National Park Service
U.S. Department of the Interior

Wrangell-St. Elias National Park and Preserve
Alaska

St. Elias Erosion and Tectonics Project
Environmental Assessment
April 2006 – Public Review Copy

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Note to Reviewers

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ACRONYMS AND ABBREVIATIONS

AEIC	Alaska Earthquake Information Center
AIRFA	American Indian Religious Freedom Act
AMD	Aviation Management Directorate
ANILCA	Alaska National Interest Lands Conservation Act
ARPA	Archeological Resources Protection Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DO	NPS Director's Order
DOI	Department of the Interior
EA	Environmental Assessment
GMP	General Management Plan
GPS	Geographic Positioning System
IAR	Investigator's Annual Report
IHOG	Interagency Helicopter Operations Guide
M	Magnitude
NEPA	National Environmental Policy Act
NPS	National Park Service
NSF	National Science Foundation
OAS	Office of Aviation Safety
OSHA	Occupational Safety and Health Administration
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
PEPC	Planning, Environment, and Public Comment website
PL	Public Law
PPE	Personal Protective Equipment
RAWS	Remote Automated Weather Station
SCAN	Southcentral Alaska Network
STEEP	St. Elias Erosion and Tectonics Project
UAF	University of Alaska Fairbanks
USGS	United States Geologic Survey
VSAT	Very Small Aperture Terminal
WRST	Wrangell-St. Elias National Park and Preserve

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE OF ACTION

The National Park Service (NPS) is considering a proposal from the Alaska Earthquake Information Center (AEIC) located at the Geophysical Institute University of Alaska Fairbanks (UAF) to expand the seismic monitoring station network in Wrangell-St. Elias National Park and Preserve (WRST) through the St. Elias Erosion and Tectonics Project (STEEP). STEEP is a study that seeks an improved understanding of interactions between surface processes and tectonics in active mountain belts. The new seismic stations would complement existing stations in WRST, which are used to monitor frequent seismic activity along and near the St. Elias orogen (mountain belt). Figure 1-1 shows the location of WRST and existing seismic stations within the park and preserve.

The AEIC would like to install 10 new seismic stations in WRST to improve earthquake detection and hazard forecasting in the region. Four existing stations would be upgraded and two additional stations would be located on private property. The new seismic stations would complement 17 existing stations inside the park which are used to monitor seismic activity along the St. Elias orogen. The unmanned seismic stations, consisting of a fiberglass hut housing equipment and a seismometer, would become part of the AEIC seismic monitoring network which provides a catalog of earthquake events for the region.

This environmental assessment (EA) analyzes the potential environmental impacts which could result from the alternatives considered, including the No Action alternative. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, regulations of the Council of Environmental Quality (CEQ) (40 Code of Federal Regulations 1508.9), and the NPS NEPA compliance guidance handbook (Director's Order (DO)-12, *Conservation Planning, Environmental Impact Analysis, and Decision-making*).

1.2 NEED FOR ACTION

STEEP is an integrated onshore-offshore study that is proposed to involve active source and passive source seismology, GPS-based geodetic studies, geologic studies, surface process studies, geochronology, and geodynamic modeling. The Passive Seismic Array Experiment and Seismicity Study, which is a component of STEEP, is specifically covered by this EA as the only project installation that would be located in WRST.

The STEEP project seeks to develop a better understanding of the interaction between erosion and tectonics in active orogenic (mountain building) belts. High rates of erosion in areas where mountains are actively being built may affect the location of areas of crustal deformation (where the Earth's surface deforms) and areas of faulting. Understanding these interactions in an existing, active mountain belt would allow a better understanding of the tectonic history and modern tectonic setting of Alaska, which will aid in assessments of geologic hazards (e.g. damaging earthquakes and tsunamis). The orogen being studied in the STEEP project is the source of the largest earthquakes in North America and has the potential to generate tsunamis

that could impact nearby and distant coasts of the Pacific Ocean. Understanding the orogenic history of the region may also improve our understanding of the effects of mountain building on the climate of North America and the world. Seismologists believe more monitoring is needed in WRST to assess the possibility of more large earthquakes in the region. In the event of a large seismic event, the proposed sites could provide invaluable detail in researching the rupture.

The passive seismic study proposes to utilize a passive seismic array in the St. Elias region to detect small earthquakes. The experiment would construct a catalog of events for the region. The existing network geometry in this region is inadequate to address the scientific questions posed in STEEP. The current seismic station spacing is widely variable from a minimum of approximately 30 km to a maximum separation approaching 200 km. Earthquake location precision scales with station spacing and precision location is most readily achieved when the station spacing is on the order of 10 km or less (USGS, 2002). This is far from the case in this region and is a fundamental limit that makes mining existing data an inadequate solution to address the questions posed in this project. Active fault monitoring stations are designed for detailed seismic observation of moderately to highly active earthquake sources to capture the near-future strong to major earthquakes in the country (M 6.5+) and seismicity associated with active volcanoes. Data obtained from monitoring stations near significant earthquakes even in areas remote from urban areas are urgently needed to improve ground-motion predictive models for high-amplitude motions on a wide range of site geologic conditions. For this reason a denser station array is needed.

Installing the network of STEEP seismometers that is proposed for WRST would increase the density of seismic stations in the AEIC network in south-central Alaska and would allow AEIC to determine earthquake locations and magnitudes with greater accuracy. Improved accuracy would allow for the production of more useful information releases for local, state, and federal authorities following major earthquakes. The new stations would also allow AEIC to detect many more small magnitude events that may reveal patterns of seismicity in and near WRST that could provide a better understanding of what areas of the park have the highest seismic hazard. That information can be used by park planners when assessing the placement and construction of new infrastructure, or the seismic safety of existing facilities. An improved understanding of the seismicity of WRST can be combined with information about local geology to assess geologic hazards and the relative risk of landslides, avalanches, impoundments and floods, etc. The data collected by the STEEP sensor network could allow the production of a much more accurate seismic hazard map for the park.

As an example, damage that occurred in Mentasta as a result of the M 7.9 Denali Fault earthquake of November 2nd, 2002 included heavy damage to the Tok Cutoff highway, ground cracks running beneath buildings, fuel storage tanks collapsed, contents of buildings falling off shelves and walls, and minor injuries sustained by a few people trying to exit buildings during the strong shaking. The Tok Cutoff highway experienced major shifting and slumping of the road bed which caused large scale cracks in the road and deep crevices, rendering the highway impassable. Prediction and understanding of such a geohazard would be addressed by this project.

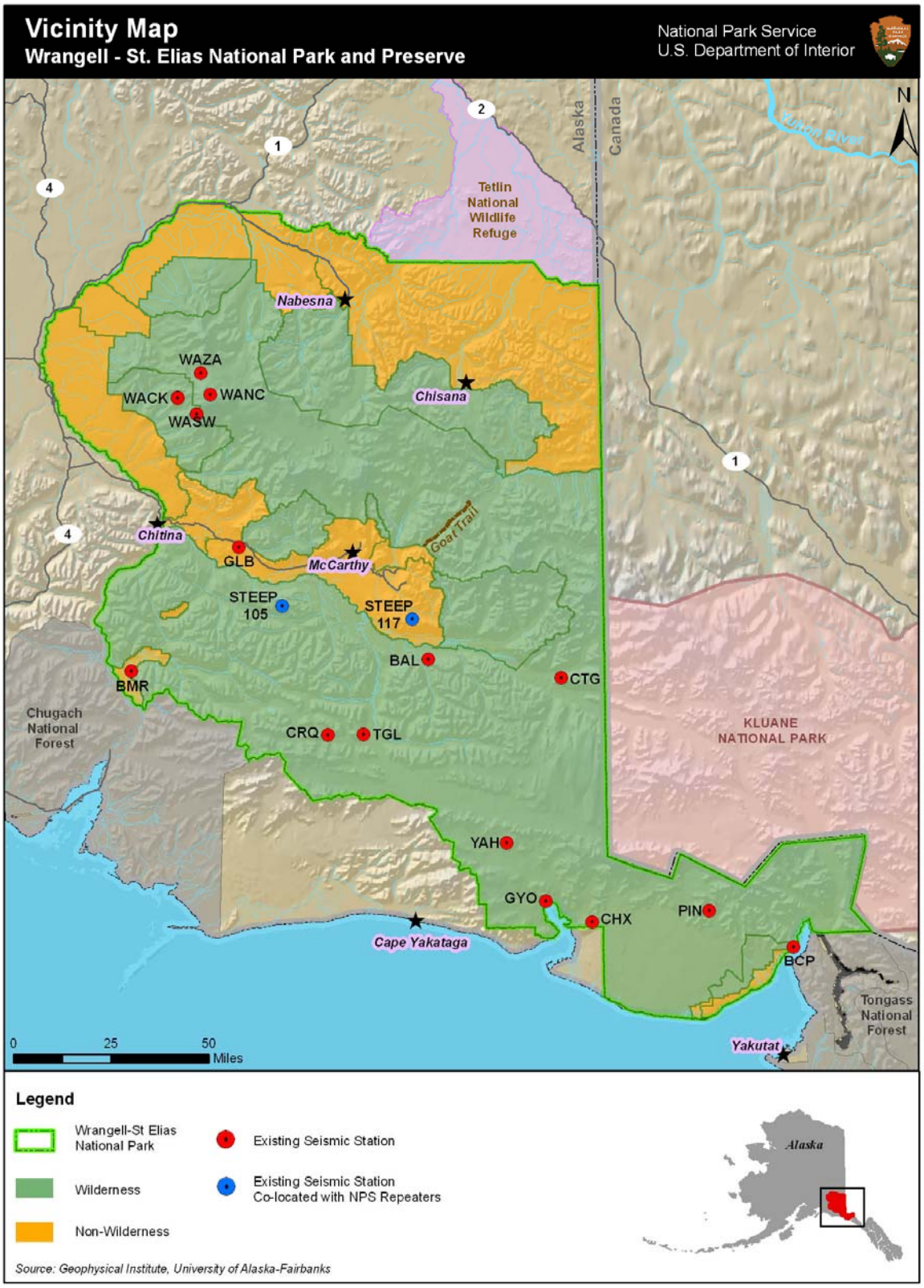

Figure 1-1. Vicinity map of Wrangell-St. Elias National Park and Preserve showing existing seismic stations.

1.3 PURPOSE AND SIGNIFICANCE OF THE PARK

Wrangell-St. Elias National Park and Preserve was established by the Alaska National Interest Lands Conservation Act (ANILCA, PL 96-487) on December 2, 1980. WRST encompasses 13.2 million acres of superlative scenery, abundant wildlife, and fascinating human history as the national park system's largest unit. The WRST Wilderness (8.7 million acres), as designated by Section 701 (8) of ANILCA, is also the largest unit of the national wilderness preservation system. WRST, Kluane National Park in Canada, Glacier Bay National Park and Preserve, and Tatshenshini-Alsek Park in British Columbia are together a World Heritage Site recognized for exceptional interest and universal value. The WRST Wilderness Suitability Review (NPS, 1986) found an additional 2.2 million acres as suitable for wilderness designation at WRST.

The general purposes of the conservation system units established under ANILCA are defined in Section 101 as follows:

a) To preserve for the benefit, use, education, and inspiration of present and future generations, certain lands and waters in the state of Alaska that contain nationally significant natural, scenic, historic, archeological, geological, scientific, wilderness, cultural, recreational, and wildlife values.

b) To preserve unrivaled scenic and geological values associated with natural landscapes; to provide for the maintenance of sound populations of, and habitat for, wildlife species of inestimable value to the citizens of Alaska and the Nation, including those species dependent on vast relatively undeveloped areas; to preserve in their natural state extensive unaltered Arctic tundra, boreal forest, and coastal rainforest ecosystems; to protect the resources related to subsistence needs; to protect and preserve historic and archeological sites, rivers, and lands, and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and sub arctic wildlands and on free flowing rivers; and to maintain opportunities for scientific research and undisturbed ecosystems.

c) Consistent with management of fish and wildlife in accordance with recognized scientific principles and the purposes for which each conservation system unit is established, designated, or expanded by or pursuant to this act, to provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so.

Section 201(9) of ANILCA states that WRST will be managed for the following purposes, among others: to maintain unimpaired the scenic beauty and quality of high mountain peaks, foothills, glacial systems, lakes and streams, valleys, and coastal landscapes in their natural state; to protect habitat for, and populations of, fish and wildlife including but not limited to caribou, brown/grizzly bears, Dall sheep, moose, wolves, trumpeter swans and other waterfowl, and marine mammals; and to provide continued opportunities, including reasonable access for mountain climbing, mountaineering, and other wilderness recreational activities. Subsistence uses by local residents shall be permitted in the park, where such uses are traditional in accordance with the provisions of title VIII.

1.4 LAWS, REGULATIONS, AND POLICIES

The NPS Organic Act (1916) and the General Authorities Act (1970) prohibit impairment of park resources and values. The NPS 2001 Management Policies and Director's Order #55 use the terms "resources and values" to mean the full spectrum of tangible and intangible attributes for which the park was established and is managed, including the Organic Act's fundamental purpose and any additional purposes as stated in the park's establishing legislation. The impairment of park resources and values may not be allowed unless directly and specifically provided by statute. The primary responsibility of the NPS is to ensure that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities to enjoy them.

The evaluation of whether impacts of a preferred alternative would lead to an impairment of park resources and values is included in this EA. Impairment is more likely when there are potential impacts to a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- essential to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- identified as a goal in the park's GMP or other relevant NPS planning documents.

The National Park Service Omnibus Management Act of 1998 (P.L. 105-391, 112 Statute 3497) addresses resources inventory and management in Title II. Section 201 defines the purposes of this title to enhance and encourage scientific study in National Park System (NPS) units. Section 202 authorizes and directs the Secretary of the Interior to assure management is enhanced of NPS units by a broad program of high quality science and information. Section 205 states the Secretary may solicit, receive, and consider requests from Federal and non-Federal public or private entities for the use of NPS units for scientific study. Such proposals must be: 1) consistent with applicable laws and the NPS Management Policies, and 2) the study would be conducted in a manner as to pose no threat to park resources or public enjoyment of those resources.

NPS Management Policies 2001 (NPS, 2000) addresses geologic resource management and geologic hazards, and the importance of and need for research and monitoring efforts in a number of sections.

Section 4.8.1.3 G*eologic hazards* "…earthquakes, volcanic eruptions, mudflows, landslides, floods, shoreline processes, tsunamis, and avalanches. The Service will work closely with specialists at the U.S. Geological Survey and elsewhere, and with local, state, and federal disaster management officials, to devise effective geologic hazard identification and management strategies. Although the magnitude and timing of future geologic hazards are difficult to forecast, park managers will strive to understand future hazards and, once the hazards are understood, minimize their potential impact on visitors, staff, and developed areas".

Section 4.2 *Studies and collections* "The Service will encourage appropriately reviewed natural resource studies whenever such studies are consistent with applicable laws and policies. These

studies support the NPS mission by providing the Service, the scientific community, and the public with an understanding of park resources, processes, values, and uses that will be cumulative and constantly refined… Studies include projects conducted by researchers and scholars in universities, foundations and other institutions, tribal colleges and organizations, other federal and state agencies, and Service staff".

Section 2.3.1.5 *Science and Scholarship* "The collection and analysis of information about park resources will be a continuous process that will help ensure that decisions are consistent with park purposes."

Section 6.3.6 *Scientific Activities in Wilderness* "The statutory purposes of wilderness include scientific activities, and these activities are encouraged and permitted when consistent with the Service's responsibilities to preserve and manage wilderness".

Section 6.3.6.1 *General Policy* "The National Park Service has a responsibility to support the appropriate scientific activities in wilderness and to use science to improve wilderness management. The Service recognizes that wilderness can and should serve as an important resource for long-term research into, and study, and observation of, ecological processes and the impacts of humans on these ecosystems. The National Park Service further recognizes that appropriate scientific activities may be critical to the long- term preservation of wilderness. Scientific activities are to be encouraged in wilderness. Even those scientific activities (including inventory, monitoring, and research) that involve a potential impact to wilderness resources or values (including access, ground disturbance, use of equipment, and animal welfare) should be allowed when the benefits of what can be learned outweigh the impacts on wilderness resources or values. However, all such activities must also be evaluated using the minimum requirement concept and include documented compliance that assesses impacts against benefits to wilderness. This process should ensure that the activity is appropriate and utilizes the minimum tool required to accomplish project objectives".

The Wilderness Act (Public Law 88-577) in the Section 2A definition of wilderness states:
(c) A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

Section 4 of the 1964 Wilderness Act acknowledges that although certain activities are prohibited in order to protect wilderness, there are also necessary exceptions in order to meet the minimum requirements for the administration of the area as wilderness. Section 4c on prohibitions states:

"…there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and, except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area."

Section 4(d) makes special provisions for exceptions, including the use of aircraft or motorboats where already established, control of fire, prospecting for the purpose of gathering information on minerals and other resources, prospecting for water resources, establishment and maintenance of reservoirs, power lines, and other facilities for the public interest, commercial services performed for realizing recreational purposes, etc. Additionally, Section 4(b) states that "each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve its wilderness character. Except as otherwise provided in this Act, wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use".

Therefore, a two-step process is used:

1) Determine whether the proposed management action is needed, necessary for the purpose of wilderness, and does not pose a threat to wilderness resources and character.
2) Determine the techniques and type of equipment needed to ensure that impact to wilderness resources and values is minimized.

The minimum requirement concept is used when making all decisions concerning management of wilderness, including administrative practices, proposed special uses, scientific activities, and equipment use (including seismic monitoring stations) in wilderness. When the minimum requirement is determined, the potential disruption of wilderness character and the physical resource is considered and given more weight than economic efficiency and convenience. If a compromise of wilderness resource or character is unavoidable, only those actions that preserve wilderness character and/or have localized, short-term adverse impacts will be acceptable. The minimum requirement/minimum tool analysis for this project is included in Appendix D.

The 2005 NPS Helicopter Use Policy for Wrangell-St. Elias National Park and Preserve (Appendix A) lists specific guidelines regarding use of helicopters at WRST and notes exceptions to the requirement to maintain an altitude of 1000 ft that include management activities (i.e., wildlife, vegetation, fire, grazing allotment, hazardous waste, park use, subsistence and mining, maintenance, etc.) specifically covered by a project statement, management plan, plan of operations, or prior approval by the Superintendent.

The National Historic Preservation Act (NHPA) sets forth Government policy and procedures regarding historic properties including districts, sites, buildings, structures and objects included in or eligible for the National Register of Historic Places. Section 106 of NHPA requires that

Federal agencies consider the effects of their actions on such properties, following regulations issued by the Advisory Council on Historic Preservation (36 CFR 800).

The Native American Graves Protection and Repatriation Act (NAGPRA) requires Federal agencies and federally assisted museums to return "Native American cultural items" to the Federally recognized Indian tribes or Native Hawaiian groups with which they are associated. Regulations, by the National Park Service (NPS) are at 43 CFR 10.

The American Indian Religious Freedom Act (AIRFA) says that the U.S. Government will respect and protect the rights of Indian tribes to the free exercise of their traditional religions; the courts have interpreted this as requiring agencies to consider the effects of their actions on traditional religious practices.

The Archeological Resources Protection Act (ARPA) prohibits the excavation of archeological resources (anything of archeological interest) on Federal or Indian lands, without a permit from the land manager.

1.5 HISTORY OF THE ST. ELIAS EROSION AND TECTONICS PROJECT

The STEEP program was initiated in December 2003 when a proposal for the project was submitted to the National Science Foundation (NSF). Upon approval of the project, the start date for NSF funding was September 15, 2004. Field research began in the summer of 2005. Existing STEEP stations were installed in July of 2005 and they include eight stations outside the park to the south of the WRST boundary clustered around Bering Glacier.

Other existing seismic stations are located within WRST and were installed prior to the creation of the park under the USGS “SCAN” (Southcentral Alaska Network) program in response to the magnitude 9.2 1964 Good Friday Earthquake. SCAN stations include BMR, GLB, BAL, CRQ, TGL, CTG, YAH, GYO, CHX, PIN, and BCP (see Fig. 1-1). These stations were installed in the early to middle 1970's. The existing stations on Mt. Wrangell (WAZA, WANC, WASW, and WACK) were installed by the USGS Alaska Volcano Observatory in 2000 and 2001.

Several other NEPA documents influence the scope of this EA. The NPS executed a Categorical Exclusion for a limited two seismic network to be installed on Mt. Wrangell in May 2000. Another Categorical Exclusion was executed to install two additional seismic stations to monitor Mt. Wrangell in May 2001. A third Categorical Exclusion was executed for STEEP GPS sites and field reconnaissance for seismic on April 12, 2005. Additionally, Categorical Exclusions for USGS seismic station network maintenance were executed in 1995, 1997, 2000, and 2001.

1.6 ISSUES AND IMPACT TOPICS

Issues and concerns with this project are grouped into distinct impact topics to aid in analyzing environmental consequences, which allows for a standardized comparison of alternatives based on the most relevant information. The impact topics were identified on the basis of federal laws, regulations and orders, NPS Management Policies 2001, and NPS knowledge of potentially affected resources. A brief rationale for selecting or dismissing each topic is provided below.

1.6.1 Issues Selected for Detailed Analysis

Soils
Soil compaction from foot traffic may occur during seismic station installation and maintenance. Soils may be disturbed by anchoring of the seismic equipment.

Vegetation
Vegetation could be trampled during installation and maintenance of the seismic stations. The seismic station footprint would have impact on vegetation. Sites would need to be surveyed for rare plants prior to installation of new seismic stations.

Wildlife
Installation and maintenance of the seismic stations could temporarily displace wildlife in the immediate vicinity. The seismic station footprint would have impact on areas of wildlife habitat.

Threatened and Endangered Species
There are no federally listed endangered and threatened species, or designated or proposed critical habitat, in the vicinity of the project within WRST. However, Kittlitz's murrelet, a candidate species for federal listing, may nest in the vicinity of several proposed seismic station sites. Human activity and helicopter use could possibly cause nesting disturbance to this bird species.

Wilderness Values

Solitude and Naturalness
Installation, operation, and maintenance of seismic stations in designated wilderness may affect solitude and naturalness. Noise intrusions would occur during installation and maintenance of the seismic stations due to presence of field crews and the aircraft used for site access; these noise intrusions would detract from the wilderness solitude.

Visual Resources
The seismic stations may be visible, thus posing an unnatural visual intrusion in pristine environments. Intrusions could include actual visibility of the hut or glare reflected off solar panels.

Visitor Experience
Encountering a seismic station in WRST could have a detrimental effect on the visitor's recreational experience.

Cultural Resources
Potentially cultural resources may be found during site investigations at the proposed seismic stations. Not all proposed station locations have been archaeologically surveyed. Of the previous surveyed stations, STEEP 109, STEEP 115, and STEEP 117 have a high potential for the discovery of cultural remains.

Seismic Monitoring and Hazard Forecasting
Large magnitude earthquakes have been recorded along the Pacific/North American plate boundary in Alaska with exception to the Yakataga seismic gap between Cape Yakataga and the Icy Bay area of Wrangell-St. Elias National Park and Preserve. The lack of large seismic events in the Yakataga seismic gap implies that stress is accumulating on the plate boundary. It is possible that a magnitude 7 or greater earthquake will occur in the region in the future. An expanded seismic station monitoring network in Wrangell-St. Elias National Park and Preserve would improve hazard evaluation and benefit human safety. The Totschunda Fault is the most likely source of the next large earthquake (magnitude 7 to 8) expected to occur in interior Alaska. Installing additional seismic stations in the northern portion of the park and preserve would provide essential scientific data before, during, and after a large magnitude earthquake in the region. Data gathered from the expanded monitoring network would increase public knowledge of seismic phenomena and hazards, enhance NPS knowledge to address geologic hazards for future park planning and infrastructure development, and supplement the park's interpretive program.

1.6.2 Impact Topics Dismissed from Further Analysis

Air Quality
The alternatives described in this plan would not cause changes to air quality. There would be no emissions from the monitoring equipment; emissions from aircraft may result in negligible, localized, temporary reductions in air quality.

Executive Order 12898, "Environmental Justice"
Executive Order 12898, "General Actions to Address Environmental Justice in Minority Populations and Low-income Populations" requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The EA alternatives would have no health or environmental effects on minorities or low-income populations or communities.

