditions, livable temperature, and levels of atmospheric oxygen essential to supporting life.

Greenhouse gas (GHG): Gases with chemical properties capable of absorbing infrared radiation found in earth's atmosphere. Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO₂), methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Glacial erratics: Stones and rocks that were transported by a glacier and left behind after it melted.

Glacial outwash: Deposits of sand and gravel carried by running water from the melting ice of a glacier that creates a plain of deposits at the terminus of a glacier. *See also: Riparian Management Area.*

Guide: A person or entity offering commercially guided tours where the guide accompanies the client during their MGRA visit. Services provided by guides are authorized using outfitter/guide special use permits.

Guideline: An indication or outline of policy or conduct that is not a mandatory requirement (as opposed to a standard, which is mandatory).

Habitat type: A classification of the vegetation resource based on dominant growth forms. The forested areas are more specifically classified by the dominant tree species.

Heat pump: A dual heating and air conditioning system that uses electricity to transfer heat from a cool space to warm space and vice versa, transferring cold inside air to the outside in the winter and sending warm inside air to the outside in the summer. There are three main types of heat pumps: air-source, water-source, or geothermal.

Heritage resources: The prehistoric or historical district, site, building, structure, or object including artifacts, records, and remains that are related to and located within such properties in, or eligible for inclusion in, the National Register of Historic Places.

Home range: Encompasses the area of an animal's movements on a periodic basis and includes all the resources an animal requires to survive and reproduce.

Hydric soils: Soils characterized by, or requiring an abundance of moisture, used in the identification of wetlands.

Hydrologic unit code: A sequence of numbers or letters that identify a hydrological feature like a river, river reach, lake, drainage basin, watershed, or catchment. United States Geological Survey (USGS) divides the country into hydrologic unit codes based on 21 regions (2-digit), 222 subregions (4-digit), 370 basins (6-digit), 2,270 subbasins (8-digit), approximately 20,000 watersheds (10-digit), and roughly 100,000 subwatersheds (12-digit).

Indirect effect (impact): Secondary consequences to the environment resulting from a direct impact. An example of an indirect impact is the deposition of sediment in a wetland resulting from surface disturbance in the upland.

Instream flow: The volume of surface water in a stream system passing a given point at a given time.

Interdisciplinary Team (ID Team): A group of individuals each representing specialty resource areas assembled to solve a problem or perform a task through frequent interaction so that different disciplines can combine to provide new solutions.

Intergovernmental Panel on Climate Change (IPCC): A United Nations body created for assessing scientific information related to climate change for the formation of climate policies.

Interpretive: Added infrastructure elements that provide meaning and context for environmental features of any area, e.g., natural processes, flora and fauna, how people lived in the area, etc.

Invasive species: A species that is non-native whose introduction causes ecological or economic harm by propagating in a new environment where it is not native. **Isostatic rebound:** The rise of land masses that were depressed by the huge weight of ice sheets or glaciers that have retreated or are retreating.

Jökulhlaup/glacial lake outbursts: Floods that occur when a dammed lake fed by glacial meltwater breaches its dam and drains rapidly, which can be predictable or erratic in frequency.

Kettle ponds: Ponds that form in depressions of glacial outwash plains, without inflowing or outflowing hydrologic connections.

Labor income impacts: Labor income impacts refers to the effect of income from the workforce, when spent in the community.

Lake terminating glacier: Mountain glaciers that terminate (end) in meltwater lakes, and the interaction between the glacier terminus and the lake can speed up melting and exacerbate glacier ice loss.

Land use designation (LUD): Land use designations (LUD) provide goals, objectives, and standards for resources including recreation, scenery, tourism, and cultural sites.

Leadership in energy and environmental design (LEED) certification: A globally recognized green building standard and rating system for designs, construction, and operation of buildings and neighborhoods run by the U.S. Green Building Council. Rating systems are based on building types and offer various certification levels (e.g., Silver, Gold, Platinum) based on applicable prerequisites and credits.

Life-cycle assessment: An analysis technique to assess environmental impacts associated with all stages of a products life, including raw materials extraction, material processing, manufacturing, distribution, use, and disposal.

Low-income population: Low-income families are those whose incomes do not exceed 80 percent of the median family income for the area.

Management direction: A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

Management indicator species (MIS): A representative group of species whose population changes are believed to indicate the effects of land management activities. The health of an indicator species is used to gauge function of the habitat on which it depends. The health of an indicator species is used to gauge function of the habitat on which it depends.

Management practice: A specific activity, measure, course of action, or treatment.

Management Requirements: Specific measures designed to minimize or avoid impacts anticipated to occur as a result of implementation of the action alternatives. Management Requirements are required components of specified action alternatives.

Management unit: In this document, a geographical area created to manage portions of the MGRA based on visitation, with each having unique standards and guidelines.

Master Plan: A document that is designed to guide recreation area planning and development and avoid piecemeal decision making.