Floodplains
Proposed sites are not located in or adjacent to a floodplain or riparian area**.**

Safety
NPS would follow all appropriate Occupational Health and Safety (OSHA) guidelines for helicopter flights. There are no hazardous materials associated with operation of the seismic stations. Refueling of aircraft would occur outside the park. Other public health and safety issues, such as earthquake detection, forecasting, and the attendant hazards from large avalanches, earth slides, impoundments, etc, are addressed under the Seismic Monitoring and Hazard Forecasting topic.

Socioeconomics
Station installation and maintenance would be performed by UAF personnel. No net impact on the local economy is expected because additional personnel from the local community would not be performing seismic installation and maintenance activities.

Subsistence
Effects on subsistence were dismissed from analysis because the proposed weather station sites would not have any effect on subsistence activities. An ANILCA Section 810(a) summary evaluation and analysis is contained in Appendix B.

Water Resources
None of the proposed seismic station sites would be located in or adjacent to any surface or groundwater.

Wetlands
The proposed seismic station sites would not be located in or adjacent to any wetlands.

1.7 PERMITS AND REVIEWS NEEDED TO IMPLEMENT PROJECT

Wilderness: a minimum requirement/minimum tool analysis has been conducted for new proposed seismic stations located in the Wrangell-St. Elias Wilderness. Results for this analysis are included in this EA (Appendix D).

Subsistence: NPS WRST has conducted an ANILCA Section 810 Analysis concerning the impacts on subsistence. Results of that analysis are included in this EA (Appendix B).

Aircraft Use: The NPS would issue a special-use permit for all aircraft activities associated with installation and maintenance of seismic stations. Full compliance with the WRST Helicopter Policy (Appendix A) is required for the installation and maintenance of any seismic station requiring helicopter support regardless of whether the site is in the WRST Wilderness.

Research: The NPS would issue a research permit to the UAF Geophysical Institute (operating the seismic stations for AEIC). A research permit would detail the permitted station locations, limits of installation, and use of the NPS facilities and other locations to safely manage fuel and landing of helicopters in the park. A research permit would be issued for 5 years; renewable upon a detailed project review. Investigator's Annual Reports (IARs) would be submitted to the NPS to assess the progress and effectiveness of the seismic monitoring program. The monitoring program would be evaluated after five years, after which a research permit could be re-issued.

CHAPTER 2: ALTERNATIVES

CEQ regulations for implementing NEPA require that Federal agencies explore and objectively evaluate all reasonable alternatives to the Preferred Alternative, and to briefly discuss the rationale for eliminating any alternatives that were not considered in detail. This chapter describes a range of reasonable alternatives, including the No Action Alternative and Preferred Alternative, and those alternatives that were considered and eliminated from further analysis.

2.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, no additional seismic monitoring stations would be established in WRST. Basic seismic data would continue to be collected using the existing network of seismic stations, including stations in WRST and outside of the park and preserve (Fig. 2-1).

The long-term seismic monitoring plan under Alternative A would continue operating and maintaining the 35 existing seismic stations. Seventeen existing stations are located in WRST (Table 2-1) and 18 stations are located outside of the park and preserve in the immediate vicinity. Of the 17 sites in WRST, 15 are in designated wilderness, 2 are co-located with permitted STEEP GPS sites, and 2 are co-located with NPS radio repeater sites. Each station has a footprint of about 120 square feet, or about 0.003 acre. AEIC may upgrade existing stations with replacement or additional equipment as needed. Upgrades at existing sites would involve the installation of telemetry repeaters (radios, antennas, and batteries - all located within the hut).

In the long-term, each of the existing seismic stations would be visited for maintenance once every 4 years during the summer field season to replace batteries. Station maintenance would take 4 hours or less per station. The sites would require use of a helicopter for access. Maintenance would be spread out so that 4 to 5 stations are visited each year for regular maintenance. In the long-term, 2 helicopter days, each day consisting of one round trip flight from the heli-base linking each site scheduled that day, would be required during maintenance years for visits to seismic stations as up to 3 stations can be maintained in one day. Maintenance flights often originate in Valdez, but can also originate in Juneau or Anchorage depending on weather. Flight paths are direct from the heli-base to the sites.

2.2 ALTERNATIVE B: EXPAND SEISMIC MONITORING NETWORK

Under Alternative B, the AEIC would implement a long-term seismic monitoring plan at WRST that would include 10 new seismic stations, upgrades to 4 existing stations, and 2 new stations on private land (Fig. 2-2). All 10 of the proposed new seismic stations would be established in designated wilderness, and one of the existing sites being upgraded is already located in wilderness. Two of the existing sites being upgraded are co-located with NPS radio repeaters, and seven of the new proposed sites are co-located with permitted STEEP GPS sites (Table 2-1). Only three proposed sites in the park would not be co-located with permitted STEEP GPS sites or any existing park facilities. All the existing stations described in Alternative A would be included here, for a total of 29 seismic stations in the network within the park.

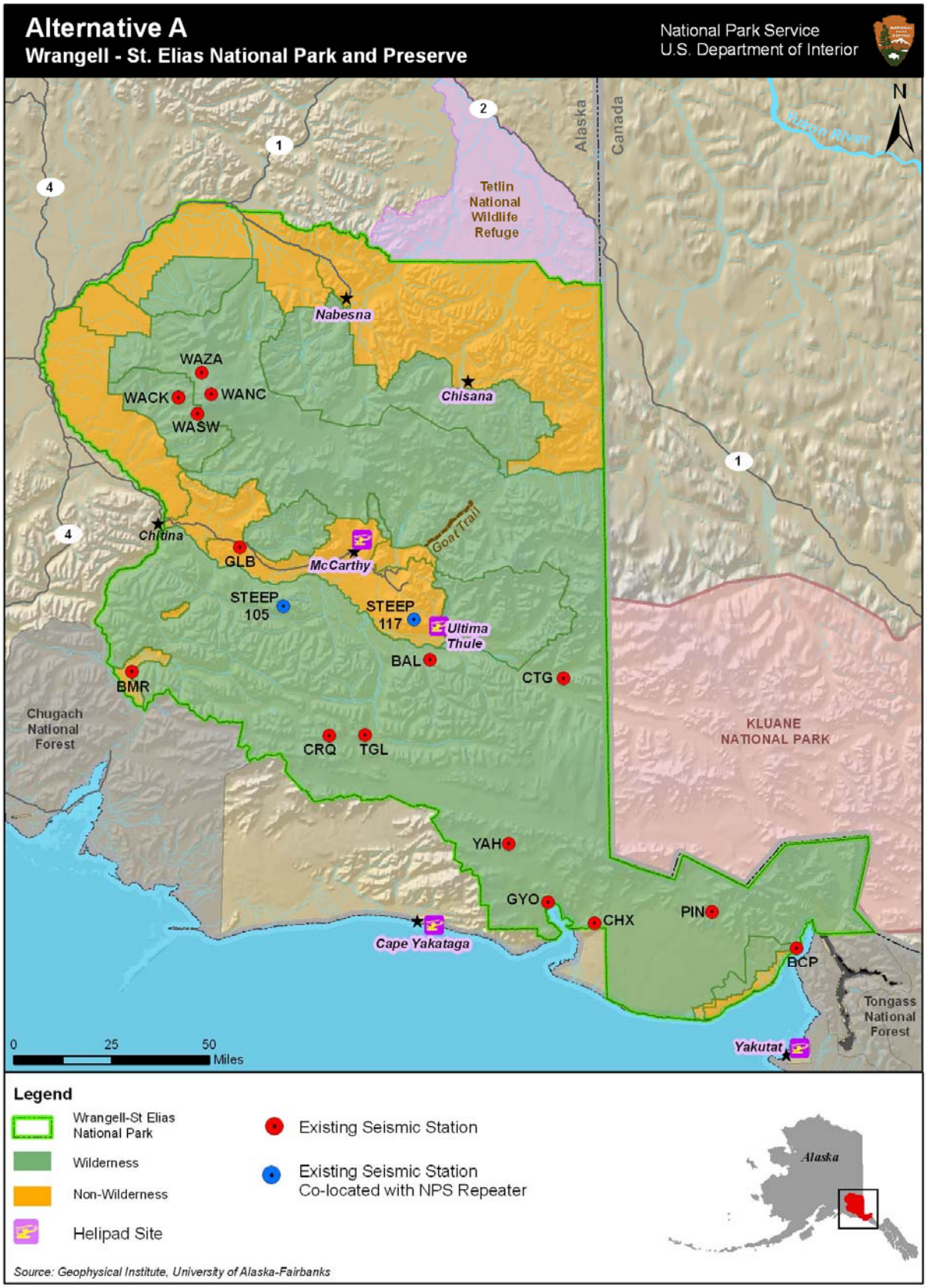

Figure 2-1. Alternative A: No Action Alternative.

Table 2-1. Existing and proposed seismic station sites identified for WRST.

Site Identifier	Station Name	Type of Site	Included in Alternative	Elevation (m)	Latitude	Longitude	Existing/ Proposed	In/Out Park	In/Out Wilderness	Co-located with Repeaters	Co-located with GPS Sites
Steep 107	Barnard Glacier	seismic	B,C	1,631	61.087	-141.707	Proposed	In	In	No	No
Steep 114	Mesa	seismic	B,C	1,889	60.179	-141.954	Proposed	In	In	No	No
Steep 116	Bagley	seismic	B,C	1,715	60.504	-141.598	Proposed	In	In	No	No
Steep 106	Logan Glacier	seismic	B,C	1,921	60.814	-141.015	Proposed	In	In	No	Yes
Steep 108	Granite Creek	seismic	B,C	1,591	60.714	-141.779	Proposed	In	In	No	Yes
Steep 109	Juniper Island	seismic	B,C	1,364	60.601	-142.342	Proposed	In	In	No	Yes
Steep 115	Kiagna River	seismic	B,C	1,698	60.891	-142.263	Proposed	In	In	No	Yes
Steep 119	RKAV GPS	seismic	B,C	1,570	60.300	-141.348	Proposed	In	In	No	Yes
Steep 123	St. Elias	seismic	B,C	2,089	60.377	-141.037	Proposed	In	In	No	Yes
Steep 124	Samovar Hills	seismic	B,C	1,466	60.160	-140.706	Proposed	In	In	No	Yes
Steep 105	Verde Peak	seismic	B,C	1,855	61.226	-143.453	Proposed*	In	In	Yes	No
Steep 117	Patty Peak	seismic	B,C	1,828	61.185	-142.467	Proposed*	In	Out	Yes	No
BAL	Baldy Mt.	seismic	B,C	1,273	61.035	-142.347	Proposed*	In	In	No	No
TGL	Tana Glacier	seismic	B,C	1,230	60.756	-142.830	Proposed*	In	In	No	No
Steep 101	McCarthy Tower (Private Property: Keith Rowland)	Seismic + VSAT	B,C	640	61.424	-143.022	Proposed	Out	-	-	-
ULTH	Ultima Thule (Private Property: Paul Claus)	VSAT	B,C	396	61.128	-142.410	Proposed	Out	-	-	-
AEIC 02	Boyden Hills	seismic	C	2,167	62.476	-142.956	Proposed	In	Out	Yes	No
AEIC 04	Cooper Pass	seismic	C	1,969	62.260	-142.440	Proposed	In	Out	Yes	No
AEIC 06	Euchre Mtn	seismic	C	2,092	62.056	-142.182	Proposed	In	Boundary	Yes	No
AEIC 07	Bend	seismic	C	1,941	61.700	-141.730	Proposed	In	In	Yes	No
AEIC 08	Terrace Point	seismic	C	747	59.948	-139.783	Proposed	In	In	Yes	No
Steep 105	Verde Peak	seismic	A, B, C	1,855	61.226	-143.453	Existing	In	In	Yes	No
Steep 117	Patty Peak	seismic	A, B, C	1,828	61.185	-142.467	Existing	In	Out	Yes	No
WAZA	Wrangell Zanetti	seismic	A, B, C	2,531	62.075	-144.152	Existing	In	In	No	No
WANC	Wrangell North Crater	seismic	A, B, C	4,109	62.003	-144.070	Existing	In	In	No	No
WACK	Wrangell Chicokna Glacier	seismic	A, B, C	2,280	61.986	-144.328	Existing	In	In	No	No
WASW	Wrangell Southwest	seismic	A, B, C	2,195	61.928	-144.172	Existing	In	In	No	No
BAL	Baldy Mt.	seismic	A, B, C	1,273	61.035	-142.347	Existing	In	In	No	No
BMR	Bremner	seismic	A, B, C	709	60.968	-144.603	Existing	In	In	No	Yes
CTG	Chitina Glacier	seismic	A, B, C	1,418	60.966	-141.338	Existing	In	In	No	No
CRQ	Cirque	seismic	A, B, C	1,740	60.757	-143.139	Existing	In	In	No	No
TGL	Tana Glacier	seismic	A, B, C	1,230	60.756	-142.830	Existing	In	In	No	No
YAH	Yahtse	seismic	A, B, C	1,805	60.352	-141.738	Existing	In	In	No	Yes
GYO	Guyot	seismic	A, B, C	171	60.142	-141.457	Existing	In	In	No	No
PIN	Pinnacle Pass	seismic	A, B, C	892	60.097	-140.254	Existing	In	In	No	No
CHX	Chaix Hills	seismic	A, B, C	1,080	60.063	-141.119	Existing	In	In	No	No
BCP	Bancas Point	seismic	A, B, C	383	59.953	-139.635	Existing	In	In	No	No
GLB	Gilahina Butte	seismic	A, B, C	792	61.442	-143.810	Existing	In	Out	No	No

* denotes an upgrade to an existing site; shown twice on the list

Co-locating stations with other existing sites is advantageous because helicopter time can be shared for maintenance visits and ground disturbance would not increase since impacts from maintenance activities are already occurring. However, seismic stations must be located on bedrock at high elevations on landforms that have good long-distance lines of site to other stations for data telemetry. Therefore, sites cannot be located near the McCarthy or Nabesna roads or co-located with RAWS stations because such low elevations sites that are not on bedrock do not meet the criteria for seismic station locations.

Locations of proposed sites include an "umbrella" of approximately a 2 mile radius to ensure the station locations work with telemetry requirements. The umbrella around each proposed site is elliptical as sites would only be located on a ridge top. A final determination of the proposed locations would be pending additional site reconnaissance field work.

Seismic stations would be installed or upgraded in summer 2006. Each seismic station would require 2-3 days to be installed. The field crew would consist of three people who would be dropped off at each site and picked up every day. Installation of the seismic stations would take up to 6 weeks during the 2006 summer field season. Each site would require clearance for cultural resources and rare plants. Either real time clearance would occur on site with an archeologist and a botanist accompanying the installation team on the first day of installation or an archeologist, a botanist and a member of the installation team would visit each site prior to installation. Installation would not commence until site clearance was completed. An archaeological monitor will be present during the installation of the stations.

Installation of the new stations and upgrades of existing stations would require approximately 66 helicopter round-trips for transport of field crews and equipment. Each of the 10 new stations and 2 of the stations being upgraded (105 and 117) would require approximately five helicopter flights (from the base of operations or from a remote staging area at an airstrip) for installation (2 flights for personnel, 2 flights to sling huts and vaults, 1 flight for equipment). Installation of the 2 VSAT sites would not require any helicopter trips as STEEP 101is a "drive to" location and Ultima Thule is reached via Paul Claus's fixed-wing air taxi service to his property. Upgrades for BAL and TGL would occur during their regular maintenance schedule and would require 3 flights each. Fixed-wing aircraft would be used to preposition equipment at landing strips close to five of the installation sites (107, 108, 109, 114, and 119), thus reducing the area of the park to be overflown by helicopter and the total amount of helicopter flight time. No aviation fuel would be stored in the park and refueling would occur only outside the park. Helicopter flights would originate from bases in Ultima Thule, McCarthy airport, Yakutat, or Cape Yakataga (Fig. 2-2), and flight paths would be direct from the bases to the sites. In some cases, high elevation terrain would require that helicopters fly up valleys, rather than in straight lines from the base, such as for STEEP sites108, 116, and 123.

Each of the existing and new seismic stations would be visited for maintenance once every 4 years during the summer field season to replace batteries and upgrade equipment. Station maintenance would take 4 hours or less per station. The sites would require use of a helicopter for access. Maintenance would be spread out so that 7-8 stations are visited each year. In the long-term, 3 helicopter days, each day consisting of one round trip flight from the heli-base linking each site scheduled that day, would be required during maintenance years for visits to seismic stations as up to 3 stations can be maintained in one day.

The footprint for the new seismic monitoring stations at each site would be about 120 square feet or 0.003 acre. A specially designed 4-foot by 4-foot fiberglass weatherproof hut about 5 feet high would house an antenna, electronic equipment, and gel cell batteries that are charged by a 2-foot by 3-foot solar panel array attached to the hut (Fig. 2-3 and 2-4). The hut would be gel-coated a color to blend with the surrounding area so it would not be highly visible. A seismometer placed in a small polyethylene drum with less than a 2-foot diameter and approximately 2-3 feet high would be mostly buried at each new location (about 6 inches would remain above ground). A buried cable in flexible conduit would link the seismometer with telemetry equipment inside the hut (Fig. 2-5). Cables to be buried between the vault containing the seismometer and the hut containing batteries and telemetry gear would vary in length according to characteristics of each site. Lengths would generally be 5 to 20 feet depending on the type of ground. In solid bedrock, vaults are located close to the huts and cable lengths are on the order of 5 feet. In looser bedrock or unconsolidated soils vaults are located farther from the huts, so that vibrations or "noise" generated by the huts (e.g. in high winds) will not be recorded by the seismometer, and a cable length of approximately 20 feet is desirable. Decisions about which cable length to be used would be made when stations are installed.

Upgrades for two of the existing sites (105 and 117) would involve installation of telemetry repeaters located inside existing NPS facilities. Antennas would be placed on the existing NPS towers and radios would be located inside the existing NPS huts. Also, a seismometer in a ground in a poly drum would be installed, as well as a buried cable between the drum and the NPS hut. These upgrades would increases the footprint of each site by about 7 square feet. At the other two sites, TGL and BAL, one hut mounted with solar panels (the same type as at new STEEP sites) would be installed. This would increase the footprint of each site by approximately 16 square feet. Additionally, one 3 foot diameter steel culvert, a solar panel array, and an antenna mast would be removed at both BAL and TGL. Removal of this equipment would reduce the footprint of each site. AEIC may upgrade other existing stations with replacement or additional equipment as needed. Upgrades at existing sites would involve the installation of telemetry repeaters (radios, antennas, and batteries all located within the hut).

Two new sites would be installed on private land: one with a seismic station and a VSAT (STEEP 101) and one with just a VSAT (Ultima Thule) (Fig. 2-2 and 2-6, and Table 2-1). VSAT stands for "very small aperture terminal" and is a satellite communications system for two way data transmission. The VSAT stations would be used to transmit real time seismic data to AEIC via the Internet. Individual seismic stations would transmit and/or relay their data to the VSAT sites where the signals are then routed onto the Internet and sent to AEIC in Fairbanks. At STEEP 101 there would be a yellow poly drum vault in the ground containing a seismometer, two gray huts (a second hut is for extra batteries), two banks of solar panels on aluminum frames, two wind generators on 8 foot towers, a satellite dish, and a tall tower (~ 20'- 40') for telemetry antennas to receive data from the remote stations. At Utima Thule, the same components would be installed minus the poly drum with the seismometer. The footprint at each site would be approximately 120 square feet, or 0.003 acre.

Seismic monitoring sites are intended to be permanent installations and would be operated and maintained indefinitely. It is recognized that advancements in technology may render the

equipment at each site obsolete at some point in the future. Existing installations would be upgraded with newer equipment as needed to maintain the network, and obsolete equipment would be removed at those times. If station upgrades should reduce the footprint of the stations in the future, then sites would be restored (to original soil surfaces and slope angles) and revegetated as needed.

2.3 ALTERNATIVE C: MAXIMUM EXPANSION OF SEISMIC MONITORING NETWORK

The long-term seismic monitoring plan under Alternative C would install, upgrade, operate and maintain all the proposed and existing seismic and VSAT stations described under Alternative B, as well as additional seismic sites in the north part of WRST, for a total of 34 stations (Fig. 2-7 and Table 2-1). Two of the five additional seismic stations would be established in designated wilderness and one would be on the wilderness boundary. All five sites would be co-located with NPS radio repeater sites, and none of them would be co-located with permitted STEEP GPS sites. Descriptions under Alternative B for final site location determination, installation, maintenance, site footprints, equipment, etc. also apply to all sites in Alternative C.

The five additional seismic stations proposed under alternative C would be installed along the portion of the Denali/Totschunda Fault System that bisects the northeast corner of WRST and extends southeast toward Yakutat through Kluane National Park. A plurality of government agencies, including AEIC, the U.S. Geological Survey, the Alaska Division of Geological and Geophysical Surveys, and the Alaska Division of Homeland Security and Emergency Management agree that the Totschunda Fault is the most likely source of the next large earthquake (magnitude 7 to 8) that will occur in interior Alaska. All of these agencies have called for increased seismic monitoring of the Totschunda Fault in WRST.

One of the new stations that would be established with Alternative C, AEIC 08, would replace the existing station at Bancas Point (BCP). AEIC 08 would be co-located with an existing NPS radio repeater at Terrace Point. BCP would be decommissioned; the antenna mast, solar panels, and other equipment would be removed and the site restored.

Installation of the new stations and upgrades of existing stations would require approximately 91 helicopter round-trips for transport of field crews and equipment. Each of the 15 new stations and 2 of the stations being upgraded (105 and 117) would require approximately five helicopter flights (from the base of operations or from a remote staging area at an airstrip) for installation (2 flights for personnel, 2 flights to sling huts and vaults, 1 flight for equipment). Installation of the 2 VSAT sites would not require any helicopter trips as STEEP 101is a "drive to" location and Ultima Thule is reached via Ultima Thule’s fixed-wing air taxi service to their property. Upgrades for BAL and TGL would occur during their regular maintenance schedule and would require 3 flights each. Maintenance would be spread out so that 8-9 stations are visited each year for regular maintenance. In the long-term, 3 helicopter days, each day consisting of one round trip flight from the heli-base linking each site scheduled that day, would be required during maintenance years for visits to seismic stations as up to 3 stations can be maintained in one day.

2.4 MITIGATION MEASURES

2.4.1 Soils

The seismic stations would be anchored in such a way to avoid disturbing any soils present. Guy anchors would be driven into the ground between rocks. If necessary, holes no greater than ½ inch in diameter would be drilled into bedrock to facilitate the anchoring of guy lines. Seismic huts and drums would be located on barren locations when possible. Walking on the site and the temporary storage of supplies would be on barren ground or rock rather than on plants or soil. Helicopter landing zones, wherever possible, would be on snow or bare rock (as for sites 108, 116, 119, and 123).

2.4.2 Vegetation

The seismic station sites would be surveyed by qualified botanists prior to equipment installation for the presence of rare plant species as designated by the Alaska Natural Heritage Program. Where practical, all efforts would be taken to mitigate effects on rare plants by avoiding sites with such plants. Time would be allowed for questionable taxa to be reviewed by specialists so that correct determinations can be made and a report prepared. Helicopter landing zones, wherever possible, would be on snow or bare rock.

Although very little vegetation is present at most of the proposed sites, where the surfaces of rocks are covered with lichen, disturbance of those rocks would be minimized. If rocks need to be moved, the surface rocks with lichen on them would be carefully set aside and rocks from underneath would be used. Rocks with lichens on them would be left lichen-side up and in their original location when possible. Where other plants are present, care would be taken to minimize disturbance (e.g., stepping on rocks where possible rather than on plants).

2.4.3 Wildlife

To the extent possible, installation and maintenance activities would be timed to avoid sensitive periods, such as nesting season. Aircraft would not fly over wildlife. If animals (e.g., Dall sheep or bears) are observed near the seismic station sites, flights would be rerouted or rescheduled in order to avoid or minimize disturbance. No helicopter flights would be made over Dall sheep habitat (above the 4000-foot contour north of the Chitina River) from August 5 through September 20.

In addition to meeting all Federal Aviation Administration and NPS helicopter policy and aircraft requirements, mitigation common to all alternatives for both fixed wing and helicopter flight paths would include:

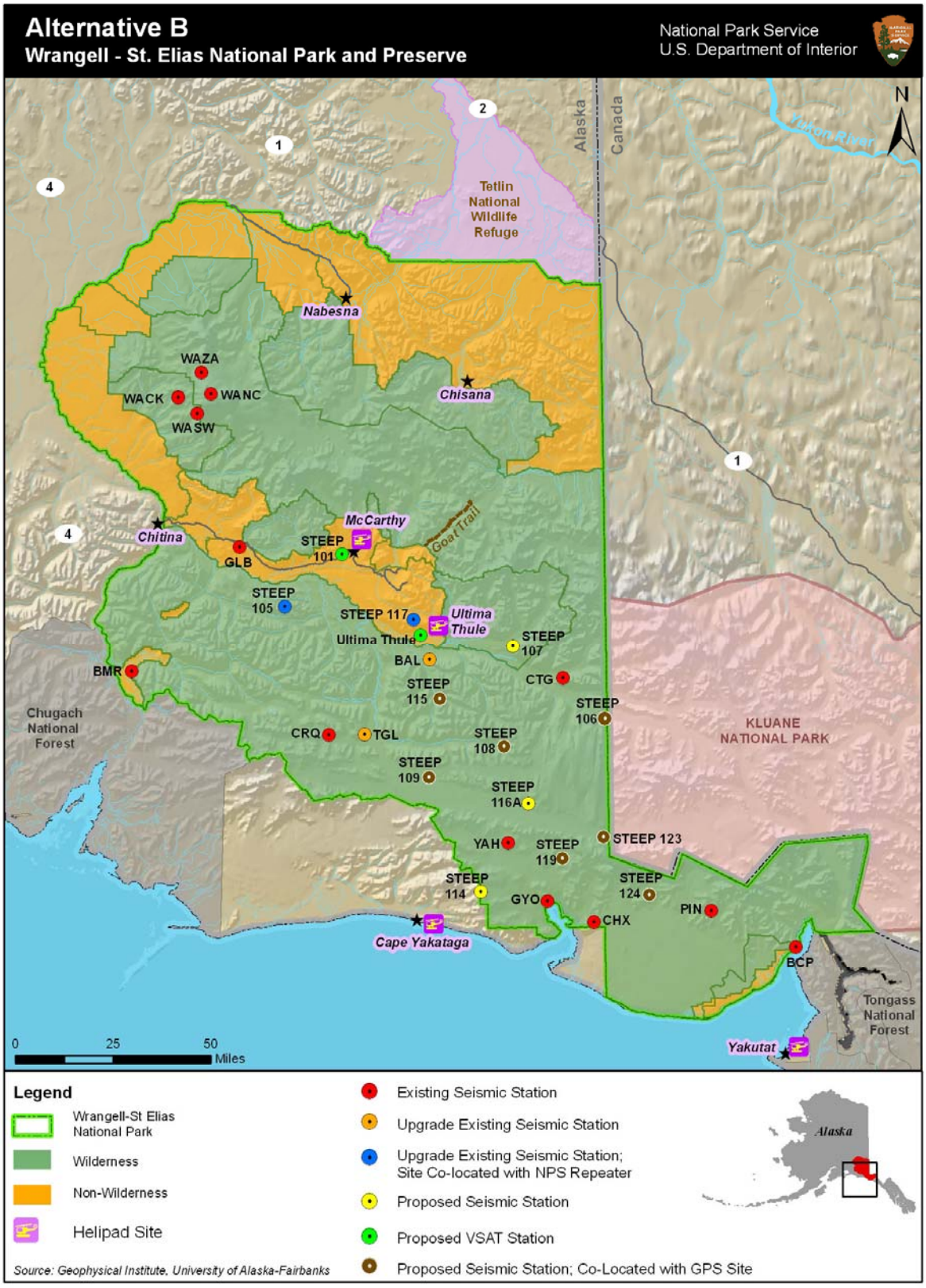

Figure 2-2. Alternative B: Expand Seismic Monitoring Network

Figure 2-3. Typical fiberglass seismic hut. Solar panels provide power, guy wires prevent movement. Hut is 16 square feet (4'x4'), 5 feet high, and gray to limit visibility.

Figure 2-4. Inside of typical hut where instruments are housed. Huts are locked or bolted closed to prevent animals from intruding.

Figure 2-5. Example of seismic drum and buried cable to equipment hut.

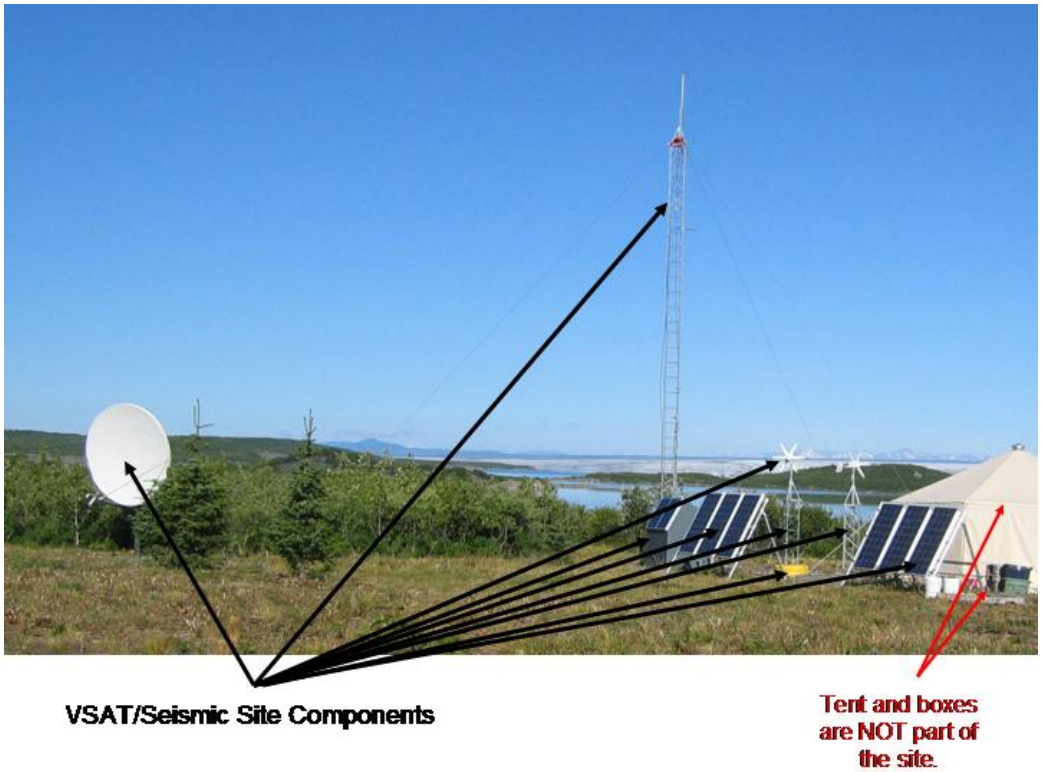

Figure 2-6. Example of a VSAT/Seismic site.

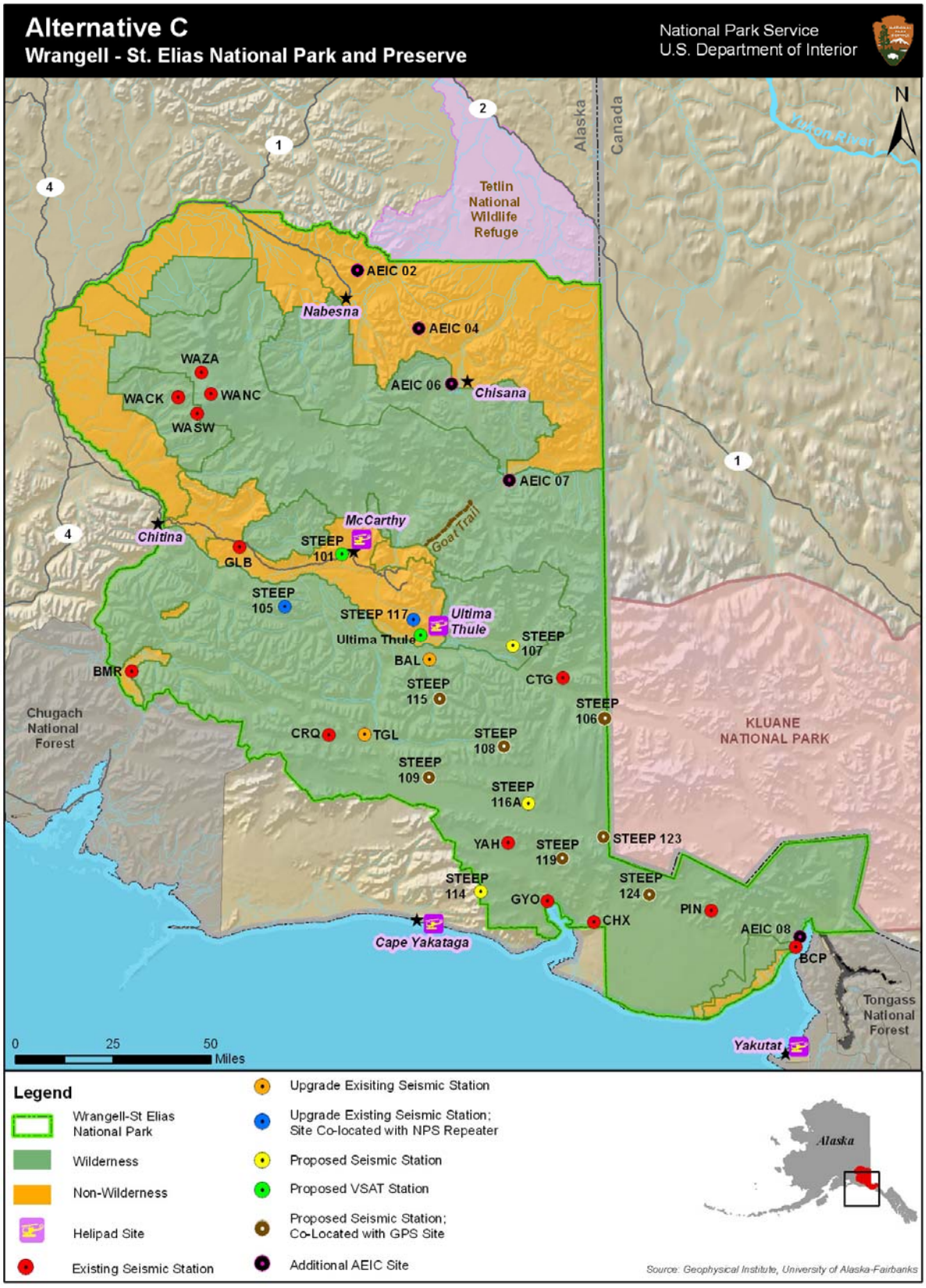

Figure 2-7. Alternative C: Maximum Expansion of Seismic Monitoring Network.

- Maintenance of a 1,500 foot vertical or horizontal clearance from traditional summer and calving or other habitats supporting reproduction as well as adult animals whenever feasible. This includes brown and black bear, moose, caribou, Dall sheep, and wolves.
- Pilots shall not hover, circle, harass, or pursue wildlife in any way.
- Where feasible, flight paths will avoid known Dall sheep breeding areas from May 15 through June 15.
- A minimum quarter-mile clearance will be maintained from all active eagle nests. All nests are considered active from March 1 to May 31. Nests used for nesting activity are considered active through August 31.

These restrictions in relation to proposed seismic stations are depicted on the map which is part of the Helicopter Use Policy for WRST (NPS, 2005b) and shown in Figure 2-8.

Sites 107, 108, 109, 114, and 119 are close to airstrips where equipment may be staged by fixed wing aircraft, thereby reducing the length of helicopter flights required to install the stations. This would reduce the area of the park to be overflown and the total amount of flight time, thereby reducing noise intrusions on wildlife.

2.4.4 Threatened and Endangered Species (Candidate for Listing)

There are no federally listed endangered and threatened species, or designated or proposed critical habitat, in the vicinity of the project within WRST. However, Kittlitz's murrelet, a candidate species for federal listing, may nest in the vicinity of several proposed seismic station sites—STEEP 109, STEEP 114, STEEP 116A, STEEP 119, STEEP 123, and STEEP 124. The following mitigation measures have been prescribed to avoid or minimize possible nesting disturbance to Kittlitz's murrelet associated with human activity and helicopter use.

- Helicopter landing zones will be approached from the north
- Avoid helicopter flights and station installations near south-facing slopes
- Overflights will be at altitudes greater than 1000 feet above ground level while avoiding ridges and potentially suitable nesting habitat
- Flights will be up glacial valleys when transiting between proposed seismic station sites and bases of operation

2.4.5 Wilderness Values

Solitude and Naturalness

Guidelines set forth by the Helicopter Use Policy for WRST (NPS, 2005b) would be followed. In planning flight paths, all feasible measures would be undertaken to avoid and/or minimize impacts to backcountry users. Planned flight routes would be sent for approval by the park superintendent and maintained by the park dispatcher. Travel routes would be as efficient as possible to minimize flights over conflict areas.

Sensitive areas, including high public use areas and high resident use areas, would be avoided by aircraft when feasible (Figure 2-8). Helicopter altitude and horizontal distances would be maintained according to the park helicopter use policy. Helicopter use could be shared between AEIC and NPS at sites that are co-located with radio repeaters to cut down on helicopter intrusions in wilderness.

With remote "state-of-health" monitoring capability, typically the type of malfunction which may occur at a site is known before embarking on a helicopter flight for maintenance of a station. Since problems can be diagnosed beforehand, the number of flights needed to perform maintenance, as well as the amount of time required at each site to perform the necessary repairs, is minimized.

Visual Resources
Where possible, the antenna on the seismic stations would be installed in such a way so as not to protrude beyond the silhouette/horizon of the nunatak or ridge. Antennas would be painted with appropriate colors to blend in with each environment. The huts are painted gray in order to blend into most landscapes. The gray color was selected when the huts were designed, by the Alaska Volcano Observatory, as the most neutral color that would best blend in to a variety of steep, rocky, alpine settings. The color of the drums (yellow) cannot be changed; however, the small portion (~ 6 inches) of the drum that is exposed above the surface would be covered with a pile of rocks gathered from the vicinity of the station, or with rocks that were excavated from the hole that is dug for the vault.

Visitor Experience
Signs would be posted on the station equipment explaining its purpose and listing a person to contact if visitors who happen upon the site have any questions. Use of helicopters during hunting season in areas of known hunting would be avoided. Flight paths would avoid known wilderness users and areas where users are known to concentrate or visit frequently. Sites 107, 108, 109, 114, and 119 are close to airstrips where equipment may be staged by fixed wing aircraft, thereby reducing the length of helicopter flights required to install the stations. This would reduce the area of the park to be overflown and the total amount of flight time, thereby reducing noise intrusions on visitors.

2.4.6 Cultural Resources
Archeological site clearance would be conducted prior to installation of equipment. An archaeologist would be onsite to monitor for cultural resources during ground altering activities. If archaeological features are encountered during equipment installation, work would cease immediately; the park superintendent and cultural resource specialist would be notified. The archaeological site would be documented, avoided, and the documentation submitted to the agency for a determination of eligibility to the National Register of Historic Places. Depending on the nature and boundaries of the site, the seismic station would be moved a minimum of 50 feet away from the archaeological site.

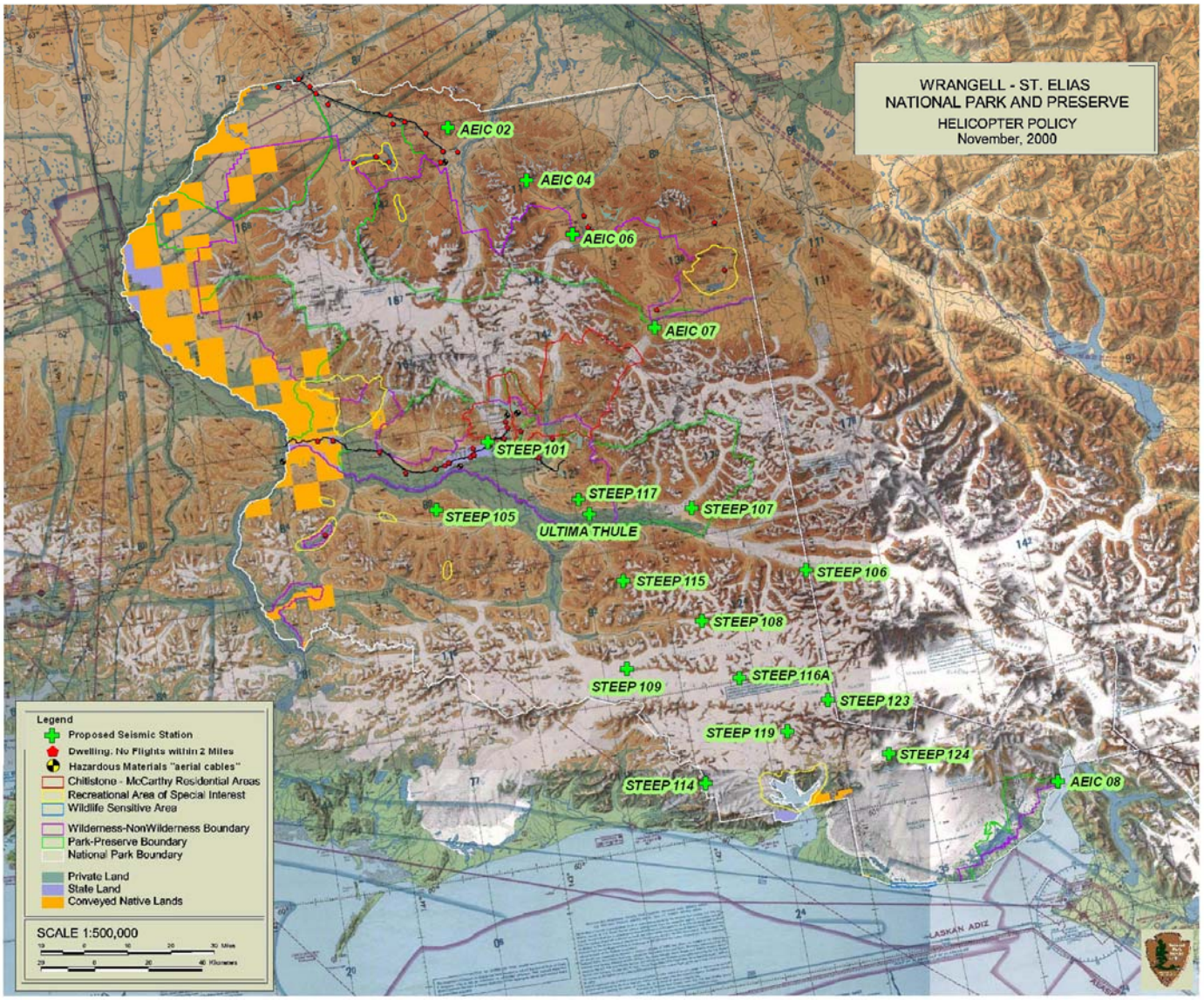

Figure 2-8. Proposed seismic stations shown in relation to special use areas and other restrictions. Base map is part of the 2005 Helicopter Use Policy for WRST (NPS, 2005b).

2.5 THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

As stated in Section 2.7 (D) of the NPS DO-12 Handbook, "The environmentally preferred alternative is the alternative that will best promote the national environmental policy expressed in NEPA (Section 101(b))." In sum, the environmentally preferred alternative is the alternative that not only results in the least damage to the biological and physical environment, but that also best protects, preserves, and enhances historic, cultural, and natural resources. Alternative A (No Action Alternative) is the environmentally preferred alternative because no new adverse impacts to the environment would occur from installation of new seismic stations. New seismic stations, however, would provide valuable earthquake forecasting and hazard information to help prepare the public for a large earthquake in this region of Alaska.

National Environmental Policy Act (NEPA) Sec 101 Goal Statements

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
2. Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
3. Attain the widest range of beneficial uses of the environment without degradation, risk to health and safety, or other undesirable and unintended consequences;
4. Preserve important historic, cultural, and natural aspects of our national heritage, and maintain wherever possible, an environment which supports diversity and variety of individual choice;
5. Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources. (NEPA, 42 USC 4321-4347)

2.6 ALTERNATIVES CONSIDERED BUT REJECTED

Expansion of the seismic monitoring network only in non-wilderness areas of WRST was considered but rejected because it would not meet the purpose and need of the project. Only four new stations are proposed in non-wilderness sites, which is an inadequate number of stations to fulfill the need for a larger data set to improve earthquake detection and hazard forecasting.

2.7 COMPARISON OF ALTERNATIVES

Table 2-2 compares the potential environmental impacts associated with the No Action alternative and the two action alternatives. Potential impacts are provided according to environmental resource topic. Chapter 4, *Environmental Consequences*, of this EA contains a detailed discussion of these potential impacts by resource topic.

Table 2-2. Comparison of Alternatives

Impact Topic	Alternative A: No Action	Alterative B: Expand Seismic Monitoring Network	Alternative C: Maximum Expansion of Seismic Monitoring Network
Soils	Negligible, long-term, localized, adverse impacts to soils from foot traffic during routine maintenance of existing stations. *Minor adverse cumulative impacts on soils.*	Minor, long-term, localized, adverse impacts to soils from disturbance and compaction during installation and maintenance of seismic stations. *Minor adverse cumulative impacts on soils.*	Minor, long-term, localized, adverse impacts to soils from disturbance and compaction during installation and maintenance of seismic stations. *Minor adverse cumulative impacts on soils.*
Vegetation	Negligible, long-term, localized, adverse impacts to vegetation from foot traffic during routine maintenance of existing stations. *Minor adverse cumulative impacts on vegetation.*	Minor, long-term, localized, adverse impacts to vegetation from destruction of plants due to anchoring of equipment and vegetation trampling during installation and maintenance of seismic stations. *Minor adverse cumulative impacts on vegetation.*	Minor, long-term, localized, adverse impacts to vegetation from destruction of plants due to anchoring of equipment and vegetation trampling during installation and maintenance of seismic stations. *Minor adverse cumulative impacts on vegetation.*
Wildlife	Minor, temporary, localized, adverse impacts to wildlife and negligible, long-term, localized, adverse impacts to wildlife habitat from human presence and routine maintenance of existing stations. *Minor adverse cumulative impacts on wildlife.*	Moderate, temporary, localized, adverse impacts to wildlife and minor, long-term, localized, adverse impacts to wildlife habitat from displacement of wildlife and disturbance of wildlife habitat during installation and maintenance of seismic stations. *Minor adverse cumulative impacts on wildlife.*	Moderate, temporary, localized, adverse impacts to wildlife and minor, long-term, localized, adverse impacts to wildlife habitat from displacement of wildlife and disturbance of wildlife habitat during installation and maintenance of seismic stations. *Minor adverse cumulative impacts on wildlife.*

Threatened and Endangered Species **(Candidate for Listing)**	Negligible adverse impacts on Kittlitz's murrelet nesting activity associated with routine maintenance of existing stations. *Negligible adverse cumulative impacts on candidate species.*	Negligible to minor temporary adverse impacts on Kittlitz's murrelet nesting activity associated with installation and routine maintenance of proposed and existing stations. *Minor adverse cumulative impacts on candidate species.*	Negligible to minor temporary adverse impacts on Kittlitz's murrelet nesting activity associated with installation and routine maintenance of proposed and existing stations. *Minor adverse cumulative impacts on candidate species.*
Wilderness Values **Solitude and Naturalness**	Overall negligible, temporary and long-term, adverse impacts. Solitude would be affected by 2 helicopter roundtrips each year for maintenance.	Overall, moderate, temporary, adverse impacts on wilderness values from helicopter activity during installation and maintenance of seismic stations, and minor, long-term, adverse impacts from the presence of seismic stations. Solitude would be affected by 66 helicopter roundtrips during installation and 3 helicopter roundtrips each year for maintenance.	One existing station at Bancas Point would be decommissioned and restored. Overall, moderate, temporary, adverse impacts on wilderness values from helicopter activity during installation and maintenance of seismic stations, and minor, long-term, adverse impacts from the presence of seismic stations. Solitude would be affected by 91 helicopter roundtrips during installation and 3 helicopter roundtrips each year for maintenance.
Visual Resources	No new impacts to visual resources. 15 stations in wilderness or wilderness-suitable lands.	12 new stations would add to visual impacts. 25 stations in wilderness or wilderness-suitable lands.	17 new stations would add to visual impacts. 27 stations in wilderness or wilderness-suitable lands.
Visitor Experience	Visitors encountering seismic stations, or subjected to overhead aircraft noise, would have a diminished visitor experience. *Minor adverse cumulative impacts on wilderness values.*	Visitors encountering seismic stations, or subjected to overhead aircraft noise, would have a diminished visitor experience. *Minor adverse cumulative impacts on wilderness values.*	Visitors encountering seismic stations, or subjected to overhead aircraft noise, would have a diminished visitor experience. *Minor adverse cumulative impacts on wilderness values.*

Cultural Resources	Negligible adverse impacts on cultural resources. *Minor adverse cumulative impacts on cultural resources.*	Negligible adverse impacts on cultural resources. *Minor adverse cumulative impacts on cultural resources.*	Negligible adverse impacts on cultural resources. *Minor adverse cumulative impacts on cultural resources.*
Seismic Monitoring and Hazard Forecasting	There would be minor, long-term adverse impacts on seismic monitoring and hazard forecasting. *Minor adverse, cumulative impacts on seismic monitoring and hazard forecasting.*	Minor long-term, beneficial impacts on seismic monitoring and hazard forecasting. *Minor beneficial, cumulative impacts on seismic monitoring and hazard forecasting.*	Minor long-term, beneficial impacts on seismic monitoring and hazard forecasting. *Minor beneficial, cumulative impacts on seismic monitoring and hazard forecasting.*

CHAPTER 3: AFFECTED ENVIRONMENT

General discussions of the characteristics of the environment in WRST that would be affected by an expanded seismic monitoring program are provided in this section. While the Wrangell-St. Elias wilderness and wilderness-suitable lands are generally considered pristine, there is major evidence of past use and human occupancy. Airplanes can land in wilderness, and helicopters can land only by permit for administrative purposes. Ten public use cabin sites exist at WRST, none of which are situated in wilderness. Snowmachine use commonly occurs in wilderness. There are existing seismic stations in WRST, as well as Remote Automated Weather Stations (RAWS), GPS sites, radio repeater sites, and one cell tower (Fig. 3-1). Appendix C provides photos of existing conditions at four proposed seismic station sites.