Median household income: The U.S. Census Bureau defines this as the income of the householder and all other individuals 15 years old and over in the household, whether they are related to the householder or not, over the course of the past 12 months.

Minority population: The U.S. Census Bureau defines this as a population of people who are not single-race white and not Hispanic. It includes populations of individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic.

Mitigation: Actions taken to avoid, minimize, reduce, eliminate, or rectify the adverse environmental impacts associated with the implementation of an alternative or a portion thereof.

National Ambient Air Quality Standards (NAAQS): Established under the Clean Air Act of 1963, there are primary standards, designed to protect public health, and secondary standards, designed to protect public welfare from known or anticipated air pollutants.

National Environmental Policy Act (NEPA): A law enacted by Congress in 1969 that requires federal agencies to analyze the environmental effects of all major federal activities that may have a significant impact on the quality of the human environment.

National Forest Management Act (NFMA): A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of regulations to guide that development.

National Forest System (NFS) lands: National Forests, National Grasslands, and other related lands for which the Forest Service is assigned administrative responsibility.

National Historic Preservation Act (NHPA): An act that was enacted by the U.S. Congress in 1966 to protect historic sites and artifacts (16 U.S.C. § 470). Section 106 of the Act requires consultation with members and representatives of Indian tribes.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries): An office within the National Oceanic and Atmospheric Administration within the Department of Commerce responsible for an ecosystem-based approach to management of fisheries, seafood, protected resources, and ecosystems.

National Register of Historic Places (NRHP): A listing of areas which have been designated as historically significant maintained by the National Park Service. The register includes places of local and state significance, as well as those of value to the nation in general.

Ocean acidification: Increased acidification and decreased pH of the ocean from a higher concentration of carbon dioxide absorbed into the ocean from the earth's atmosphere with implications for ocean conditions and marine life.

Outfitter: A person or entity that rents equipment for clients to use at MGRA (e.g. kayaks and associated paddling equipment) and delivers those items to Forest Service lands. Services provided by outfitters are authorized using outfitter/guide special use permits. Outfitters are often compensated guides who facilitate the use, enjoyment, understanding, and appreciation of national forest recreation settings where the need for service has been identified and is compatible with objectives and management direction.

Overstory/Overstory Vegetation: The highest layer of vegetation in a forest, usually forming the canopy. This is typically comprised of the trees and foliage in a forest whose crowns make up the highest layer.

Palustrine emergent wetlands (PEM): A wetland class is characterized by the presence of erect, rooted, usually perennial, herbaceous hydrophytic plants.

Palustrine shrub/scrub wetlands (PSS): A wetlands class characterized as being dominated by a woody vegetation community composed of shrubs and young trees less than 6 feet tall.

Palustrine: System of inland, nontidal wetlands characterized by the presence of trees, shrubs, and emergent vegetation, can be permanently or seasonally flooded.

Particulates: Small particles suspended in the air and generally considered pollutants.

Preferred alternative: The alternative selected from the range of alternatives which is favored by the lead agency.

Primary Species: Species uniquely adapted to colonize newly formed environments.

Primary use season: The season during which visitation to the forest is generally the highest; for the MGRA as of 2022, it corresponds to the high tourist season, May 1 to September 30.

Project area: The area encompassed by the development proposal including base area and the permit area.

Record of Decision (ROD): A document prepared within 30 days after the final EIS is issued which states the agency's decision and why one alternative was favored over another, what factors entered into the agency's decision, and whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why not.

Recreation Opportunity Spectrum (ROS): A Forest Service management framework used to define the type of recreational experiences desired for facilities and areas and to establish use thresholds that are intended to maintain that recreational experience.

Representative Concentration Pathway (RCP): A climate modelling system used by the IPCC, RCPs are based on possible radiative forcing values for the year 2100, and the most conservative RCP assumes radiative forcing value of 8.5 watts per square meter. Radiative forcing is the ability of the earth to retain the sun's radiative heat, largely based on the concentration of atmospheric GHGs.

Riparian: Refers to the area in the interfaces between terrestrial land and a river or stream.

Riparian management area (RMA): The area including water, land, and plants adjacent to perennial streams, lakes, and other bodies of water that is managed for the inherent qualities of the riparian ecosystem. They are categorized into process groups based on channel types with similar physical processes and relationships to the watershed (flood plain; glacial outwash;

alluvial fan; low gradient contained; moderate gradient, mixed control; moderate gradient contained; high gradient contained; palustrine; estuarine; and lakes and ponds).

Scenery management system: The Forest Service methodology for classifying the aesthetic values of landscapes are based upon the scenic attractiveness of the landscape, the landscape's visibility and the public's concern about changes in the landscape from a natural condition.