3.1 SOILS

Much of the park and preserve is steep rock land, talus, and ice (NPS, 1986). On the lower slopes, the soils are predominantly loam. They are either poorly drained with permafrost or deep, well-drained gravelly material over bedrock. Soils in valley bottoms are generally well-drained loamy alluvium on top of gravelly and sandy material. Permafrost is extensive in the region, except along the coast. It is most prevalent and deep in shaded, moist, fine-soiled, and moss insulated areas. Coarse grained soils along watercourses and on south-facing slopes are most likely to be free of this frozen condition. Permafrost impedes subsurface drainage, causes unstable soil conditions on sloping ground, and melts readily when disturbed, causing irregular subsidence.

Existing and proposed seismic station sites occur in different ecological regions of the park (Fig. 3-2 and Table 3-1). The soils in these regions are described below from ecological subsection characterizations (NPS, 2001). However, the proposed sites would be located on bare rock, rock rubble, or on rock interspersed with small pockets of soil (see example photos in Appendix C). New sites that may have some soils are 115 and 107.

Alaska Range

High elevations in the Mentasta Sedimentary Mountains subsection are mostly bare rock, rock rubble, snow and ice without soil, except locally on stable sites where coarse-loamy soils with numerous rocks and little horizon development occur. Permafrost is present but below 1 m depth. Lower slopes have well-drained, loamy soils with rocks and little horizonation. Permafrost here may in places be above 1 m depth.

Chugach-St. Elias Region

The Bagley-Seward Icefield subsection is mostly bare rock, scree, or rock rubble without soil, with some small pockets of loamy soil with rocks in small crevices. There is more soil cover in the far west where they are coarse-grained and dry with little horizonation.

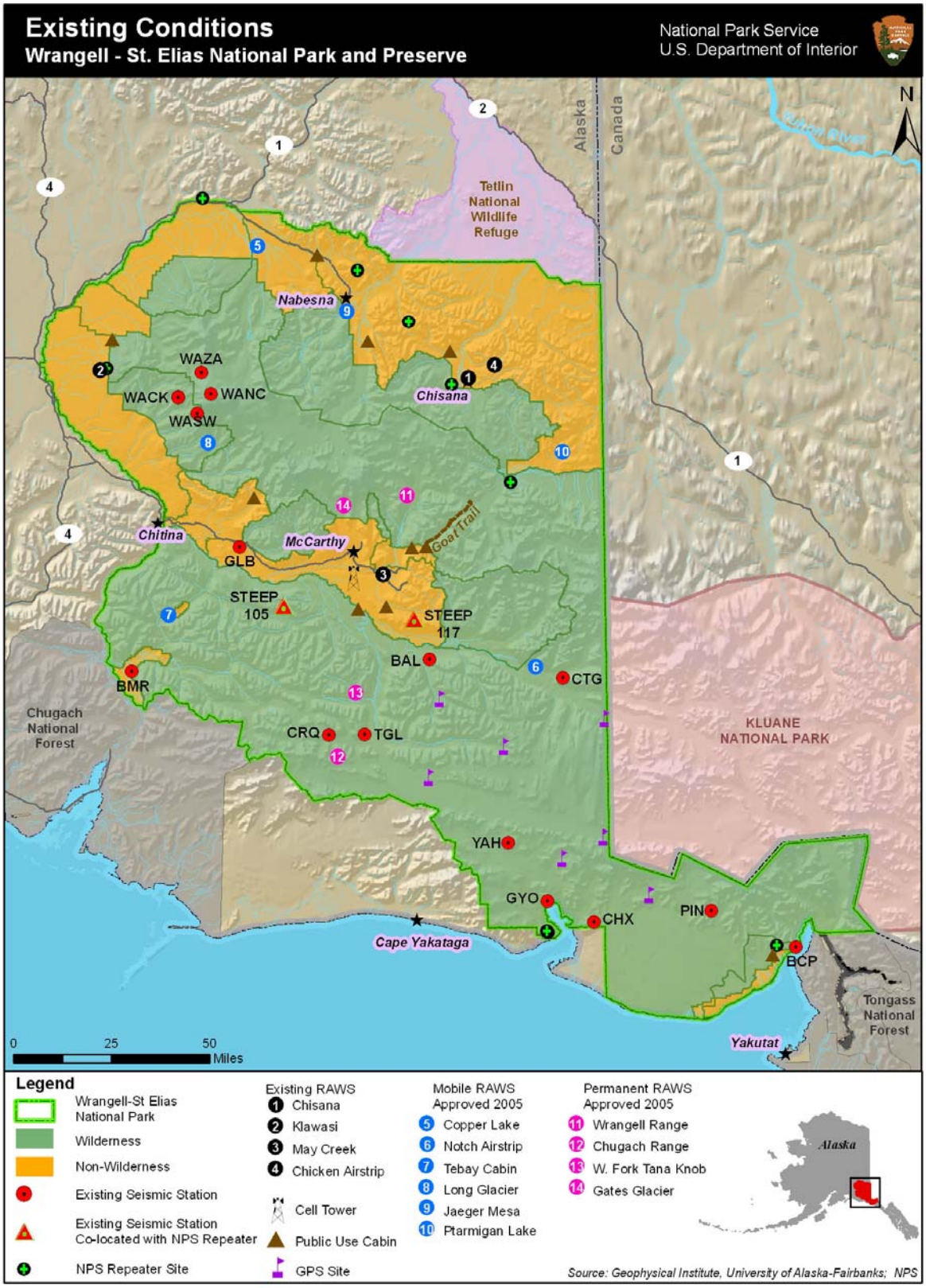

Figure 3-1. Existing facilities at Wrangell-St. Elias National Park and Preserve.

Table 3-1. Existing and proposed seismic station sites in WRST with corresponding ecological regions and subsections.

Site Identifier	Station Name	Ecological Region	Subsection
AEIC 02	Boyden Hills	Alaska Range	Mentasta Sedimentary Mtns
Steep 109	Juniper Island	Chugach-St. Elias Mtns	Bagley-Seward Icefield
Steep 116	Bagley	Chugach-St. Elias Mtns	Bagley-Seward Icefield
BMR	Bremner	Chugach-St. Elias Mtns	Bremner Valley
GYO	Guyot	Chugach-St. Elias Mtns	Icy Bay Foothills
CHX	Chaix Hills	Chugach-St. Elias Mtns	Icy Bay Foothills
Steep 106	Logan Glacier	Chugach-St. Elias Mtns	Northern Chugach Cirque Glacier Mtns
TGL	Tana Glacier	Chugach-St. Elias Mtns	Northern Chugach Cirque Glacier Mtns
Steep 105	Verde	Chugach-St. Elias Mtns	Northern Chugach Foothills
Steep 115	Kiagna River	Chugach-St. Elias Mtns	Northern Chugach Foothills
BAL	Baldy Mt.	Chugach-St. Elias Mtns	Northern Chugach Foothills
Steep 108	Granite Creek	Chugach-St. Elias Mtns	Northern Chugach Glaciers and Ridges
CRQ	Cirque	Chugach-St. Elias Mtns	Northern Chugach Glaciers and Ridges
Steep 114	Mesa	Chugach-St. Elias Mtns	Robinson Mountains
Steep 123	St. Elias	Chugach-St. Elias Mtns	Southern St. Elias Mtns
Steep 124	Samovar Hills	Chugach-St. Elias Mtns	Southern St. Elias Mtns
AEIC 08	Terrace Point	Chugach-St. Elias Mtns	Southern St. Elias Mtns
PIN	Pinnacle Pass	Chugach-St. Elias Mtns	Southern St. Elias Mtns
BCP	Bancas Point	Chugach-St. Elias Mtns	Southern St. Elias Mtns
AEIC 07	Bend	Chugach-St. Elias Mtns	University-Centennial Mtns
Steep 107	Barnard Glacier	Chugach-St. Elias Mtns	University-Centennial Mtns
CTG	Chitina Glacier	Chugach-St. Elias Mtns	University-Centennial Mtns
Steep 119	RKAV GPS	Chugach-St. Elias Mtns	Waxell-Barkley Ridge
YAH	Yahtse	Chugach-St. Elias Mtns	Waxell-Barkley Ridge
Steep 117	Patty	Chugach-St. Elias Mtns	Western St. Elias Foothills
GLB	Gilahina Butte	Copper River Basin	Chitina Valley Moraines and Hills
AEIC 04	Cooper Pass	Kluane Range	Nutzotin Sedimentary Mtns
AEIC 06	Euchre Mtn.	Wrangell Mtns	Cross Range
Steep 101	McCarthy Tower	Wrangell Mtns	McCarthy Mountains
WAZA	Wrangell Zanetti	Wrangell Mtns	Wrangell Icecap
WANC	Wrangell North Crater	Wrangell Mtns	Wrangell Icecap
WACK	Wrangell Chicokna Glacier	Wrangell Mtns	Wrangell Icecap
WASW	Wrangell Southwest	Wrangell Mtns	Wrangell Icecap

Soils in the Bremner Valley subsection are thin, dry, loamy soils with numerous stones over bedrock. Distinct horizons due to podzolization are likely. Clefts between the bedrock ridges have wet, stoney, loamy soils.

Soils in the Icy Bay Foothills subsection are coarse-grained and well-drained with weak horizonation other than accumulation of organic matter near the surface.

Soils in the Northern Chugach Cirque-Glacier Mountains subsection are coarse-grained loamy soils with abundant rocks, well-drained, with little horizonation except an A horizon and/or a thin surface organic mat. Permafrost is present in places but below 1 m depth. Some areas are composed of bare rock, rock rubble, snow, and ice without soil.

Soils in the Northern Chugach Foothills subsection are mostly coarse-grained, rocky, well-drained, and weakly-developed soils. There may be a strong A horizon or O development under dense shrubs. Permafrost is absent or below 1 m depth.

Soils in the Northern Chugach Glaciers and Ridges subsection are mostly absent. There may be some small pockets of loamy soil with rocks in small crevices.

The Robinson Mountains subsection is mostly snow, ice, bare rock, scree, or rock rubble without soil. Coarse-grained soils with little horizonation are present under scattered vegetated areas.

The Southern St. Elias Mountains subsection is mostly ice, snow, rock, and rock rubble without soil or coarse-grained, well-drained soils with weak horizonation other than accumulation of organic matter near the surface in the vegetated foothills.

Soils of the University-Centennial Mountains subsection are dry, rocky, and coarse-grained with little horizon development. Permafrost is absent or below 1 m depth. Some areas are mostly rock, rock rubble, snow, and ice without soil.

The Waxell-Barkley Ridge subsection is mostly ice, snow, rock, and rock rubble without soil. Coarse-grained soils with little horizonation are present under vegetated areas in the south.

Soils in the Western St. Elias Foothills subsection are mostly absent at high elevations. In vegetated areas, soils are loamy, coarse-grained and well drained. Permafrost, where present, is below 1 m depth.

Copper River Basin Region

Soils in the Chitina Valley Moraines and Hills subsection are rocky with a loamy matrix, dry, and mostly lacking permafrost. Wetness and permafrost are variable depending on slope position. The small areas of lowland between the buttes have wetter soils with a thick surface organic layer and permafrost within 1 m of the surface.

Kluane Range

Soils in the Nutzotin Sedimentary Mountains subsection are mostly bare rock, rock rubble, snow, and ice without soil. Some dry, weakly developed, very rocky soils with sandy loamy matrix occur on more stable sites. Permafrost is present but mostly below 1 m depth.

Wrangell Mountains Region

High elevations in the Cross Range subsection are mostly ice, snow, rock, and rock rubble without soil. Lower slopes have rocky soils with a coarse-loamy matrix, well-drained and with permafrost either below 1 m depth or absent. Little horizonation is present except for a thin surface organic layer under the densest vegetation.

Soils in the McCarthy Mountains subsection are mostly rocky with a coarse loamy matrix, well-drained, and with little horizon development beyond a surface organic layer.
Permafrost status is uncertain, but if present it is probably below 1 m depth in most places. Some areas are covered with snow, ice, and rock rubble without soil.

There are no soils in the Wrangell Icecap subsection.

Figure 3-2. Ecoregions of Wrangell-St. Elias National Park and Preserve (from NPS, 2001).

3.2 VEGETATION

Much of the park is covered with perpetual ice and snow or barren rock. Alpine tundra is found at elevations between 3,000 and 5,000 feet. Dry tundra, consisting mostly of low, matted alpine plants dominated by mountain avens, is found on the steeper mountain slopes and exposed ridges. Wet (or moist) tundra, consisting of sedges and grasses interspersed with low shrubs, occurs on the lower more gradual slopes. This meadowlike tundra is an extremely productive arctic/alpine vegetation type. It provides summer grazing for caribou, both summer and winter food for Dall sheep, and nesting habitat for migrating tundra birds (NPS, 1986).

Existing and proposed seismic station sites occur in different ecological regions of the park (Fig. 3-2 and Table 3-1). The vegetation in these regions is described below from ecological subsection characterizations (NPS, 2001). Vegetation at proposed sites would consist of lichens, sparse alpine plants such as very low growing herbaceous plants on stabilized patches of soil, or no plants at all. New sites that may have some vegetation are 115 and 107.

Alaska Range

High elevations in the Mentasta Sedimentary Mountains subsection are mostly bare rock, rock rubble, snow and ice, with dwarf shrub and dry herbaceous tundra on stable soils. Lower slopes have deciduous shrubs with scattered white spruce trees.

Chugach-St. Elias Region

The Bagley-Seward Icefield subsection is mostly unvegetated rock, scree, snow, and ice, with crustose lichens on rocks and scattered vascular plants on small patches of stabilized soil. In the far western part, especially on “Juniper Island”, gentler slopes are covered with tundra vegetation, dry herbaceous vegetation, fruticose lichens, and low shrubs.

Vegetation in the Bremner Valley subsection is mostly open white spruce forest (possibly with some paper birch) with alder and willow understory. Tree overstory is often lacking in the narrow clefts between bedrock ridges.

At high elevations, vegetation in the Icy Bay Foothills subsection is sparse with exposed rock , scree, and snow. Shrub tundra at higher elevations grades downslope to tall shrubs. Few spruce trees are present, mainly in the far southeast. Recently deglaciated bedrock areas are largely barren but being colonized by herbs and shrubs.

Sparse alpine vegetation in the Northern Chugach Cirque-Glacier Mountains subsection is found at higher elevations and on unstable sites. Lower slopes have discontinuous patches of shrubby vegetation. White spruce trees occur locally at low elevations. Willow/alder brush with sparse vegetation occurs on bedrock knobs and braided stream floodplains.

Vegetation in the Northern Chugach Foothills subsection is open white spruce forest with willow/alder understory at low elevations. Slopes at middle elevations are willow and alder

shrubs. Higher elevations are rock rubble, sparsely vegetated with low shrubs and herbs. Unstable gulley slopes are unvegetated.

The Northern Chugach Glaciers and Ridges subsection is mostly bare rock, scree, snow and ice. Vegetation consists of crustose lichens on rocks and scattered vascular plants on small patches of stabilized soil at lower elevations. On stable south slopes there is dry herbaceous vegetation, fruticose lichens, and low shrubs.

The Robinson Mountains subsection is mostly unvegetated rock, scree, snow, and ice, with crustose lichens on rocks and scattered vascular plants on small patches of stabilized soil. Scattered patches of denser vegetation, mostly deciduous shrubs, are present on south-facing slopes at low elevations.

The Southern St. Elias Mountains subsection is mostly ice, snow, rock, and unvegetated rock rubble. Some small areas of shrub vegetation occur at low elevations and a few plants have colonized the more stable parts of the supraglacial debris. The higher elevations of the vegetated foothills are sparsely vegetated. Lower and more stable sites have shrubs, which become denser and taller at lower elevations. Spruce trees appear to be small and/or rare or absent, even at low elevations along Icy Bay.

The University-Centennial Mountains subsection is mostly bare rock, scree, talus, snow, and ice. A few herbaceous plants and shrubs have probably colonized the superglacial rubble. At low elevations and mainly in the southern part there is sparse vegetation, some open and closed shrubs, and spruce woodland. Some areas contain dense deciduous shrubs with an open spruce overstory.

The Waxell-Barkley Ridge subsection is mostly unvegetated ice, snow, bedrock, and rock rubble. A few small patches of shrubs occur on favorable sites. Crustose lichens occur on rocks and scattered vascular plants on small patches of stabilized soil. Some patches of deciduous shrubs are present on south-facing slopes at low elevations in the far southern part.

Higher elevations in the Western St. Elias Foothills subsection are scree, bare rock, and rock rubble. Gentler ridges have dwarf shrubs and dry to mesic herbaceous vegetation. Lower elevations have dense shrubs (alder and willow), with scattered spruce in some places.

Copper River Basin Region

Vegetation in the Chitina Valley Moraines and Hills subsection is mostly dense alder shrubs with scattered white spruce or open and closed white spruce forest on well-drained, unburned sites, and open black spruce forest in depressional areas and on burns, mostly deciduous forest and shrubs.

Kluane Range

The Nutzotin Sedimentary Mountains subsection is mostly snow, ice, scree, and rock rubble. Some dwarf shrubs and herbs occur on favorable sites. Lower slopes have low to mid-sized shrubs, and south-facing slopes have an open spruce overstory above the shrubs.

Wrangell Mountains Region

High elevations in the Cross Range subsection are mainly ice, snow, bedrock, talus, and scree. Lower slopes show progressively greater cover by shrubs and taller shrubs, with dwarf shrubs above and open to closed low- to mid-height shrubs below. There are a few white spruce trees at lowest elevations.

High elevations in the McCarthy Mountains subsection have mostly exposed rock, talus, and scree with little vegetation. More stable lower slopes and valley bottoms have deciduous shrubs that generally increase in height and density downslope. Some open white spruce or mixed spruce-birch forests occur at low elevations. Some closed deciduous mid- to tall shrubs are present, especially on valley sideslopes.

The Wrangell Icecap subsection is covered by snow and ice, with small areas of exposed rock and no vegetation.

3.3 WILDLIFE

Wildlife species that may be found in the areas of the existing and proposed seismic station sites include brown and black bear, moose, caribou, Dall sheep, wolves, lynx, wolverine, and small mammals such as voles and shrews (NPS, 1986). Migratory caribou herds range throughout the north, east, and west portions of WRST, mainly north of the Chitina River. Extensive populations of Dall sheep inhabit the park in suitable high mountain terrain north of the Chitina River. Areas of highest sheep densities are the Nutzotin Mountains; slopes above Nabesna and Chisana; the southern flanks of Mt. Wrangell; MacColl Ridge; and the Crystalline Hills in the Chitina Valley (NPS, 1990). Mountain goats occur primarily south of the Chitina River. Brown and black bears range throughout the area and generally prefer high elevation tall and low shrub communities and alpine tundra. Moose, the region's most widespread lowland ungulate, may be encountered anywhere below 4,000 feet but are most commonly found in brushy areas or bog margins where browse is abundant. Wolves are present throughout the area. Wolverines, lynx, and other furbearers occur throughout the park and preserve, primarily at lower elevations. Wildlife sensitive areas are shown in Figure 2-8.

Two passerine migratory routes pass through the park and there are records for 239 species of birds with approximately 53 species listed as residents (NPS, no date). Birds that may be found at the proposed seismic station sites include ravens, golden eagles, snow bunting, golden-crowned sparrow, rosy finch, Lapland longspur, gyrfalcon, hawks, ptarmigans, and corvids such as jays, crows, and magpies.

3.4 THREATENED AND ENDANGERED SPECIES

3.4.1 Wildlife (Candidate Species)

In February 2006, WRST requested information regarding the presence of species protected under the Endangered Species Act of 1973 in the project vicinity. In March 2006, the U.S. Fish and Wildlife Service (FWS) Anchorage Field Office officially responded that there are no

federally listed endangered and threatened species, or designated or proposed critical habitat, in the vicinity of the project within WRST (Appendix E). However, FWS advised that Kittlitz's murrelet (*Brachyramphus brevirostris*), a candidate species for federal listing, may nest in the vicinity of several proposed seismic station sites. In most of its range, the species nests in rugged mountains near glaciers or in previously glaciated areas; nests have been found as much as 75 km inland in Alaska.

In response to documented population declines, FWS listed Kittlitz's murrelet as a candidate species under the Endangered Species Act in May 2004. Initially listed as listing priority (LP) 5, FWS is considering elevating the species to LP 2 because of observed steep population declines and the species' low reproductive potential. While causes of population declines are not fully known, suspected causes include oil pollution, gill-net mortality, and availability of preferred forage fish (Piatt and Anderson 1996, van Vliet and McAllister 1994).

Distribution of Kittlitz's murrelets seems to be restricted to tidewater glaciers, glaciated fjords or outflows of glacial streams (Day et al. 1999, Day et al. 2003, Kuletz et al. 2003). They tend to forage near tidewater glaciers or glacially-influenced coastal waters, and nest in recently deglaciated areas (Isleib and Kessel 1973, Day et al. 1999). Most of the world's population of Kittlitz's murrelet frequent Alaskan waters, and they migrate between winter offshore and summer inshore regions. Summer records of birds at sea, presumed to be breeding nearby, indicate the species range extends from the Okhotsk Sea, throughout the Bering Sea, along the coast of Alaska and into southeast Alaska. The highest densities of the species appear to be in the northern Gulf of Alaska (Day et al. 1999); however, few nest records exist to confirm breeding areas. Within WRST, one nest has been found to date near Taan Fjord at Icy Bay.

Limited data exist to assess the conservation status of Kittlitz's murrelets. Based on marine surveys conducted in 2002, Icy Bay, which adjoins WRST, was found to have one of the highest recorded densities of the species in Alaska. Densities in this area amount to approximately 18% of the known world population of Kittlitz's murrelet (FWS, unpublished data). However, species abundance along the Malaspina Forelands immediately adjacent to Icy Bay declined by 38-75% based on surveys conducted in 1992 and 2002 (Kozie 1993, FWS, unpublished data). The observed population declines statewide, and the significance of Icy Bay as a population center for Kittlitz's murrelets, underscore the importance of obtaining accurate species population data in this area. The world population of Kittlitz's murrelets is estimated to range between 9,500 and 26,500 birds (FWS 2004).

In July 2005, FWS, NPS, and the Alaska Department of Fish and Game conducted cooperative studies in Icy Bay to gather information for developing a long-term monitoring plan for the species. Field research that year occurred from 30 June to 6 August. Preliminary analyses resulted in a peak population estimate of 1457 Kittlitz's murrelets from 3 – 16 July compared to an estimated population level of 2212 birds observed in July 2002. However, the occurrence of adult murrelets in the Icy Bay area in 2005 was quite noticeable in Taan Fjord, Kageet Point, Kichyatt Point, and Independence Creek. Up to 38 percent of Kittlitz's murrelets observed during the 2005 population surveys were holding fish. Research data available to date suggest that WRST may have breeding areas and suitable habitat surrounding Icy Bay. Additional field research on Kittlitz's murrelet in Icy Bay is planned for 2006, 2007, and 2008; and is contingent

on funding. WRST and FWS have collaborated on Kittlitz's murrelet research in Icy Bay since 2002 (Kissling, personal communication, 2006).