Scenic integrity objectives (SIOs): These provide direction and objectives for various landscapes within a Forest Service Land Use Designation, and are based on the concept that scenic integrity is the degree to which a landscape is visually perceived to be "complete." The highest SIO ratings are for landscapes with little or no deviation from the character valued by constituents for aesthetic appeal.

Scoping process: A process that determines the issues, concerns, and opportunities which should be considered in analyzing the impacts of a proposal by receiving input from the public and affected agencies. The depths of analysis for these issues identified are determined during scoping.

Sea level rise: The measurable net increase in global tidal gauge measurements as a result of climate change with various causes that include influx of meltwater from ice loss from the Antarctic and Greenland ice sheets and thermal expansion of warming oceans.

Sediment: Solid material, both organic and mineral, that has been transported from its site of origin by air, water, or ice.

Sensitive species: Species which have appeared in the *Federal Register* as proposed additions to the endangered or threatened species list; those which are on an official state list or are recognized by the Regional Forester to need special management in order to prevent them from becoming endangered or threatened.

Service day: An allocation of use constituting a day or any part of a day on National Forest System lands for which an outfitter or guide provides services to a client. The total number of service days is calculated by multiplying each service day by the number of clients on the trip.

Shore power: Availability and provision of shoreside electrical power to ships while at berth, enabling diesel-run ships to turn off their main and auxiliary engines.

Snag: Name for dead trees that are left upright to decompose naturally, provide unique habitat in forests.

Snowfall equivalent: The conversion of snowfall to water, measured in the height (volume/area) of melted snow.

Social encounter: A social encounter occurs when a person or group using an NFS trail or other facility, including established scenic viewpoints, passes or is passed by another person or group.

Socioeconomics: Relating to or concerned with the interaction of social and economic factors.

Spawning: Method of reproduction where spawn, eggs and sperm, are released or deposited into water by aquatic animals such as fish.

Special Interest Area: A designation for areas possessing unique or unusual scenic, historic, prehistoric, scientific, or other characteristics.

Special use permit: A legal document, similar to a lease, issued by the Forest Service. These permits are issued to private individuals or corporations to conduct commercial operations on NFS land. They specify the terms and conditions under which the permitted activity may be conducted.

Stand: A community of trees or other vegetation, which is sufficiently uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities and to thus, form a management entity.

Standard: A standard is a course of action which must be followed; adherence is mandatory.

State Historic Preservation Officer (SHPO): The official appointed or designated pursuant to Section 101(b)(1) of the National Historic Preservation Act of 1966, as amended, to administer the State Historic Preservation Program.

Stream class: Alaska Region stream value classification system based on subsistence, recreational, and economic fish harvest considerations.

Class I: Streams and lakes with anadromous or adfluvial fish or fish habitat; or, high quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

Class II: Streams and lakes with resident fish or fish habitat and generally steep (6 to 25 percent or higher) gradients where no anadromous fish occur, and otherwise not meeting class I criteria.

Class III: Streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability.

Class IV: Other intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capabilities to directly influence downstream water quality or fish habitat capability.

Subwatershed: USGS 12-digit and smallest geographic hydrologic unit code classification.

Sustainable: Programs, initiatives, actions, or design features aimed at reducing use of and impacts to environmental, economic, and societal resources.

Temperate maritime glacier: Coastal glaciers in temperate or moderately cool climates where glacial ice exists at or near melting point, as opposed to polar glaciers which exist below their freezing temperature throughout the year.

Threatened species: Any species which is likely to become an endangered species within the foreseeable future and which has been designated in the *Federal Register* as a threatened species.

Total maximum daily load (TMDL): A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

Transporter: A person or entity that offers transportation to the MGRA via bus, van, cab or other means. A transporter does not accompany a client during their MGRA visit. Services provided by MGRA transporters are authorized using outfitter/guide special use permits.

U.S. Army Corps of Engineers (USACE): The federal agency charged with, among other activities, enforcing the Clean Water Act by regulation of dredge and fill activities in waters of the United States, including wetlands.

U.S. Fish and Wildlife Service (USFWS): The agency of the Department of the Interior responsible for managing wildlife, including non-ocean going species protected by the ESA.

Unguided public: A visitor to the MGRA that does not use a commercial guiding or transport service, and therefore is not included in commercial capacity allocations.

Visitation: The reportable entry of a person onto lands or waters administered by the Forest Service for recreation purposes.

Visual quality: Describes the degree of variety in the landscape, created by the basic vegetative patterns, landform, and water forms. Landscapes with the greatest variety or diversity have the greatest potential for high scenic value or visual quality.

Water rights: The legal right to use water.

Waters of the United States (WOTUS): A threshold term that establishes the scope of federal jurisdiction for the Clean Water Act as navigable waters up to the discretion of the EPA and USACE.

Watershed: The entire area that contributes water to a drainage system or stream.

Wetlands: Areas inundated or saturated with water sufficient to support vegetation specially adapted for wet soil conditions.

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