In its March 2006 correspondence to WRST (Appendix E), the FWS Anchorage Field Office recommends that helicopter and human activity at proposed sites within 75 km of the coastline be avoided until after August 10 when murrelet young are expected to have fledged; and when seismic station installations are not expected to present any risk of disturbance to nesting Kittlitz's murrelets. The proposed seismic stations situated 75 km or less inland are STEEP 109, STEEP 114, STEEP 116A, STEEP 119, STEEP 123, and STEEP 124.

Personal communication was made with a Kittlitz's murrelet expert cited by the FWS Anchorage Field Office in its March 2006 correspondence to WRST (Day, personal communication, 2006). Inland distances of Kittlitz's murrelet nests in southeastern and southcentral Alaska range from 5.6 to 39 km as opposed to 75 km in the Chukchi Sea breeding region in northwestern Alaska. Murrelet nesting site habitat requirements include an aspect that is typically south-facing with a minimum slope of 15-20 degrees or higher. Also, based on information available for 19 nests documented in the northern Gulf of Alaska, nests are generally found at elevations below 1070 m with exception to one nest located on Mt. Griggs in the Aleutian mountain range at 2000 m elevation. Characteristics of the proposed seismic stations relative to Kittlitz's murrelet nesting habitat requirements are as follows:

Proposed Seismic Site	Inland Distance	Elevation	Remarks
STEEP 109	57 km	1364 m	Nesting unlikely; birds would have to cross St. Elias mountain range.
STEEP 114	22 km	1889 m	Closest site to protected waters. Nesting unlikely given availability of suitable habitat closer to shore and site elevation. However, site has south aspect that could provide suitable nesting habitat.
STEEP 116A	39 km	1715 m	Nesting unlikely given location beyond St. Elias mountain range.
STEEP 119	24 km	1570 m	Site mainly level with no apparent slope aspect suitable for nesting. Nesting unlikely.
STEEP 123	30 km	2089 m	Nesting unlikely given location beyond St. Elias mountain range and elevation.
STEEP 124	40 km	1466 m	Nesting unlikely given inland distance and elevation.

In summary:

- Suitable habitat is available in the nearest protected waters and tidewater/ocean interface provided at Icy Bay
- The inland distance to each proposed station is greater than the average inland distance (16.1 m) of most known inland murrelet nests observed in southeastern and southcentral Alaska.
- The St. Elias mountain range is a high elevation barrier to the murrelet's typical flight paths; they usually fly down valley centers
- The elevation of the stations 75 km or less inland is greater than the highest elevation (1070 m) nests are typically found at

Given the above, the following mitigation measures may be more practical than restricting helicopter use and human activity up to 75 km inland until after August 10 to avoid possible nesting disturbance:

- Helicopter landing zones will be approached from the north
- Avoid helicopter flights and station installations near south-facing slopes
- Overflights will be at altitudes greater than 1000 feet above ground level while avoiding ridges and potentially suitable nesting habitat
- Flights will be up glacial valleys when transiting between proposed seismic station sites and bases of operation

3.4.2 Plants

In February 2006, WRST requested information regarding the presence of species protected under the Endangered Species Act of 1973 in the project vicinity. In March 2006, the U.S. Fish and Wildlife Service (FWS) Anchorage Field Office officially responded that there are no federally listed endangered and threatened species, or designated or proposed critical habitat, in the vicinity of the project within WRST (Appendix E).

The State of Alaska Natural Heritage Program (AKNHP) maintains a database on the state's rare plant species. AKNHP ranks 91 taxa in WRST as rare, uncommon, or imperiled. Approximately 75 percent of these rare plant populations are found in the alpine zone; 44 percent are above 1525 m elevation; 66 percent are above 1220 m elevation; 54 percent are associated with xeric (dry) communities; 37 percent are associated with mesic (wet) communities; and 30 percent of the taxa identified as rare by AKNHP are found in barren land cover with less than 1 percent plant cover (Cook, personal communication, 2006).

3.5 WILDERNESS VALUES

Wilderness areas preserve the primeval character and pristine nature of wild spaces. They offer outstanding opportunities for solitude, recreation, and unconfined exploration in a setting of naturalness. With the passage of ANILCA in 1980, a new vision of wildness and wilderness was established where humans are viewed not as separate from nature but rather a part of it. The vision also prescribes that park and preserve protection are not meant exclusively for natural and

cultural resources - it also extends to people, their lifestyles and intangible associations with the land.

Section 701 of ANILCA designated approximately 9,687,000 acres of Wrangell-St. Elias National Park/Preserve as wilderness, and directed that this wilderness be managed in accordance with the Wilderness Act of 1964, except as otherwise expressly provided for in ANILCA (NPS, 1986). According to the WRST General Management Plan, about 2,215,000 additional acres in the park and preserve are suitable for wilderness designation. In accordance with NPS wilderness management policy, existing designated wilderness (Wrangell St. Elias Wilderness) and wilderness-suitable lands, a total of about 11,902,000 acres, are managed as wilderness.

WRST is the largest unit of the national park system. The Wrangell-St. Elias wilderness is the largest unit of the national wilderness preservation system. WRST provides excellent opportunities for wilderness recreational activities, solitude, and naturalness. Within the authorized WRST boundary, about 1,286,024 acres are not considered suitable for wilderness designation because of nonfederal land, past mining development, human habitation and buildings, and land applications.

Wilderness values that may be affected by the installation of seismic stations are described below. Although impacts on designated wilderness areas would be of greater concern, these values would be affected similarly whether at wilderness or non-wilderness sites given that about 90 percent of WRST is either designated wilderness or wilderness-suitable. Therefore, the descriptions below apply to all proposed seismic sites.

3.5.1 Solitude and Naturalness

Visitors to WRST's remote backcountry areas rarely encounter other people or signs of human presence. Wilderness visitors can expect natural areas of undeveloped land retaining primeval character and influence, without permanent improvements or human habitation. Wilderness areas are affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable, and they have outstanding opportunities for solitude or a primitive and unconfined type of recreation. Possible anthropogenic signs that may be encountered include mines, seismic and climate monitoring stations, radio repeaters, and aircraft.

The ambient sounds at the proposed seismic station sites consist predominantly of natural sounds, including wind and rain. On this natural background can occasionally be heard the manmade sounds of transiting high altitude commercial airlines, authorized helicopters for research and routine park management operations, and low level local fixed-wing aircraft utilized for transport of park visitors into the backcountry or for sight seeing. Human voices may occasionally be heard at sites where limited visitor access is possible. Table 3-2 compares decibel levels of sounds that may be heard near seismic stations.

Table 3-2. Decibel levels of ambient and human-induced sounds.

Source	Decibels (dBA)

Rainfall	50
Normal Conversation	60
Wind	35-85
Shouting	90
Airplanes (overhead)	65-70
Helicopter (at site)	105
Helicopter (5 seconds away)	95
Helicopter (10 seconds away)	85
Helicopter (15 seconds away)	80

(Data derived from the following sources: Hamilton, 2003; LHH, no date; Miller, 2002; UCSC, no date)

3.5.2 Visual Resources

Views at the potential seismic station sites include expansive vistas of mountains, glaciers, undulating hills, grassy knolls, plateaus, or river valleys. It may be possible to see the seismic stations at locations within sight distance of valleys or inhabited areas. However, the hut would be gel-coated a gray color to blend with the surrounding area so as to reduce visual impacts. Qualitative observations indicate that the huts are visible at less than 1 mile, and visibility varies greatly with the viewing angle and whether the hut is silhouette against the sky or is viewed against terrestrial background.

3.5.3 Visitor Experience

None of the existing or proposed seismic stations would be in locations directly accessible by road vehicles traveling either Nabesna or McCarthy Road, or readily visible from popular visitor destinations such as McCarthy or Kennecott. About 90 percent of WRST is designated wilderness or wilderness-suitable. Therefore, issues regarding the park-wide visitor experience in this EA are presented in association with wilderness values.

Annual park visitation is approximately 50,000 people per year, of which approximately 60% visit the McCarthy/Kennecott area (Hunt, 2006). Use of the WRST backcountry for those seeking a remote experience includes activities such as hiking, mountaineering, hunting, fishing, and river running. Opportunities for solitude abound and a primitive and unconfined type of recreation can be expected in the Wrangell-St. Elias Wilderness as well as other backcountry locations in non-wilderness. Recreationists in designated wilderness do not expect to encounter any modern man-made structures. Most of the potential seismic station sites are remote and inaccessible other than by aircraft. Residential areas and recreation areas of special interest are shown in Figure 2-8.

3.6 CULTURAL RESOURCES

Of the proposed seismic station sites previously surveyed, cultural sites have been documented to occur in the vicinity of three of the proposed seismic station sites. STEEP 109 would be located on Juniper Island, an area with known historic and prehistoric sites; although it is not known whether a cultural site exists in the location of the proposed seismic station. STEEP 115 would

be located in the Kiagna River area where prehistoric activity occurred in the valley. It is not known if a cultural site occurs at the seismic station location, which would be situated on a ridge above the valley. A prehistoric site is within close proximity to STEEP 117 (Bleakley 2006). Cultural sites that could potentially be found while conducting site clearance include lithic scatters, which are the debris from stone tool manufacturing; and prehistoric/historic hunting blinds, which consist of stacked stones.

3.7 SEISMIC MONITORING AND HAZARD FORECASTING

Large magnitude earthquakes have been recorded along the Pacific/North American plate boundary in Alaska with exception to the Yakataga seismic gap and another seismic gap along the Alaska Peninsula. The term seismic gap refers an area along a major fault or plate boundary where large magnitude earthquakes are expected but have not yet occurred.

The Yakataga seismic gap is bounded on the west by the rupture zone of the 1964 magnitude 9.2 Great Alaskan Earthquake, and on the east by the rupture zone of a 1979 magnitude 7.6 earthquake with an epicenter just northeast of Mt. St. Elias. This area extends from Icy Bay in Wrangell-St. Elias National Park and Preserve to Cape Yakataga; and approximately 60 miles offshore to the south, and 60 miles inland to the north. The lack of large seismic events in the Yakataga seismic gap implies that stress is accumulating on the plate boundary. It is possible that a magnitude 7 or greater earthquake will occur in the region in the future.
The northern portion of Wrangell-St. Elias National Park and Preserve was affected by the largest inland earthquake in North America in nearly 150 years when the Denali Fault ruptured on November 3, 2002. This was a magnitude 7.9 event that also ruptured the Totschunda Fault in the vicinity of the Mentasta and Nutzotin mountain ranges. The Denali Fault earthquake caused significant damage to transportation systems in central Alaska, and the villages of Mentasta and Northway just north of Wrangell-St. Elias National Park and Preserve.

The magnitude 7.9 Denali Fault earthquake that occurred in 2002 was a strike-slip event that ruptured a 205 mile section of the Denali Fault that extending from the central Alaska Range eastward onto the Totschunda Fault and into WRST. The event caused significant damage to property and infrastructure in the region immediately north and west of the WRST boundary, and precipitated a number of large scale landslides in the Alaska Range mountains. It is assumed that the release of accumulated tectonic stress on the portion of the fault system that ruptured in 2002 has increased the chances of a large magnitude earthquake on the portions of the fault that did not rupture. The most likely area for subsequent ruptures to occur is inside WRST along the Totschunda Fault. An earthquake in the range of magnitude 7 to 8 would result in prolonged high intensity shaking that may cause large scale landslides and avalanches, impoundments, floods, and ground failures, as well as damage to infrastructure, communications systems, and the Trans-Alaska Oil Pipeline (which skirts the western boundary of WRST).

An expanded seismic monitoring network can provide invaluable scientific data before, during, and after a large magnitude earthquake in this region. The data obtained can be used to detect smaller magnitude foreshocks that may preceed a large magnitude strike-slip event. Data gathered during a large magnitude event will allow detailed analysis of ground motion that will yield valuable information for hazard mapping and the engineering of earthquake-safe structures.

Such data are greatly needed for planning purposes in heavily populated earthquake-prone areas such as southern California. Seismic data collected immediately after a large magnitude strike-slip event on the Totschunda Fault would allow AEIC to determine when aftershock activity is occurring and to assess the potential for any subsequent large magnitude earthquakes in the region. All of this information will enhance the ability of the NPS to address geologic hazards and to improve management decision making and park planning regarding existing and future infrastructure in WRST.

Monitoring of seismic activity is essential for hazard forecasting given that the park and preserve are situated along a tectonically active plate boundary and contain several known volcanic centers. Seismic monitoring has occurred in Wrangell-St. Elias National Park and Preserve since 1980; the existing network of seismic stations is shown on Figure 3-1. The data gathered from the seismic station network are of benefit to park management, the public, and the park's interpretive program in regard to increasing knowledge and understanding of this geologically active region.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This chapter provides an evaluation of the potential effects or impacts of each of the alternatives on the resources described in the issue statements presented in Chapter 1, *Purpose and Need for Action.*

4.1 METHODOLOGY

The impact analysis was conducted in a consistent manner based on standardized impact definitions. For each issue or resource, direct, indirect, and cumulative impacts have been characterized as negligible, minor, moderate, or major. Impacts identified for each issue or resource were based on their duration, extent, and intensity. These impact level thresholds are defined below.

Duration of Impact:

Temporary – Impact would occur only during the time that seismic station installation or maintenance activities are being conducted. In the interim between these activities, resource conditions would return to pre-activity conditions.
Short-term – Impact would extend beyond the time of the installation or maintenance activities, but would not last more than two years.
Long-term – Impact would likely last more than two years and may continue beyond the lifetime of the project.

Extent of Impact:

Localized – Impact would occur only on the seismic station site or its immediate surroundings, and would not extend into the region.
Regional – Impact would affect the resource on a regional level or on the park as a whole, extending well beyond the immediate seismic station site.
National – Impact would affect the resource on a national level, extending well beyond the region or park as a whole.

Intensity of Impact:

Negligible – Minimal or no impact on the resource would occur; any change that might occur would be neither noticeable nor measurable.
Minor – Change in a resource would occur, but no substantial resource impact would result; the change in the resource would be barely perceptible and would not alter the condition or appearance of the resource.
Moderate – Noticeable change in a resource would occur and this change would alter the condition or appearance of the resource, but the integrity of the resource would remain intact.
Major – Substantial impact or change in a resource area would occur that is easily defined and highly noticeable, and that measurably alters the condition or appearance of the resource.

Wilderness Impacts

The assessment of wilderness impacts addressed effects to the solitude, visual resources, and visitor experience in the context of the requirements of the Wilderness Act (text box) to protect a landscape "untrammeled by man" where "man and his works do not dominate the landscape". Under this requirement, visitors to the wilderness areas of WRST are likely to have a general expectation that man-made features, sights and sounds, would constitute a virtually unnoticeable part of their experience.

Solitude impacts were based primarily on the degree to which aircraft and field crews must be used in installing and maintaining the weather stations.

Visual resource impacts were assessed based on the degree to which the station equipment would be visible at a location and detract from the natural features of the landscape.

DEFINITION OF WILDERNESS

A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value. (Public Law 88-577 Sec.2c)

Visitor experience impacts were considered to the degree visitors are likely to encounter man-caused features, sights or sounds, based on the likelihood of a visitor being in or near the location of any seismic station and the likelihood that the impacts are apparent in those locations based on terrain and vegetation.

4.2 CUMULATIVE IMPACTS

Cumulative impacts were assessed by combining the potential environmental impacts of the alternatives with the impacts of projects that have occurred in the past, are currently occurring, or are proposed in the future within WRST. Known past, present, and reasonably foreseeable future projects and actions in the authorized WRST boundary include areas of nonfederal land, past mining development (NPS, 1990), human habitation, roads, trails, buildings, campgrounds, air strips, and land applications; about1,286,024 acres are not considered suitable for wilderness designation. There are a variety of human installations located in both wilderness and non-wilderness (Fig. 3-1), including 17 existing seismic stations and 14 existing and approved Remote Automated Weather Stations (RAWS). There are an additional 18 existing seismic stations and 3 RAWS in the vicinity outside of the park and preserve. There are 9 STEEP GPS sites, 9 NPS radio repeater sites, one cell tower, and 10 public use cabin locations (Table 4-1). Within the park there are 109 miles of road, 602 miles of trails, and 466 patented mining claims encompassing 10,629 acres (NPS, 1990).

Table 4-1. Locations of RAWS, GPS sites, NPS radio repeaters, cell towers, and public use cabins (PUC). (Locations for seismic stations are provided in Table 3-1.)

Installation	Site Name	Latitude	Longitude	In/Out Wilderness
RAWS	Chisana	62.043	-142.03	Out
RAWS	Klawasi	62.045	-144.521	Out
RAWS	May Creek	61.205	-142.421	Out
RAWS	Chicken Airstrip	62.124	-141.845	Out
RAWS	Copper Lake	62.236	-143.903	Out
RAWS	Notch Airstrip	61.002	-141.315	In
RAWS	Tebay Cabin	61.105	-144.201	Out
RAWS	Long Glacier	61.491	-144.044	In
RAWS	Jaeger Mesa	62.322	-143.014	In
RAWS	Ptarmigan Lake	61.802	-141.317	Out
RAWS	Wrangell Range	61.645	-142.542	In
RAWS	Chugach Range	60.673	-143.034	In
RAWS	West Fork Tana	60.542	-142.535	In
RAWS	Gates Glacier	61.602	-143.015	In
GPS	Logan	60.814	-141.015	In
GPS	Granite Creek	60.714	-141.779	In
GPS	Juniper	60.601	-142.342	In
GPS	Kiagna	60.891	-142.263	In
GPS	RKAV	60.300	-141.348	In
GPS	STEL	60.377	-141.037	In
GPS	Samovar Hills	60.160	-140.706	In
GPS	Bremner	60.968	-144.603	In
GPS	Yahtse	60.352	-141.738	In
Radio Repeater	Verde Peak	61.226	-143.453	In
Radio Repeater	Patty Peak	61.185	-142.467	Out
Radio Repeater	Boyden Hills	62.476	-142.956	Out
Radio Repeater	Cooper Pass	62.260	-142.440	Out
Radio Repeater	Euchre Mtn.	62.056	-142.182	Boundary
Radio Repeater	Bend	61.700	-141.730	In
Radio Repeater	Terrace Point	59.948	-139.783	In
Radio Repeater	Klawasi Hill	62.079	-145.008	Out
Radio Repeater	Independence Hills	60.033	-141.464	In
Cell Tower	Sourdough Hill	61.23	-142.47	Out
PUC	Nugget Creek	61.626	-143.713	Out
PUC	Chelle Lake	62.192	-144.866	Out
PUC	Orange Hill	62.212	-142.848	Out
PUC	Glacier Creek	61.455	-142.375	Boundary
PUC	Too Much Johnson	62.066	-142.042	Out
PUC	May Creek	61.233	-142.677	Out
PUC	Peavine	61.452	-142.487	Out
PUC	Jake’s Bar	61.223	-142.892	Out
PUC	Viking Lodge	62.531	-143.258	Out
PUC	Esker Stream	59.928	-139.806	Boundary

The expansion of the climate monitoring program at WRST (NPS, 2005) includes 7 stations in wilderness and 7 stations in non-wilderness. RAWS that existed prior to the summer of 2005 are located at May Creek in the McCarthy area, Chisana Town Site and Chicken Airstrip in the Chisana area, and Klawasi southwest of Mount Drum. Three of the new RAWS were installed in summer 2005 at West Fork Knob in the Tana River area, Gates Glacier in the McCarthy area, and Tebay Cabin in the Tebay area (Hunt, 2005). Four more will be installed by 2011. All of the new RAWS wilderness sites are remote and can be accessed only by helicopter or fixed wing aircraft. Several of the non-wilderness sites can be accessed on foot via trails.

Each RAWS station consists of two towers: a precipitation tower and a tri-leg tower. RAWS have a footprint of about 100 square feet, or about 0.002 acre. Total surface disturbance for the 14 existing and approved RAWS stations is approximately 0.028 acres. Each GPS site consists of a small disc on the ground with negligible surface footprint (see example of disc in photo for STEEP 109 of Appendix D).

Helicopters or fixed-wing aircraft are used to carry personnel and equipment to the RAWS sites for installation and to carry staff for maintenance once a year during the summer season. As many as 6 fixed wing flights and 5 helicopter days would be required annually for maintenance of RAWS, and about 3 RAWS can be maintained in one day. GPS sites will be revisited a total of two times after installation over a period of 2 to 3 years, and since many sites can be visited in one day, there would be only 1or 2 flights each year. Maintenance activities for seismic stations are described under Alternatives A, B, and C in Chapter 2. Table 4-2 outlines the maintenance schedule for seismic stations, RAWS, and radio repeaters. As only several seismic stations would be maintained each year, the maximum total number of helicopter days per year would be 11. Each flight day would consist of one round-trip helicopter trip traveling from the heli-base, linking sites scheduled that day, and back. However, this number could be lowered where sites are co-located and flights can be shared.

Table 4-2. Maintenance schedule for seismic stations, RAWS, and NPS radio repeaters.

Installation	Maintenance Frequency	Number of Fixed Wing Round-trip Flights per Year	Number of Helicopter Flight Days per Year
Seismic (Alt A)	Every 4 years (4-5 stations each year)	0	2 each year, 8 over 4 years
Seismic (Alt B)	Every 4 years (7-8 stations each year)	0	3 each year, 12 over 4 years
Seismic (Alt C)	Every 4 years (8-9 stations each year)	0	3 each year, 12 over 4 years
RAWS	Every year	6	5
Radio Repeaters	Every year	0	3

4.3 ALTERNATIVE A (NO ACTION)

4.3.1 Soils

Under the No Action Alternative, no new seismic stations would be installed. Impacts currently occurring at the existing seismic monitoring stations would continue. The area of soil compaction from foot traffic and helicopter landings during maintenance would both be minimal and limited to the area immediately surrounding the stations. Maintenance at the sites is already occurring, so soil disturbance from additional maintenance would be negligible.

Cumulative Impacts

Existing and future RAWS directly affect about 0.028 acres of soils. Existing seismic stations directly affect about 0.047 acres of soils. Park visitation in the backcountry, and the presence of field crews maintaining RAWS, seismic stations, and repeater stations could cause additional localized, temporary trampling of the ground surface. Public use cabins, radio repeaters, and cell towers also add to existing impacts on soils. Given the soil impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, trails, buildings, campgrounds, airstrips, and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on soils.

Past and future activities can remove soils from production and lead to the loss of soil resources through burial, and wind and water erosion. In most cases the loss of production is temporary and when human occupancy and use is discontinued soil productivity resumes, although at an initially reduced level. Disturbance also changes the original character of native soils by modifying texture, organic matter content and drainage class. Vegetation regrowth often reflects that change and new growth usually contrasts with surrounding undisturbed sites.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on soils.

Conclusion

Alternative A would have negligible, long-term, localized, adverse impacts to soils from routine maintenance of existing stations. There would be minor adverse cumulative impacts on soils. The level of impact to soils from Alternative A would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.3.2 Vegetation

Under the No Action Alternative, no new seismic stations would be installed. Impacts currently occurring at the existing seismic monitoring stations would continue. The area of vegetation trampling from foot traffic and helicopter landings during maintenance would both be minimal and limited to the area immediately surrounding the stations. Maintenance at the sites is already occurring, so vegetation disturbance from additional maintenance would be negligible.

Cumulative Impacts

Existing and future RAWS have directly affected about 0.028 acres of vegetation. Existing seismic stations directly affect about 0.047 acres of vegetation. Park visitation in the

backcountry, and the presence of field crews maintaining RAWS, seismic stations, and repeater stations could cause localized, temporary trampling of plants. Public use cabins, radio repeaters, and cell towers also add to existing impacts on vegetation. Given the vegetation impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, buildings and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on vegetation.

Vegetation in parts of the park has been cleared for construction of buildings, roads, trails, and other facilities. Besides the actual footprint of facilities, plants in the immediate surrounding areas have been impacted by trampling from pedestrian and vehicle traffic. Dispersed vegetation impacts have also been caused by off-trail pedestrian traffic. Concentrated areas of pedestrian traffic often take the form of unofficial social trails where vegetation is often denuded.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on vegetation.

Conclusion
Alternative A would have negligible, long-term, localized, adverse impacts to vegetation from routine maintenance of existing stations. There would be minor adverse cumulative impacts on vegetation. The level of impact to vegetation from Alternative A would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.3.3 Wildlife
Under the No Action Alternative, no new seismic stations would be installed. Impacts currently occurring at the existing seismic monitoring stations would continue. The area of wildlife habitat disturbed by foot traffic and helicopter landings during maintenance would likely be minimal and limited to the area immediately surrounding the stations. Maintenance at the sites is already occurring, so wildlife habitat disturbance from additional maintenance would be negligible.

Site maintenance and the presence of humans on site would continue to cause temporary, localized displacement of wildlife during maintenance years. Wildlife would continue to be disturbed temporarily by helicopters accessing the sites. Although there have not been any reports of wildlife disturbance or habituation at existing seismic sites, it is documented that wildlife startle responses to helicopters include fleeing, cessation of foraging, and disruption of bedding (Cote, 1996; Larkin, 1996; Frid, 1999a and 1999b). Frid (1999c) found that activity disruptions occurred when the helicopter was a median distance of 1 km away. Disturbance from maintenance activities on wildlife would be minor as each site would be visited once every 4 years. Overall there would be a total of 2 helicopter round-trips each year.

Seismic stations in other parts of Alaska have occasionally been damaged by curious bears, as is the case with all types of equipment installations in every part of Alaska. If damage occurs to the equipment, it would be repaired or replaced.

Cumulative Impacts
Existing and future RAWS have directly affected about 0.028 acres of wildlife habitat. Existing seismic stations directly affect about 0.047 acres of habitat. Each year there would be 2 helicopter round trips for maintenance of seismic stations, 5 for maintenance of RAWS, and 3 for maintenance of radio repeaters. These 10 trips could be reduced if co-located sites share flights. Other helicopter flights and fixed wing flights occur in the park associated with park administrative duties, flight-seeing, and access to remote areas by private operators.

Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause localized, temporary displacement of wildlife and disturbance of wildlife habitat. Public use cabins, radio repeaters, and cell towers also add to existing impacts on wildlife and wildlife habitat. Given the wildlife and habitat impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, buildings and land applications within WRST, this alternative would have minor adverse cumulative impacts on wildlife and habitat.

Past mining activity; past, present, and future subsistence and sport hunting; past, present, and future development; past, present, and future inholder access; past, present, and future visitation all contribute to cumulative impacts on wildlife. These actions have resulted in long and short-term habitat loss, displacement of wildlife, and increased human-wildlife conflicts.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on wildlife.

Conclusion
Alternative A would have minor, temporary, localized, adverse impacts to wildlife and negligible, long-term, localized, adverse impacts to wildlife habitat from human presence and routine maintenance of existing stations. There would be minor adverse cumulative impacts on wildlife and habitat. The level of impact to wildlife and habitat from Alternative A would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.3.4 Threatened and Endangered Species (Candidate for Listing)
Under the No Action Alternative, no new seismic stations would be installed. No nests are known to occur at present at existing sites (GYO, CHX, BCP, and PIN). There would be negligible adverse impacts on Kittlitz's muirrelet nesting activity.

Cumulative Impacts
Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause disturbance of nesting Kittlitz's murrelets. Activity at radio repeaters, GPS sites, and cell towers which are located on alpine ridges could also add to sources of disturbance. Other noise sources include helicopter flights and fixed wing flights which occur in the park associated with park administrative duties, flight-seeing, and access to remote areas by private operators. Given the potential for disturbance from these human installations and

activities, this alternative would have minor adverse cumulative impacts on threatened and endangered species.

Conclusion
Alternative A would have negligible, temporary, localized, adverse impacts to candidate threatened and endangered species from routine maintenance of existing stations. There would be minor adverse cumulative impacts. The level of impact to threatened and endangered species from Alternative A would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.3.5 Wilderness Values

Under the No Action Alternative, no new seismic stations would be installed and there would be no additional impacts on visual resources. Two helicopter roundtrips each year to existing stations scheduled for maintenance would affect solitude when the aircraft are flying over designated wilderness. Because helicopter-produced sound can be heard at long distances (see Table 3-2 for sound levels of helicopters at various distances), wilderness solitude would be diminished. These intrusions of solitude would be temporary and of short duration. Park visitors encountering seismic stations, or subjected to overhead aircraft noise during maintenance, would have a diminished visitor experience. Due to the remote location and inaccessibility of the sites, as well as the limited time during which sites would be maintained, it is estimated that approximately 500 of the 50,000 annual visitors to WRST could be impacted. Naturalness would continue to be impacted due to the presence of the 17 existing stations in remote areas, although each site comprises a very small area (0.003 acres) of human presence.

Cumulative Impacts
Fixed-wing aircraft flights occur on a daily basis in WRST by NPS, general aviation, or air taxi operators (no estimates are available for frequency of flights as flight plans are not required by the park). Fixed wing aircraft are allowed to fly over and land in designated wilderness or wilderness-suitable lands. Noise intrusions and disruptions to solitude from these flights would be temporary and of short duration to individuals on the ground. Additionally, jets fly over the park, including outbound traffic from the Anchorage airport.

Helicopter use would be required to access existing and future RAWS, seismic stations, NPS repeaters, and other installations or research projects in the backcountry. These helicopter flights are point to point and of limited duration, thus noise intrusions would be temporary although spread throughout WRST. Helicopters would be used to access RAWS, seismic stations, and radio repeaters for routine maintenance, requiring up to 10 helicopter round trips over the course of 3 to 4 weeks each field season (see Table 4-2). Additionally, GPS sites would be visited only 2 more times over a period of 2-3 years; as many GPS sites can be visited in one day, there would be 1 or 2 round-trip helicopter flights in each of those years. Flight paths for all these maintenance activities would be direct from the heli-base to the sites but would traverse and land in designated wilderness.

Wilderness naturalness and visual resources are affected by the presence and operation of human installations such as the 14 RAWS (of which 7 could be in designated wilderness), 17 seismic

stations in WRST (of which 15 could be in designated wilderness), 9 radio repeaters (of which 4 are in designated wilderness), and 9 GPS sites (all of which are in designated wilderness).

Park visitors encountering RAWS, seismic equipment, radio repeaters, and GPS sites, and exposed to noise from aircraft flying over and landing in designated wilderness to install or maintain equipment, would have a diminished visitor experience.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on wilderness values.

Conclusion
Alternative A would have negligible, temporary, adverse impacts on wilderness values from the presence and routine maintenance of existing stations. There would be minor adverse cumulative impacts on wilderness values. The level of impact to wilderness values from Alternative A would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.3.6 Cultural Resources
Under the No Action Alternative, no new seismic stations would be installed, thus no new impacts to cultural resources would be expected.

Cumulative Impacts
The majority of known historic properties in the park are associated with early placer and lode mining operations. Prehistoric sites include lithic scatters, village sites, semi-subterranean house pits, cache pits, and hunting blinds. Impacts to historic and prehistoric resources associated with mining and other development include exposure of a buried site, changes in artifact condition, destruction of artifacts or structures, loss of context of artifacts, site covering, and contamination of sites. Given the greater adverse effects of past mining development, construction of roads and buildings, and land applications within WRST, this alternative would be negligible adverse cumulative impacts on cultural resources.

Conclusion
Alternative A would have negligible, adverse impacts on cultural resources. There would be minor adverse cumulative impacts on cultural resources. The level of impact to cultural resources from Alternative A would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.3.7 Seismic Monitoring and Hazard Forecasting
Seismic hazard evaluation and human safety would not be improved with the No Action Alternative as the seismic monitoring program would not be expanded. The park's interpretive program on seismic phenomena and hazards would not be enhanced with new information.
Cumulative Impacts
Additional data are needed to adequately forecast large seismic events for the Yakataga seismic gap. The seismic monitoring program in the park would be limited to the data generated from

the 17 existing seismic stations. There would be minor adverse cumulative impacts on seismic monitoring and hazard forecasting.

Conclusion
The No Action Alternative would have minor long-term adverse impacts on seismic monitoring and hazard forecasting. There would be minor adverse cumulative impacts.

4.4 ALTERNATIVE B: EXPAND SEISMIC MONITORING NETWORK

4.4.1 Soils
Under Alternative B, 10 new seismic stations and 2 new VSAT stations would be installed, each having a footprint of about 120 square feet. Upgrades to stations 105 and 117 would have additional footprints of 7 square feet each, and upgrades to stations BAL and TGL would have additional footprints of 16 square feet each. Although most sites consist of bare rock, rock rubble, and/or small pockets of soil, direct impacts would result from anchoring of equipment and foot traffic. New sites that may have some soils are 115 and 107. The area of soil compaction from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment. There would also be localized trampling of any existing surface soils from helicopter landings; however, helicopters would land on bare rock or snow wherever possible. Foot traffic and landing zones at each new site would comprise an area of about 360 square feet. The maximum direct impacts to soils from the installation and upgrade of 16 stations, including the equipment footprint (0.034 acres) and foot traffic and landing zones (0.083 acres), would be about 0.117 acres. However, this figure is likely substantially lower as most sites are situated on bare rock. Impacts currently occurring to soils at the existing seismic stations would continue.

Cumulative Impacts
Existing and future RAWS directly affect about 0.028 acres of soils. Existing seismic stations directly affect about 0.047 acres of soils. Proposed and upgraded seismic stations would affect up to an additional 0.117 acres of soils. Park visitation in the backcountry, and the presence of field crews maintaining RAWS, seismic stations, and repeater stations could cause additional localized, temporary trampling of the ground surface. Public use cabins, radio repeaters, and cell towers also add to existing impacts on soils. Given the soil impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, trails, buildings, campgrounds, airstrips, and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on soils.

Past and future activities can remove soils from production and lead to the loss of soil resources through burial, and wind and water erosion. In most cases the loss of production is temporary and when human occupancy and use is discontinued soil productivity resumes, although at an initially reduced level. Disturbance also changes the original character of native soils by modifying texture, organic matter content and drainage class. Vegetation regrowth often reflects that change and new growth usually contrasts with surrounding undisturbed sites.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on soils.

Conclusion
Alternative B would result in minor, long-term, localized, adverse impacts to soils from disturbance and compaction during installation and maintenance of seismic stations. There would be minor, long-term, adverse cumulative impacts to soils. The level of impact on soils from Alternative B would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.4.2 Vegetation

Under Alternative B, 10 new seismic stations and 2 new VSAT stations would be installed, each having a footprint of about 120 square feet. Upgrades to stations 105 and 117 would have additional footprints of 7 square feet each, and upgrades to stations BAL and TGL would have additional footprints of 16 square feet each. Although most sites consist of bare rock, rock rubble, and/or small pockets of soil supporting low growing herbaceous vegetation, direct impacts would result from anchoring of equipment and foot traffic. New sites that may have some vegetation are 115 and 107. The area of vegetation trampling from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment. There would also be localized trampling of any existing vegetation from helicopter landings; however, helicopters would land on bare rock or snow wherever possible. Foot traffic and landing zones at each new site would comprise an area of about 360 square feet. The maximum direct impacts to vegetation from the installation and upgrade of 16 stations, including the equipment footprint (0.034 acres) and foot traffic and landing zones (0.083 acres), would be about 0.117 acres. However, this figure is likely substantially lower as most sites are situated on bare rock. Impacts currently occurring to vegetation at the existing seismic stations would continue.

Cumulative Impacts
Existing and future RAWS have directly affected about 0.028 acres of vegetation. Existing seismic stations directly affect about 0.047 acres of vegetation. Proposed and upgraded seismic stations would affect up to an additional 0.117 acres of vegetation. Park visitation in the backcountry, and the presence of field crews maintaining RAWS, seismic stations, and repeater stations could cause localized, temporary trampling of plants. Public use cabins, radio repeaters, and cell towers also add to existing impacts on vegetation. Given the vegetation impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, buildings and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on vegetation. The cumulative effect on park alpine tundra and high brush tundra vegetation would be minimal relative to the large area of these vegetation types within the park and preserve.

Vegetation in parts of the park has been cleared for construction of buildings, roads, trails, and other facilities. Besides the actual footprint of facilities, plants in the immediate surrounding areas have been impacted by trampling from pedestrian and vehicle traffic. Dispersed vegetation impacts have also been caused by off-trail pedestrian traffic. Concentrated areas of pedestrian traffic often take the form of unofficial social trails where vegetation is often denuded.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on vegetation.

Conclusion
Alternative B would likely result in minor, long-term, localized, adverse impacts to vegetation from destruction of plants due to anchoring of equipment and vegetation trampling during installation and maintenance of seismic stations. There would be minor adverse cumulative impacts on vegetation. The level of impact to vegetation from Alternative B would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.4.3 Wildlife

Under Alternative B, installation of new seismic stations and upgrades to existing ones would temporarily displace wildlife in the immediate vicinity during construction. Disturbance would be temporary as installation would require only 3 days at each site. Wildlife would be disturbed temporarily by helicopters accessing the sites. Although there have not been any reports of wildlife disturbance or habituation at existing seismic sites, it is documented that wildlife startle responses to helicopters include fleeing, cessation of foraging, and disruption of bedding (Cote, 1996; Larkin, 1996; Frid, 1999a and 1999b). Frid (1999c) found that activity disruptions occurred when the helicopter was a median distance of 1 km away. Helicopter disturbance during installation and upgrades would be moderate as there would be 3 or 5 round-trip flights at each site, for a total of 66 flights overall. Disturbance from maintenance activities on wildlife would be minor as each site would be visited once every 4 years, and there would be an overall total of 3 helicopter round trips each year. None of the new proposed stations would be located in a wildlife sensitive area (Fig. 2-8).

The 10 new seismic stations and 2 new VSAT stations that would be installed each have a footprint of about 120 square feet. Upgrades to stations 105 and 117 would have additional footprints of 7 square feet each, and upgrades to stations BAL and TGL would have additional footprints of 16 square feet each. Although most sites consist of bare rock, rock rubble, and/or small pockets of soil supporting low growing herbaceous vegetation, direct impacts to wildlife habitat would result from anchoring of equipment and foot traffic. New sites that may have some soils and vegetation are 115 and 107. The area of habitat disturbance from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment. There would also be localized habitat disturbance from helicopter landings; however, helicopters would land on bare rock or snow wherever possible. Foot traffic and landing zones at each new site would comprise an area of about 360 square feet. The maximum direct impacts to wildlife habitat from the installation and upgrade of 16 stations, including the equipment footprint (0.034 acres) and foot traffic and landing zones (0.083 acres), would be about 0.117 acres. However, this figure is likely substantially lower as most sites are situated on bare rock. Impacts currently occurring at the existing seismic stations would continue to affect wildlife habitat.

Seismic stations in other parts of Alaska have occasionally been damaged by curious bears, as is the case with all types of equipment installations in every part of Alaska. If damage occurs to the equipment, it would be repaired or replaced.

Cumulative Impacts
Existing and future RAWS have directly affected about 0.028 acres of wildlife habitat. Existing seismic stations directly affect about 0.047 acres of habitat. Proposed and upgraded seismic stations would affect up to an additional 0.117 acres of habitat. Each year there would be 3 helicopter round trips for maintenance of seismic stations, 5 for maintenance of RAWS, and 3 for maintenance of radio repeaters. These 11 trips could be reduced if co-located sites share flights. Other helicopter flights and fixed wing flights occur in the park associated with park administrative duties, flight-seeing, and access to remote areas by private operators.

Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause localized, temporary displacement of wildlife and disturbance of wildlife habitat. Public use cabins, radio repeaters, and cell towers also add to existing impacts on wildlife and wildlife habitat. Given the wildlife and habitat impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, buildings and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on wildlife and habitat.

Past mining activity; past, present, and future subsistence and sport hunting; past, present, and future development; past, present, and future inholder access; past, present, and future visitation all contribute to cumulative impacts on wildlife. These actions have resulted in long and short-term habitat loss, displacement of wildlife, and increased human-wildlife conflicts.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on wildlife.

Conclusion
Alternative B would likely result in moderate, temporary, localized, adverse impacts to wildlife and minor, long-term, localized, adverse impacts to wildlife habitat from displacement of wildlife and disturbance of wildlife habitat during installation and maintenance of seismic stations. There would be minor adverse cumulative impacts on wildlife. The level of impact to wildlife from Alternative B would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.4.4 Threatened and Endangered Species (Candidate for Listing)
There would be negligible to minor temporary adverse impacts on Kittlitz's murrelet nesting activity with Alternative B from installation of new seismic stations and upgrades to existing stations, and recurring station maintenance.

Cumulative Impacts
Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause disturbance of nesting Kittlitz's murrelets. Activity at radio repeaters, GPS sites, and cell towers which are located on alpine ridges could also add to sources of disturbance. Other noise sources include helicopter flights and fixed wing flights which occur in the park associated with park administrative duties, flight-seeing, and access to remote areas

by private operators. Given the potential for disturbance from these human installations and activities, this alternative would contribute minor adverse cumulative impacts on threatened and endangered species.

Conclusion
Alternative B would have negligible, temporary, localized, adverse impacts. There would be minor adverse cumulative impacts. The level of impact to threatened and endangered species from Alternative B would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.4.5 Wilderness Values

Under Alternative B, 10 new seismic stations and 2 new VSAT stations would be installed and 4 existing stations would be upgraded. If 14 sites are installed/upgraded in 2006, it would take 4-6 weeks to install the sites at 2-3 days each with helicopter support. BAL and TGL would be upgraded during their regular maintenance schedule and would require 3 flights each. Installation of 10 new sites and upgrades of STEEP 105 and 117 would require 5 round trip helicopter flights per site. Total round trip helicopter flights required for installation and upgrades would be 66. Several fixed wing aircraft roundtrips would occur to preposition supplies and equipment at airstrips near seismic sites 107, 108, 109, 114, and 119. Use of fixed wing aircraft would reduce the amount of helicopter flight time. In the long-term, after installation, there would be 3 helicopter roundtrips every 4 year to existing and new stations in the park for maintenance. Noise from helicopters would affect solitude when the aircraft are flying over and landing in designated wilderness. Because helicopter-produced sound can be heard at long distances (see Table 3-2 for sound levels of helicopters at various distances), wilderness solitude would be diminished. These intrusions of solitude would be temporary and of short duration.

The operation and maintenance of 29 new and existing stations in designated wilderness and wilderness-suitable lands would have adverse impacts on naturalness, although each site comprises a very small area (0.003 acres) of human presence. In some areas, human activity would be evident and may have an effect on those who value the intangible aspects of wilderness such as knowing an area is untrammeled and undeveloped; however, the sites are so remote that very few park visitors are expected to encounter them. Hunters and climbers explore all over WRST, though in low numbers.

The visual quality and aesthetics at each site would be affected by the seismometer and instrument hut. The hut is colored gray to blend in with the site and the seismometer is mostly buried, but both would be visible to visitors who may encounter the sites. As many sites would be located on exposed ridges, there is the possibility that they could be visible from a distance. The instrument hut could be visible on the skyline to visitors within a short distance, or to those passing by in a lowflying aircraft. Qualitative observations indicate that the huts are visible at 1 mile or less, and this varies greatly with the viewing angle and whether the hut is silhouette against the sky or is viewed against terrestrial background.

Park visitors encountering seismic equipment at close range, or subjected to overhead aircraft noise during maintenance, would have a diminished visitor experience. Due to the remote location and inaccessibility of the sites, as well as the limited time during which sites would be installed or maintained, it is estimated approximately 500 of the 50,000 annual visitors to WRST could be impacted.

Cumulative Impacts
Fixed-wing aircraft flights occur on a daily basis in WRST by NPS, general aviation, or air taxi operators (no estimates are available for frequency of flights as flight plans are not required by the park). Fixed wing aircraft are allowed to fly over and land in designated wilderness or wilderness-suitable lands. Noise intrusions and disruptions to solitude from these flights would be temporary and of short duration to individuals on the ground. Additionally, jets fly over the park, including outbound traffic from the Anchorage airport.

Helicopter use would be required to access existing and future RAWS, seismic stations, NPS repeaters, and other installations or research projects in the backcountry. These helicopter flights are point to point and of limited duration, thus noise intrusions would be temporary although spread throughout WRST. Helicopters would be used to access RAWS, seismic stations, and radio repeaters for routine maintenance, requiring up to 11 helicopter round trips over the course of 3 to 4 weeks each field season (see Table 4-2). Additionally, GPS sites would be visited only 2 more times over a period of 2-3 years; as many GPS sites can be visited in one day, there would be 1 or 2 round-trip helicopter flights in each of those years. Flight paths for all these maintenance activities would be direct from the heli-base to the sites but would traverse and land in designated wilderness.

Wilderness naturalness and visual resources are affected by the presence and operation of human installations such as the 14 RAWS (of which 7 could be in designated wilderness), 29 seismic stations in WRST (of which 25 could be in designated wilderness), 9 radio repeaters (of which 4 are in designated wilderness), and 9 GPS sites (all of which are in designated wilderness).

Park visitors encountering RAWS, seismic equipment, radio repeaters, and GPS sites, and exposed to noise from aircraft flying over and landing in designated wilderness to install or maintain equipment, would have a diminished visitor experience.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on wilderness values.

Conclusion
Alternative B would have moderate, temporary, adverse impacts on wilderness values from helicopter activity during installation and maintenance of seismic stations, and minor, long-term, adverse impacts from the presence of seismic stations. There would be minor adverse cumulative impacts on wilderness values. The level of impact to wilderness values from Alternative B would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.4.6 Cultural Resources

Not all of the proposed seismic station sites have been archaeologically surveyed. If during the identification stage a cultural site is discovered at any of the proposed seismic station sites, the cultural resource will be documented, avoided, and the seismic station relocated. Cultural sites have been documented to occur in the vicinity of three of the proposed seismic station sites; STEEP 109, STEEP 115, and STEEP 117. The prehistoric site that occurs close to STEEP 117 would not be approached during the upgrade of that station. An archaeological monitor will be present at all station installations due to the ground altering activities involved. Implementing regulations (36 CFR 800) of Section 106 of the National Historic Preservation Act would be followed, culminating in a final report to the agency.

Cumulative Impacts

The majority of known historic properties in the park are associated with early placer and lode mining operations. Prehistoric sites include lithic scatters, village sites, semi-subterranean house pits, cache pits, and hunting blinds. Impacts to historic and prehistoric resources associated with mining and other development include exposure of a buried site, changes in artifact condition, destruction of artifacts or structures, loss of context of artifacts, site covering, and contamination of sites. Given the greater adverse effects of past mining development, construction of roads and buildings, and land applications within WRST, this alternative would be negligible adverse cumulative impacts on cultural resources.

Conclusion

Alternative B would have negligible, adverse impacts on cultural resources. There would be minor adverse cumulative impacts on cultural resources. The level of impact on cultural resources under the Preferred Alternative would not result in any impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the cultural integrity of the park and preserve.

4.4.7 Seismic Monitoring and Hazard Forecasting

Seismic hazard evaluation and human safety would be improved with Alternative B as the seismic monitoring program would be expanded to a total of 29 monitoring stations.
The park's interpretive program on seismic phenomena and hazards would be enhanced with new information.

Cumulative Impacts

Additional data are needed to adequately forecast large seismic events for the Yakataga seismic gap. The seismic monitoring program in the park would be expanded to a total of 29 seismic stations. There would be minor beneficial cumulative impacts on seismic monitoring and hazard forecasting.

Conclusion

Alternative B would have minor long-term beneficial impacts on seismic monitoring and hazard forecasting. There would be minor beneficial cumulative impacts.

Alternative C: Maximum Expansion of Seismic Monitoring Networks

4.5.1 Soils

Under Alternative C, 15 new seismic stations and 2 new VSAT stations would be installed, each having a footprint of about 120 square feet. Upgrades to stations 105 and 117 would have additional footprints of 7 square feet each, and upgrades to stations BAL and TGL would have additional footprints of 16 square feet each. Although most sites consist of bare rock, rock rubble, and/or small pockets of soil, direct impacts would result from anchoring of equipment and foot traffic. New sites that may have some soils are 115 and 107. The area of soil compaction from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment. There would also be localized trampling of any existing surface soils from helicopter landings; however, helicopters would land on bare rock or snow wherever possible. Foot traffic and landing zones at each new site would comprise an area of about 360 square feet. The maximum direct impacts to soils from the installation and upgrade of 21 stations, including the equipment footprint (0.048 acres) and foot traffic and landing zones (0.124 acres), would be about 0.172 acres. However, this figure is likely substantially lower as most sites are situated on bare rock. Impacts currently occurring to soils at the existing seismic stations would continue.

Cumulative Impacts

Existing and future RAWS directly affect about 0.028 acres of soils. Existing seismic stations directly affect about 0.047 acres of soils. Proposed and upgraded seismic stations would affect up to an additional 0.172 acres of soils. Park visitation in the backcountry, and the presence of field crews maintaining RAWS, seismic stations, and repeater stations could cause additional localized, temporary trampling of the ground surface. Public use cabins, radio repeaters, and cell towers also add to existing impacts on soils. Given the soil impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, trails, buildings, campgrounds, airstrips, and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on soils.

Past and future activities can remove soils from production and lead to the loss of soil resources through burial, and wind and water erosion. In most cases the loss of production is temporary and when human occupancy and use is discontinued soil productivity resumes, although at an initially reduced level. Disturbance also changes the original character of native soils by modifying texture, organic matter content and drainage class. Vegetation regrowth often reflects that change and new growth usually contrasts with surrounding undisturbed sites.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on soils.

Conclusion

Alternative C would result in minor, long-term, localized, adverse impacts to soils from disturbance and compaction during installation and maintenance of seismic stations. There would be minor, long-term, adverse cumulative impacts to soils. The level of impact on soils from Alternative C would not result in impairment of park resources that fulfill specific purposes

identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.5.2 Vegetation

Under Alternative C, 15 new seismic stations and 2 new VSAT stations would be installed, each having a footprint of about 120 square feet. Upgrades to stations 105 and 117 would have additional footprints of 7 square feet each, and upgrades to stations BAL and TGL would have additional footprints of 16 square feet each. Although most sites consist of bare rock, rock rubble, and/or small pockets of soil supporting low growing herbaceous vegetation, direct impacts would result from anchoring of equipment and foot traffic. New sites that may have some vegetation are 115 and 107. The area of vegetation trampling from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment. There would also be localized trampling of any existing vegetation from helicopter landings; however, helicopters would land on bare rock or snow wherever possible. Foot traffic and landing zones at each new site would comprise an area of about 360 square feet. The maximum direct impacts to vegetation from the installation and upgrade of 21 stations, including the equipment footprint (0.048 acres) and foot traffic and landing zones (0.124 acres), would be about 0.172 acres. However, this figure is likely substantially lower as most sites are situated on bare rock. Impacts currently occurring to vegetation at the existing seismic stations would continue.

Cumulative Impacts

Existing and future RAWS have directly affected about 0.028 acres of vegetation. Existing seismic stations directly affect about 0.047 acres of vegetation. Proposed and upgraded seismic stations would affect up to an additional 0.172 acres of vegetation. Park visitation in the backcountry, and the presence of field crews maintaining RAWS, seismic stations, and repeater stations could cause localized, temporary trampling of plants. Public use cabins, radio repeaters, and cell towers also add to existing impacts on vegetation. Given the vegetation impacts from these human installations, plus the more extensive impacts from past mining development (NPS, 1990), human habitation, roads, buildings and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on vegetation. The cumulative effect on park alpine tundra and high brush tundra vegetation is minimal relative to the large area of these vegetation types within the park and preserve.

Vegetation in parts of the park has been cleared for construction of buildings, roads, trails, and other facilities. Besides the actual footprint of facilities, plants in the immediate surrounding areas have been impacted by trampling from pedestrian and vehicle traffic. Dispersed vegetation impacts have also been caused by off-trail pedestrian traffic. Concentrated areas of pedestrian traffic often take the form of unofficial social trails where vegetation is often denuded.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on vegetation.

Conclusion

Alternative C would likely result in minor, long-term, localized, adverse impacts to vegetation from destruction of plants due to anchoring of equipment and vegetation trampling during

installation and maintenance of seismic stations. There would be minor adverse cumulative impacts on vegetation. The level of impact to vegetation from Alternative C would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.5.3 Wildlife

Under Alternative C, installation of new seismic stations and upgrades to existing ones would temporarily displace wildlife in the immediate vicinity during construction. Disturbance would be temporary as installation would require only 3 days at each site. Wildlife would also be disturbed temporarily by helicopters accessing the sites. Although there have not been any reports of wildlife disturbance or habituation at existing seismic sites, it is documented that wildlife startle responses to helicopters include fleeing, cessation of foraging, and disruption of bedding (Cote, 1996; Larkin, 1996; Frid, 1999a and 1999b). Frid (1999c) found that activity disruptions occurred when the helicopter was a median distance of 1 km away. Helicopter disturbance during installation and upgrades would be moderate as there would be 3 or 5 round-trip flights at each site, for a total of 91 flights. Disturbance from maintenance activities on wildlife would be minor as each site would be visited once every 4 years, and there would be an overall total of 3 helicopter round trips each year. In addition, none of the new proposed stations would be located in a wildlife sensitive area (Fig. 2-8).

The 15 new seismic stations and 2 new VSAT stations that would be installed each have a footprint of about 120 square feet. Upgrades to stations 105 and 117 would have additional footprints of 7 square feet each, and upgrades to stations BAL and TGL would have additional footprints of 16 square feet each. Although most sites consist of bare rock, rock rubble, and/or small pockets of soil supporting low growing herbaceous vegetation, direct impacts to wildlife habitat would result from anchoring of equipment and foot traffic. New sites that may have some soils and vegetation are 115 and 107. The area of habitat disturbance from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment. There would also be localized habitat disturbance from helicopter landings; however, helicopters would land on bare rock or snow wherever possible. Foot traffic and landing zones at each new site would comprise an area of about 360 square feet. The maximum direct impacts to wildlife habitat from the installation and upgrade of 21 stations, including the equipment footprint (0.048 acres) and foot traffic and landing zones (0.124 acres), would be about 0.172 acres. However, this figure is likely substantially lower as most sites are situated on bare rock. Impacts currently occurring at the existing seismic stations would continue to affect wildlife habitat.

Seismic stations in other parts of Alaska have occasionally been damaged by curious bears, as is the case with all types of equipment installations in every part of Alaska. If damage occurs to the equipment, it would be repaired or replaced.

Cumulative Impacts

Existing and future RAWS have directly affected about 0.028 acres of wildlife habitat. Existing seismic stations directly affect about 0.047 acres of habitat. Proposed and upgraded seismic stations would affect up to an additional 0.172 acres of habitat. Each year there would be 3 helicopter round trips for maintenance of seismic stations, 5 for maintenance of RAWS, and 3

for maintenance of radio repeaters. These 11 trips could be reduced if co-located sites share flights. Other helicopter flights and fixed wing flights occur in the park associated with park administrative duties, flight-seeing, and access to remote areas by private operators.

Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause localized, temporary displacement of wildlife and disturbance of wildlife habitat. Public Use Cabins, radio repeaters, and cell towers also add to existing impacts on wildlife and wildlife habitat. Given the wildlife and habitat impacts from these human installations, plus the more extensive impacts from past mining development, human habitation, roads, buildings and land applications within WRST, this alternative would contribute minor adverse cumulative impacts on wildlife and habitat.

Past mining activity; past, present, and future subsistence and sport hunting; past, present, and future development; past, present, and future inholder access; past, present, and future visitation all contribute to cumulative impacts on wildlife. These actions have resulted in long and short-term habitat loss, displacement of wildlife, and increased human-wildlife conflicts.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on wildlife.

Conclusion
Alternative C would likely result in moderate, temporary, localized, adverse impacts to wildlife and minor, long-term, localized, adverse impacts to wildlife habitat from displacement of wildlife and disturbance of wildlife habitat during installation and maintenance of seismic stations. There would be minor adverse cumulative impacts on wildlife and habitat. The level of impact to wildlife and habitat from Alternative C would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.5.4 Threatened and Endangered Species (Candidate for Listing)
There would be negligible to minor temporary adverse impacts on Kittlitz's murrelet nesting activity with Alternative C from installation of new seismic stations and upgrades to existing stations, and recurring station maintenance.

Cumulative Impacts
Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause disturbance of nesting Kittlitz's murrelets. Activity at radio repeaters, GPS sites, and cell towers which are located on alpine ridges could also add to sources of disturbance. Other noise sources include helicopter flights and fixed wing flights which occur in the park associated with park administrative duties, flight-seeing, and access to remote areas by private operators. Given the potential for disturbance from these human installations and activities, this alternative would contribute minor adverse cumulative impacts on threatened and endangered species.

Conclusion
Alternative C would have negligible, temporary, localized, adverse impacts. There would be minor adverse cumulative impacts. The level of impact to threatened and endangered species from Alternative C would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.5.5 Wilderness Values

Under Alternative C, 15 new seismic stations and 2 new VSAT stations would be installed and 4 existing stations would be upgraded. If 19 sites are installed/upgraded in 2006, this would take 4- 6 weeks to install the sites at 2-3 days each with helicopter support. BAL and TGL would be upgraded during their regular maintenance schedule and would require 3 flights each. Installation of 15 new sites and upgrades of STEEP 105 and 117 would require 5 round trip helicopter flights per site. Total round trip helicopter flights required for installation and upgrades would be 91. Several fixed wing aircraft roundtrips would occur to preposition supplies and equipment at airstrips near seismic sites 107, 108, 109, 114, and 119. Use of fixed wing aircraft would reduce the amount of helicopter flight time. In the long-term, after installation, there would be 3 helicopter roundtrips every 4 year to existing and new stations in the park for maintenance. Noise from helicopters would affect solitude when the aircraft are flying over and landing in designated wilderness. Because helicopter-produced sound can be heard at long distances (see Table 3-2 for sound levels of helicopters at various distances), wilderness solitude would be diminished. These intrusions of solitude would be temporary and of short duration.

The operation and maintenance of 34 new and existing stations in designated wilderness and wilderness-suitable lands would have adverse impacts on naturalness, although each site comprises a very small area (0.003 acres) of human presence. In some areas, human activity would be evident and may have an effect on those who value the intangible aspects of wilderness such as knowing an area is untrammeled and undeveloped; however, the sites are so remote that very few park visitors are expected to encounter them. Hunters and climbers explore all over WRST, though in low numbers.

The visual quality and aesthetics at each site would be affected by the seismometer and instrument hut. The hut is colored gray to blend in with the site and the seismometer is mostly buried, but both would be visible to visitors who may encounter the sites. As many sites would be located on exposed ridges, there is the possibility that they could be visible from a distance. The instrument hut could be visible on the skyline to visitors within a short distance, or to those passing by in a lowflying aircraft. Qualitative observations indicate that the huts are visible at 1 mile or less, and this varies greatly with the viewing angle and whether the hut is silhouette against the sky or is viewed against terrestrial background.

Park visitors encountering seismic equipment at close range, or subjected to overhead aircraft noise during maintenance, would have a diminished visitor experience. Due to the remote location and inaccessibility of the sites, as well as the limited time during which sites would be installed or maintained, it is estimated approximately 500 of the 50,000 annual visitors to WRST could be impacted.

Cumulative Impacts
Fixed-wing aircraft flights occur on a daily basis in WRST by NPS, general aviation, or air taxi operators (no estimates are available for frequency of flights as flight plans are not required by the park). Fixed wing aircraft are allowed to fly over and land in designated wilderness or wilderness-suitable lands. Noise intrusions and disruptions to solitude from these flights would be temporary and of short duration to individuals on the ground. Additionally, jets fly over the park, including outbound traffic from the Anchorage airport.

Helicopter use would be required to access existing and future RAWS, seismic stations, NPS repeaters, and other installations or research projects in the backcountry. These helicopter flights are point to point and of limited duration, thus noise intrusions would be temporary although spread throughout WRST. Helicopters would be used to access RAWS, seismic stations, and radio repeaters for routine maintenance, requiring up to 11 helicopter round trips over the course of 3 to 4 weeks each field season (see Table 4-2). Additionally, GPS sites would be visited only 2 more times over a period of 2-3 years; as many GPS sites can be visited in one day, there would be 1 or 2 round-trip helicopter flights in each of those years. Flight paths for all these maintenance activities would be direct from the heli-base to the sites but would traverse and land in designated wilderness.

Wilderness naturalness and visual resources are affected by the presence and operation of human installations such as the 14 RAWS (of which 7 could be in designated wilderness), 34 seismic stations in WRST (of which 27 could be in designated wilderness), 9 radio repeaters (of which 4 are in designated wilderness), and 9 GPS sites (all of which are in designated wilderness).

Park visitors encountering RAWS, seismic equipment, radio repeaters, and GPS sites, and exposed to noise from aircraft flying over and landing in designated wilderness to install or maintain equipment, would have a diminished visitor experience.

Combined with known past, current and future projects and actions, there would be minor adverse cumulative impacts on wilderness values.

Conclusion
Alternative C would have moderate, temporary, adverse impacts on wilderness values from helicopter activity during installation and maintenance of seismic stations, and minor, long-term, adverse impacts from the presence of seismic stations. There would be minor adverse cumulative impacts on wilderness values. The level of impact to wilderness values from Alternative C would not result in impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the natural and cultural integrity of the park and preserve.

4.5.6 Cultural Resources
Not all of the proposed seismic station sites have been archaeologically surveyed. If during the identification stage a cultural site is discovered at any of the proposed seismic station sites, the cultural resource will be documented, avoided, and the seismic station relocated. Cultural sites have been documented to occur in the vicinity of three of the proposed seismic station sites; STEEP 109, STEEP 115, and STEEP 117. The prehistoric site that occurs close to STEEP 117

would not be approached during the upgrade of that station. An archaeological monitor will be present at all station installations due to the ground altering activities involved. Implementing regulations (36 CFR 800) of Section 106 of the National Historic Preservation Act would be followed, culminating in a final report to the agency.

Cumulative Impacts
The majority of known historic properties in the park are associated with early placer and lode mining operations. Prehistoric sites include lithic scatters, village sites, semi-subterranean house pits, cache pits, and hunting blinds. Impacts to historic and prehistoric resources associated with mining and other development include exposure of a buried site, changes in artifact condition, destruction of artifacts or structures, loss of context of artifacts, site covering, and contamination of sites. Given the greater adverse effects of past mining development, construction of roads and buildings, and land applications within WRST, this alternative would be negligible adverse cumulative impacts on cultural resources.

Conclusion
Alternative C would have negligible adverse impacts on cultural resources. There would be minor adverse cumulative impacts on cultural resources. The level of impact on cultural resources under Alternative C would not result in any impairment of park resources that fulfill specific purposes identified in the WRST enabling legislation or that are essential to the cultural integrity of the park and preserve.

4.5.7 Seismic Monitoring and Hazard Forecasting
Installing the five additional stations under Alternative C would provide invaluable scientific data before, during, and after a large magnitude earthquake in this region. The data obtained can be used to detect smaller magnitude foreshocks that may preceed a large magnitude strike-slip event. Data gathered during a large magnitude event will allow detailed analysis of ground motion that will yield valuable information for hazard mapping and the engineering of earthquake-safe structures. Seismic data collected immediately after a large magnitude strike-slip event on the Totschunda Fault would allow AEIC to determine when aftershock activity is occurring and to assess the potential for any subsequent large magnitude earthquakes in the region.

Seismic hazard evaluation and human safety would be improved with Alternative C as the seismic monitoring program would be expanded to a total of 34 monitoring stations. The park's interpretive program on seismic phenomena and hazards would be enhanced with new information.

Cumulative Impacts
Additional data are needed to adequately forecast large seismic events for the Totschunda Fault and Yakataga seismic gap. The seismic monitoring program in the park would be expanded to a total of 34 seismic stations. There would be minor beneficial cumulative impacts on seismic monitoring and hazard forecasting.

Conclusion

Alternative C would have minor long-term beneficial impacts on seismic monitoring and hazard forecasting. There would be minor beneficial cumulative impacts.

CHAPTER 5: CONSULTATION & COORDINATION

5.1 PUBLIC INVOLVEMENT

This environmental assessment is available for public review and comment for 30 days. It is available online at the National Park Service Planning, Environment, and Public Comment (PEPC) website. Go the http://parkplanning.nps.gov to access the PEPC site. Public comments on this environmental assessment can also be provided on the PEPC website.

A press release announcing the public comment period and availability of the environmental assessment was issued by Wrangell-St. Elias National Park and Preserve (WRST), and announced over local public radio stations.

5.2 LIST OF PREPARERS AND CONSULTANTS

U.S. Department of the Interior, National Park Service

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The park wilderness committee reviewed the working draft EA beginning on December 30, 2005. The park wilderness committee met at park headquarter on January 17, 2006, and March 28, 2006 to discuss concerns and review comments on the initial and final draft EAs.

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CHAPTER 6: REFERENCES CITED

(Bleakley, 2006). United States Department of the Interior, National Park Service, Wrangell-St. Elias National Park and Preserve. 27 February 2006. Personal communication with Geoff Bleakley, Historian.

(Cote, 1996). Cote, S.D. 1996. Mountain goat responses to helicopter disturbance. Wildlife Society Bulletin 24:681-685.

(Day, 2006). 23 March 2006 and 20 March 2006 personal communications with Bob Day, Biologist, Alaska Biological Research Incorporated, Fairbanks, Alaska.

(Frid, 1999a). Frid, A. 1999. Fleeing decisions by Dall's sheep exposed to helicopter overflights. Prepared for the Yukon Fish and Wildlife Branch, Department of Renewable Resources, Whitehorse, Yukon.

(Frid, 1999b). Frid, A. 1999. Short-term effects of helicopter overflights on activity budgets of Dall's sheep. Prepared for the Yukon Fish and Wildlife Branch, Department of Renewable Resources, Whitehorse, Yukon.

(Frid, 1999c). Frid, A. 1999. Short-term responses by Dall's sheep to multiple helicopter overflights occurring within 12-hour periods. Prepared for the Yukon Fish and Wildlife Branch, Department of Renewable Resources, Whitehorse, Yukon.

(Hamilton, 2003). Hamilton, M.C. 2003. Aircraft activity and sound levels relative to recreation opportunity spectrum settings in the Great Barrier Reef Marine Park: A case study from Whitehaven Beach, Whitsunday Island. Great Barrier Reef Marine Park Authority, Research Publication No. 75. Accessed at: http://www.gbrmpa.gov.au/corp_site/info_services/publications/research_publications/rp75/rp75_full.pdf

(Hunt, 2005). United States Department of the Interior, National Park Service, Wrangell-St. Elias National Park and Preserve. 29 November 2005. Email communication with Steve Hunt, NEPA Coordinator.

(Hunt, 2006). United States Department of the Interior, National Park Service, Wrangell-St. Elias National Park and Preserve. 24 February 2006. Personal communication with Steve Hunt, NEPA Coordinator.

(Jesperson, 2006). United States Department of the Interior, National Park Service, Wrangell-St. Elias National Park and Preserve. 23 February 2006. Personal communication with Michele Jesperson, Cultural Resource Specialist.

(Kissling, 2006). United States Department of the Interior, Fish and Wildlife Service, Ecological Services Office, Juneau, Alaska. 23 March 2006. Personal communication with Michele Kissling, Biologist.

(Kuletz, 2006). Kuletz, K. 2004. Kittlitz's Murrelet - a Glacier Bird in Retreat. U.S. Fish and Wildlife Service, Alaska. Accessed at: http://alaska.fws.gov/media/murrelet/

(Larkin, 1996). Larkin, R.P. 1996. Effects of military noise on wildlife: a literature review. Center for Wildife Ecology. Illinois Natural History Survey. Accessed at: http://nhsbig.inhs.uiuc.edu/bioacoustics/noise_and_wildlife.pdf

(LHH, no date). League for the Hard of Hearing. No date provided. Web page. Noise levels in our environment fact sheet. Accessed on: 24 February 2006. Accessed at: http://www.lhh.org/noise/decibel.htm

(Miller, 2002). Miller, N.P. 2002. Transportation noise and recreational lands. The 2002 International Congress and Exposition on Noise Control Engineering. Deerborn, MI. August 19-21, 2002. Accessed at: http://www.hmmh.com/presentations/N011.pdf

(NPS, no date). United States Department of the Interior, National Park Service. No date provided. Web page. Nature and Science: Animals. Accessed on 29 November 2005. Accessed at: http://www.nps.gov/wrst/pphtml/animals.html

(NPS, 1986). United States Department of the Interior, National Park Service. 1986. General Management Plan, Land Management Plan, Wilderness Suitability Review. Wrangell-St. Elias National Park and Preserve, Alaska . 239 pp.

(NPS, 1990). United States Department of the Interior, National Park Service. April 1990. Final Environmental Impact Statement/Cumulative Impacts of Mining. Wrangell-St. Elias National Park & Preserve. NPS D-120A.

(NPS, 2005b). United States Department of the Interior, National Park Service. 2005. Helicopter Use Policy for Wrangell-St. Elias National Park & Preserve.

(NPS, 2000). United States Department of the Interior, National Park Service. 08 December 2000. NPS Management Policies 2001.

(NPS, 2001). United States Department of the Interior, National Park Service. September 2001. Ecological Units of Wrangell – St. Elias National Park and Preserve, Alaska. Alaska Region, Inventory and Monitoring Program. Anchorage, AK.

(NPS, 2005). United States Department of the Interior, National Park Service. May 2005. Climate Monitoring Program Expansion Environmental Assessement. Wrangell-St. Elias National Park and Preserve, AK.

(Reid, 2006). United States Department of the Interior, National Park Service, Wrangell-St. Elias National Park and Preserve. 24 February 2006. Personal communication with Mason Reid, Wildlife Biologist.

(UCSC, no date). University of California Santa Cruz, Science Communication Program. No date provided. Web Page. Sources of noise. Accessed on: 24 February 2006. Accessed at: http://scicom.ucsc.edu/SciNotes/9601/OceanNoise/Noises.html

(USGS, 2002). United States Department of the Interior, United States Geologic Survey. 2002. Technical Guidelines for the Implementation of the Advanced National Seismic System.

Appendix A

HELICOPTER USE POLICY FOR WRANGELL-ST. ELIAS NATIONAL PARK AND PRESERVE

Revised 2005

HELICOPTER USE POLICY FOR WRANGELL-ST. ELIAS NATIONAL PARK AND PRESERVE Revised 2005

Human safety and the protection of park resources are the primary considerations during all use of helicopters within WRST. The use of helicopters in WRST will conform to all applicable laws, regulations, policies and guidelines. The Interagency Helicopter Operations Guide (http://www.nifc.gov/ihog/) will serve as the official guidance. The use of personal protective equipment (PPE), Aviation Management Directorate (AMD – formerly OAS) carded aircraft and pilots, and a qualified helicopter flight manager or helicopter project manager1 will be required for all flights involving government employees or government contractors. All users of NPS contract helicopters are required to possess the appropriate level of training for their operations as prescribed by IHOG. The Helicopter Safety Course (DOI B-3) is the minimum requirement for all frequent fliers or if involved in special use flights. For infrequent fliers, a thorough safety briefing by the pilot will meet this requirement

In order to protect the natural, cultural and wilderness resources within WRST, and to minimize conflicts with local residents and the visiting public, the following guidelines will be followed by all federal government users, government cooperator users, or state/private helicopter users who have obtained a landing permit from the park regardless of ownership of the helicopter:

1. All non-NPS activities that require helicopter landings on federal lands within WRST require a special use permit signed by the Superintendent.
2. The helicopter pilot, project (park or other) manager, and field crews are responsible for knowing the park policy and the land status prior to commencing helicopter activities.
3. The park project manager or park contact will provide all permittees that use helicopters with a copy of the park helicopter policy and map prior to commencing operations.
4. It is the responsibility of the park project manager to ensure the use of helicopters in WRST complies with NEPA, Section 106 compliance and WRST Wilderness policies.
5. Flights in or near sensitive areas or private/conveyed lands require advance notification to area residents by the district ranger or park project manager. Permission from the landowner is required for landings on private/conveyed lands.
6. All flights will maintain a minimum altitude of 1,000 feet above ground level (AGL) unless listed under “Exceptions to WRST Helicopter Use Guidelines” listed below or when specifically approved, in writing, by the Superintendent, or his/her designate.
7. All feasible measures will be undertaken to avoid and/or minimize impacts to backcountry users and wildlife.
8. No helicopter flights will be made over Dall sheep habitat (above the 4000-foot contour north of the Chitina River) from August 5 through September 20 (during sheep hunting season and the five day period which precedes it) or any area where subsistence hunting occurs unless specifically authorized by the Superintendent.
9. Dwellings (identified on the attached map) will not be approached within a two-mile horizontal distance or 2000 feet above ground level.
10. Hazards (identified on the attached map) include suspended cables, bridges, and aerial trams. Pilots should review the information about these sites prior to their mission.

11. Any waiver from these guidelines must be approved in writing by the Superintendent or his/her designee.
12. A flight plan must be filed with the WRST dispatcher (907-822-5236), and closed following the day's activities. A non NPS permittee may request flight following with WRST dispatch (Gulkana Operations Center). After hours a flight plan can be filed with Kenai Flight Services (1-800-992-7433).
13. Any deviation from the policy due to an emergency, helicopter mechanical problems, or aviation restrictions will be reported as soon as possible by radio or phone to the park dispatcher (907-822-5236). The dispatcher will then relay the information to both the Chief Ranger and park project manager.

Exceptions to WRST Helicopter Use Guidelines

Helicopters may fly below 1000 feet AGL only under the following conditions:

1. Mechanical or flight problems with the helicopter.
2. Staying out of clouds or maintaining adequate visibility in bad weather.
3. Landing or taking off.
4. Law enforcement purposes.
5. Search and/or rescue or other emergency activities.
6. Message dropping or attempting to read ground-to-air messages.
7. Approved management activities (i.e., wildlife, fisheries, vegetation, fire, grazing allotment, hazardous waste, park use, subsistence and mining, maintenance, etc.) specifically covered by a project statement, management plan or plan of operations and environmental clearance.
8. Aerial photography when specifically authorized by the Superintendent.

Approved By:

_____ _____

Superintendent Date

Appendix B

ANILCA SECTION 810(a)

SUMMARY EVALUATION AND FINDINGS

Appendix B

ANILCA SECTION 810(a)

SUMMARY EVALUATION AND FINDINGS

I. INTRODUCTION

This section was prepared to comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA). It summarizes the evaluations of potential restrictions to subsistence activities that could result from issuing a permit to allow the Alaska Earthquake Information Center to expand the seismic monitoring station network in Wrangell-St. Elias National Park and Preserve.

II. THE EVALUATION PROCESS

Section 810(a) of ANILCA states:

"In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands … the head of the federal agency … over such lands … shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be effected until the head of such Federal agency -

(1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to section 805;

(2) gives notice of, and holds, a hearing in the vicinity of the area involved; and

(3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands, (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition, and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions."

ANILCA created new units and additions to existing units of the national park system in Alaska. Wrangell-Saint Elias National Park, containing approximately eight million one hundred and forty-seven thousand acres of public lands, and Wrangell-Saint Elias National Preserve containing approximately four million one hundred and seventeen thousand acres of public lands, was created by ANILCA, section 201(9), for the following purposes:

> "To maintain unimpaired the scenic beauty and quality of high mountain peaks, foothills, glacial systems, lakes, and streams, valleys, and coastal landscapes in their natural state; to protect habitat for, and populations of, fish and wildlife including but not limited to caribou, brown/grizzly bears, Dall sheep, moose, wolves, trumpeter swans and other waterfowl, and marine mammals; and to provide continued opportunities including reasonable access for mountain climbing, mountaineering, and other wilderness recreational activities. Subsistence uses by local residents shall be permitted in the park, where such uses are traditional, in accordance with the provisions of Title VIII."

The potential for significant restriction must be evaluated for the proposed action's effect upon "…subsistence uses and needs, the availability of other lands for the purposes sought to be achieved and other alternatives which would reduce or eliminate the use."

III. PROPOSED ACTION ON FEDERAL LANDS

The National Park Service is considering three alternatives for the installation and maintenance of additional seismic monitoring stations within Wrangell-St. Elias National Park and Preserve. This stems from a permit request by the Alaska Earthquake Information Center at the Geophysical Institute of University of Alaska Fairbanks. The proposed stations will supplement the 17 seismic monitoring sites that already exist in the park. The seismic stations would become part of the Alaska Earthquake Information Center's seismic monitoring network which monitors seismic activity in an effort to improve earthquake detection and hazard forecasting in the region. Those stations in the St. Elias Mountains would contribute to a project that seeks to improve understanding of interactions between surface processes, such as erosion, and tectonics in active mountain belts, in this case specifically in the St. Elias Mountains. A full discussion of the alternatives and their anticipated effects is presented in the Environmental Assessment (EA) for the St. Elias Erosion and Tectonics Project (STEEP). The alternatives are summarized briefly below.

Alternative A – No Action: No additional seismic monitoring stations would be established within Wrangell-St. Elias. Basic seismic data would continue to be collected using the existing network of seismic stations, which includes 17 stations located with in the park. Existing stations would be visited once a year for maintenance.

Alternative B – Expand Seismic Monitoring Network: In addition to the continued use of existing seismic monitoring stations, ten new stations would be established in Wrangell-St. Elias, two existing sites would be upgraded, and two new stations would be established on private land (not discussed further in this analysis). This would bring the total number of stations on park lands to 29. Because seven of the new sites would be co-located with already permitted STEEP

GPS sites, however, only three of the proposed new stations would not be co-located with existing park facilities or already permitted STEEP GPS sites. Seismic stations must be located on bedrock, at high elevations on landforms that have good long-distance lines of sight to other stations for data telemetry (e.g., ridge tops). The stations are intended as permanent installations and would be operated and maintained indefinitely. The unmanned stations would consist of a small fiberglass hut (4 feet on each side and 5 feet high) housing equipment and battery along with a seismometer linked to the equipment in the hut by a buried cable. The footprint for each site would be about 120 square feet. For the two upgraded sites, new equipment will be installed in existing huts such that there would not be a change in the footprint at these sites. Additional sites may be upgraded as needed. All ten of the new stations along with one of the upgraded sites would be located within designated wilderness. The specific location of the stations has yet to be determined, and thus this 810 analysis is based on the general information provided in the Environmental Assessment and not on site visits or prior familiarity with the specific locations. Following installation, the stations would be visited once every four years for maintenance purposes, on a rotating schedule so that a few sites would be visited each year. For both installation and maintenance, the station locations would be accessed by helicopter in accordance with the park's helicopter policy.

Alternative C – Maximum Expansion of Seismic Monitoring Network: In addition to the continued use of existing seismic monitoring stations, 15 new stations would be established in Wrangell-St. Elias and two existing sites would be upgraded. This would bring the total number of seismic stations on park lands to 34. Most of the unmanned stations would consist of a small fiberglass hut (4 feet on each side and 5 feet high) housing equipment and battery along with a seismometer linked to the equipment in the hut by a buried cable. Two of the sites would have dish antennas approximately 6 feet in diameter outside of the hut. The footprint for each site would be about 120 square feet. Eighteen of the new stations would be located within designated wilderness. The specific location of the stations has yet to be determined, and thus this 810 analysis is based on the general information provided in the Environmental Assessment and not on site visits or prior familiarity with the specific locations. Following installation, the stations would be visited once a year for maintenance purposes. For both installation and maintenance, the station locations would be accessed by helicopter in accordance with the park's helicopter policy.

IV. AFFECTED ENVIRONMENT

A summary of the affected environment pertinent to subsistence use is presented here. The following documents contain additional descriptions of subsistence uses within Wrangell-St. Elias National Park and Preserve:

- *General Management Plan/Land Protection Plan, Wrangell-St. Elias National Park and Preserve*, NPS Alaska Region, 1986.

- *Final Environmental Impact Statement, Wilderness Recommendation*, NPS Alaska Region, 1988.

- *Wrangell-St. Elias Subsistence Plan*, NPS Alaska Region, 1998. (Updated approximately annually.)

Subsistence uses are allowed within Wrangell-St. Elias National Park and Preserve in accordance with Titles II and VIII of ANILCA. The national preserve is open to federal subsistence uses and state authorized general (sport) hunting, trapping and fishing activities. Qualified local rural residents who live in one of the park's twenty-three designated resident zone communities or have a special subsistence use permit issued by the park superintendent may engage in subsistence activities within the national park. State-regulated sport fishing is also allowed in the national park. The proposed action would potentially affect both park and preserve lands.

The landscape included within Wrangell-St. Elias National Park and Preserve ranges from forests and tundra to the rock and ice of high mountains. The region's main subsistence resources are salmon, moose, caribou, Dall sheep, mountain goat, ptarmigan, grouse, snowshoe hare, furbearing animals, berries, mushrooms, and dead and green logs for construction and firewood. Most subsistence hunting within Wrangell-St. Elias occurs off the Nabesna, McCarthy, and Kotsina roads. The Copper, Nabesna, Chisana and Chitina rivers serve as riverine access routes for subsistence users.

The NPS recognizes that patterns of subsistence use vary from time to time and from place to place depending on the availability of wildlife and other renewable natural resources. A subsistence harvest in a given year may vary considerable from previous years due to weather conditions, migration patterns, and natural population cycles.

V. SUBSISTENCE USES AND NEEDS EVALUATION

To determine the potential impact on existing subsistence activities, three evaluation criteria were analyzed relative to existing subsistence resources which could be impacted.

The evaluation criteria are as follows:

1. the potential to reduce important subsistence fish and wildlife populations by (a) reductions in numbers, (b) redistribution of subsistence resources, or (c) habitat losses;

2. what affect the action might have on subsistence fisher or hunter access; and

3. the potential for the action to increase fisher or hunter competition for subsistence resources.

<u>The potential to reduce populations:</u>

The proposed installation and maintenance of the additional seismic stations in the park and preserve has no potential to affect subsistence fish resources, their distribution or habitat. Installation and maintenance of the new stations along with station upgrades under Alternatives B and C could temporary displace wildlife in the immediate vicinity of the stations. The footprint of the seismic stations is quite small, however, and any wildlife habitat loss would be extremely

minor. In sum, the proposed alternatives are not expected to significantly reduce populations of important subsistence resources.

The effect on subsistence access:

Rights of access for subsistence uses on NPS lands are granted by Section 811 of ANILCA. Allowed means of access by federally qualified subsistence users in Wrangell-St. Elias National Park and Preserve include motorboat, snowmachine (subject to frozen ground conditions and adequate snow cover), all-terrain vehicles (ATVs), and airplane (preserve only), along with non-motorized means such as foot, horses, and dog teams. The proposed action alternatives along with the no-action alternative would have no direct impact on allowed means of subsistence access, nor would the alternatives affect the areas open to subsistence users or access routes to those areas. Thus, none of the alternatives discussed in this analysis would affect subsistence hunter or fisher access.

The potential to increase competition:

Competition for subsistence resources on federal public lands is not expected to increase under any of the alternatives discussed in this analysis. Therefore, the proposed action is not expected to adversely affect resource competition.

VI. AVAILABILITY OF OTHER LANDS

The EA and this evaluation have described and analyzed the proposed alternatives. The proposed actions are consistent with NPS mandates and the General Management Plan for the park and preserve. No other alternatives that would reduce or eliminate the use of public lands needed for subsistence purposes were identified. That said, the amount of land affected by the proposed action is minimal in relation to the overall amount of federal public land in the park and the preserve, and it is possible for subsistence users to utilize other lands both inside and outside the park and preserve. Subsistence users extend their activities to other areas as necessary to obtain subsistence resources.

VII. ALTERNATIVES CONSIDERED

The EA and this evaluation have described and analyzed the proposed alternatives. The expansion of the seismic monitoring network only in non-wilderness areas was considered but rejected because it did not meet the purpose and need of the project in terms of number and density of new stations. No other alternatives were considered.

VII. FINDINGS

This analysis concludes that the proposed action alternatives would not result in a significant restriction of subsistence uses. The No Action alternative would also not result in a significant restriction of subsistence uses.

Appendix C

PHOTOS OF FOUR PROPOSED SEISMIC STATION SITES

STEEP 119

STEEP 114

STEEP 109

STEEP 116

Appendix D

Wilderness Mimimum Requirement/ Minimum Tool Analysis

Modified from 2004 Arthur Carhart Wilderness Training Center

MINIMUM REQUIREMENTS DECISION GUIDE

WORKSHEETS

Introduction

While the National Park Service Organic Act of 1916 and the Wilderness Act of 1964 speak in comparable terms about preserving the integrity of resources, the Wilderness Act constrains many activities in National Park wilderness areas that the Organic Act permits or leaves open to interpretation by park managers. *The effect of the Wilderness Act is to unambiguously place an additional layer of protection on wilderness areas within the National Park System.*

The purpose of the Act as stated in Section 2(a) is"…to secure for the American people of present and future generations the benefits of an enduring resource of wilderness…shall be administered…in such a manner as will leave [the wilderness areas] unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, [and] the preservation of their wilderness character…". Then Section 4(b) further emphasizes this direction stating *"Except as otherwise provided in this Act, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area and shall so administer such area for such other purposes for which it may have been established as also to preserve it's wilderness character."* Section 101(b) of the Alaska National Interest Lands Conservation Act (ANILCA) states that Congress intended one of the fundamental purposes of that sweeping law to be preservation *"…of wilderness resource values and related recreational opportunities…".*

The Minimum Requirements Decision Guide 2004 (MRDG) is a result of interagency collaboration to bring an appropriate level of consistency to administrative decisions in units of the National Wilderness Preservation System. The worksheet process is designed to assist Superintendents, wilderness managers and project leads in collaborative evaluations in order to make appropriate decisions for wilderness. These instructions refer to completing the MRDG *Worksheets.* Wrangell-St. Elias National Park and Preserve (WRST) staff refer to this process and forms as the *Minimum Requirement-Minimum Tool Analysis.*

Please refer to MRDG Instructions, park enabling legislation, NPS guidance in NPS Management Policies 2001, Director's Order #41 and National Wilderness Steering Committee guidance documents in completing this analysis. Use of this process assumes a familiarity with these laws and policies as well as applicable provisions of the Alaska National Interest Lands Conservation Act of 1980

The MRDG is derived from Section 4(c) of the Wilderness Act and involves two sequential steps. ***Step 1*** determines whether action (proposed project or activity) is a) ***necessary*** *for administering the area as*

wilderness ***and b) does not pose significant impacts***. ***Both*** elements should be affirmatively met in order to proceed. If an action is found to be necessary, then ***Step 2*** provides guidance for determining ***how the action is to be undertaken*** in order to cause the least amount of impact to wilderness resources, character and purposes.

NOTE: Do not use this guide for emergencies involving the imminent health or safety of people, including wildland fire suppression, rescue or medical responses.

PEPC Project Identification # : 11618

Project Title: St. Elias Erosion and Tectonics Project

Step 1: Determine if it is necessary to take action.

Description: Briefly describe the situation that may prompt action (This is not a description of possible methods or tools to be employed, but rather the **situation that prompts** the action/project/activity).

The Alaska Earthquake Information Center (AEIC) situated at the Alaska Geophysical Institute, University of Alaska, Fairbanks, proposes expansion of the seismic station monitoring network within Wrangell-St. Elias National Park and Preserve (WRST). The seismic station network expansion would be accomplished through the St. Elias Erosion and Tectonics Project (STEEP). Data and information acquired from STEEP would increase knowledge and understanding of the interactions between surface processes and tectonics in an active mountain belt. More specifically, STEEP would articulate the evolution of the St. Elias Mountains, the highest coastal mountain range in the world, which is the product of the complex tectonic, climatic, and erosional events and processes that have been ongoing for several million years. Expanded seismic monitoring in WRST would also have practical applications for hazard forecasting and dissemination of information of interest to park managers and the public given the location of WRST relative to the Yakataga seismic gap and Denali Fault.

Large magnitude earthquakes have been recorded along the Pacific/North American plate boundary in Alaska with exception to the Yakataga seismic gap and another seismic gap along the Alaska Peninsula. The term seismic gap refers an area along a major fault or plate boundary where large magnitude earthquakes are expected but have not yet occurred. The Yakataga seismic gap is bounded on the west by the rupture zone of the 1964 magnitude 9.2 Great Alaskan Earthquake, and on the east by the rupture zone of a 1979 magnitude 7.6 earthquake with an epicenter just northeast of Mt. St. Elias. This area extends from Icy Bay in Wrangell-St. Elias National Park and Preserve to Cape Yakataga; and approximately 60 miles offshore to the south, and 60 miles inland to the north. The lack of large seismic events in the Yakataga seismic gap implies that stress is accumulating on the plate boundary. It is possible that a magnitude 7 or greater earthquake will occur in the region in the future.

The northern portion of Wrangell-St. Elias National Park and Preserve was affected by the largest inland earthquake in North America in nearly 150 years when the Denali Fault ruptured on November 3, 2002. This was a magnitude 7.9 event that also ruptured the Totschunda Fault in the vicinity of the Mentasta and Nutzotin mountain ranges. The Denali Fault earthquake caused significant damage to transportation systems in central Alaska, and the villages of Mentasta and Northway just north of Wrangell-St. Elias National Park and Preserve.

Seismic monitoring has occurred in Wrangell-St. Elias National Park and Preserve since 1980; the existing monitoring network consists of the following seismic stations (note: **bold** not in designated wilderness).

1. Wrangell Zanetti
2. Wrangell North Crater
3. Wrangell Chichokna Glacier
4. Wrangell Southwest
5. **Gilahina Butte**

6. Verde Peak repeater
7. **Patty Peak repeater**
8. Baldy Mountain
9. Bremner
10. Chitina Glacier
11. Cirque
12. Tana Glacier
13. Yahtse
14. Guyot
15. Pinnacle Pass
16. Chaix Hills
17. Bancas Point

Two of the existing 17 seismic stations, Gilahina Butte (5) and Patty Peak repeater (7), are not in designated wilderness. The remaining 15 existing seismic stations are situated in the Wrangell-Et. Elias Wilderness.

AEIC and Alaska Geophysical Institute seismologists are proposing expansion of the seismic monitoring network in WRST by establishing new monitoring stations under the STEEP project as follows (note: **bold** on private lands, or not in designated wilderness).

1. **STEEP 101 McCarthy with very small aperture transmitter (VSAT)**
2. **STEEP Ultima Thule VSAT**
3. **STEEP 105 Patty Peak repeater (upgrade existing seismic station)**
4. STEEP 117 Verde Peak repeater (upgrade existing seismic station)
5. STEEP 106 Logan permitted global positioning system (GPS) site
6. STEEP 108 Granite Creek permitted GPS site
7. STEEP 109 Juniper Island permitted GPS site
8. STEEP 115 Kiagna permitted GPS site
9. STEEP 119 RKAV permitted GPS site
10. STEEP 123 St. Elias permitted GPS site
11. STEEP 124 Samovar Hills permitted GPS site
12. STEEP 107 Barnard
13. STEEP 114 Mesa
14. STEEP 116 Bagley

Two of the proposed new stations, STEEP 101 McCarthy and STEEP Ultima Thule, are on private lands. Two of the proposed stations are upgrades of existing seismic stations (STEEP 105 Patty Peak repeater and STEEP 117 Verde Peak repeater). Seven of the proposed stations would be co-located with an existing permitted GPS site (STEEP 106 Logan, STEEP 108 Granite Creek, STEEP 109 Juniper Island, STEEP 115 Kiagna, STEEP 119 RKAV, STEEP 123 St. Elias, and STEEP 124 Samovar Hills). Three of the proposed stations are not co-located with an existing facility, GPS, or on private lands and involve new surface disturbance (STEEP 107 Barnard, STEEP 114 Mesa, and STEEP 116 Bagley).

With exception to the new stations on private lands (STEEP 101 McCarthy (1) and STEEP Ultima Thule VSAT (2)), and STEEP 117 Patty Peak repeater (3), 11 new STEEP monitoring stations are situated in the Wrangell-St. Elias Wilderness. Three of the 11 new stations in designated wilderness would not be co-located with an existing repeater or seismic station, or permitted GPS site (STEEP 107 Barnard (12), STEEP 114 Mesa (13), and STEEP 116 Bagley (14)).

Access to the 12 proposed STEEP sites on park lands would require use of helicopter. Each site would require 2 or 3 days for installation. Installation is proposed to begin in July 2006. Helicopter access would be required for recurring station maintenance. It is estimated that each remote station would be visited for maintenance once every 4 years for about one day.

A. Describe Valid Existing Rights or Special Provisions of Wilderness Legislation

Are there valid existing rights or is there a special provision in wilderness legislation (the Wilderness Act of 1964 or subsequent wilderness laws like ANILCA) that allows consideration of action involving Section 4(c) uses? Cite law and section.

Yes: ☐ **No:** X☐ **Not Applicable:** ☐

Explain:
ANILCA Section 1310(b) Navigation Aids and Other Facilities—New Facilities. This provision provides some exceptions for certain types of facilities, but no exceptions are provided for seismic stations.

B. Describe Requirements of Other Legislation

Do other laws require action?

Yes: ☐ **No:** X☐ **Not Applicable:** ☐

Explain:
No other laws require action pertaining to permitting the installation of new seismic stations. Title I of ANILCA sets out the purposes of conservation system units established by ANILCA, which include any unit in Alaska of the National Park System (Wrangell-St. Elias National Park and Preserve) and National Wilderness Preservation System (Wrangell-St. Elias Wilderness), as follows:

> In order to preserve for the benefit, use, education, and inspiration of present and future generations certain lands and waters in the State of Alaska that contain nationally significant natural, scenic, historic, archaeological, geological, scientific, wilderness, cultural, recreational, and wildlife values, the units described in the following titles are hereby established (ANILCA Section 101(a)).
>
> It is the intent of Congress in this Act to preserve unrivaled scenic and geological values associated with the natural landscapes;…to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and subarctic wildlands and on freeflowing rivers; and to maintain opportunities for scientific research and undisturbed ecosystems (ANILCA Section 101(b)).

ANILCA states that the park and preserve shall be managed for the following purposes:

> To maintain unimpaired the scenic beauty and quality of high mountain peaks, foothills, glacial systems, lakes, and streams, valleys, and coastal landscapes in their natural state; to protect habitat for, and populations of, fish and wildlife including but not limited to caribou, brown/grizzly bears, Dall sheep, moose, wolves, trumpeter swans and other waterfowl, and marine mammals; and to provide continued opportunities, including reasonable access for mountain climbing, mountaineering, and other wilderness recreational activities. Subsistence uses by local residents shall be permitted in the park, where such uses are traditional, in accordance with the provisions of title VIII (ANILCA Section 201(9)).

In summary, ANILCA recognizes that:

> The purposes of conservation system units include their preservation for the benefit, use, education, and inspiration of present and future generations;
>
> Conservation system units contain nationally significant natural, scenic, geological, scientific, and wilderness values;
>
> Opportunities for scientific research and undisturbed ecosystems should be maintained;
>
> And that Wrangell-St. Elias National Park and Preserve shall be managed for the purposes stated above.

C. Describe Other Guidance

Does taking action conform to and implement relevant standards and guidelines and direction contained in agency policy, unit and wilderness management plans, species recovery plans, tribal government agreements, state and local government and interagency agreements?

Yes: **X**☐ **No:** ☐ **Not Applicable:** ☐

Explain:
NPS Management Policies state that wilderness policy directives apply regardless of the category of wilderness, and all management decisions affecting wilderness must be consistent with the minimum requirement concept. The policies require that the management action must be appropriate or necessary for administration of the area as wilderness.

The NPS Management Policies recognize that scientific research can be considered an important use of wilderness. However, like any other use of wilderness, the costs must be weighed against the benefits of providing an enduring wilderness resource in situations where impacts on wilderness can occur. The policies provide more specific guidance for those scientific activities that involve the prohibitions in Section 4(c) of the Wilderness Act; in this instance, the STEEP project would involve the installation of seismic monitoring devices, landing of aircraft, and use of helicopters for motorized transport in wilderness. The research must either provide essential information for the understanding, health, management, or administration of wilderness; or not compromise wilderness resources or character if it has no direct relationship to wilderness. Additionally, scientific monitoring devices that are installed and operated in wilderness must provide information that is essential to wilderness administration and preservation.

6.3.6 Scientific Activities in Wilderness
The statutory purposes of wilderness include scientific activities, and these activities are encouraged and permitted when consistent with the Service's responsibilities to preserve and manage wilderness.

6.3.6.1 General Policy
Scientific activities involving prohibitions identified in Section 4(c) of the Wilderness Act may be conducted within wilderness when:

- The desired information is essential for the understanding, health, management, or administration of wilderness, and the project cannot be reasonably modified to eliminate or reduce the nonconforming wilderness use; or if it increases scientific knowledge, even when this serves no immediate wilderness management purposes, provided it does not compromise wilderness resources or character. The preservation of wilderness resources and character will be given significantly more weight than economic efficiency or convenience.
- Research and monitoring devices may be installed and operated in wilderness if the desired information is essential for the administration and preservation of wilderness, and cannot be obtained from a location outside of wilderness without significant loss of precision and applicability; and the proposed device is the minimum requirement necessary to accomplish the research objectives safely.
- Devices located in wilderness will be removed when determined to be no longer essential. Permanent equipment caches are prohibited within wilderness. Temporary caches must be evaluated using the minimum requirement concept.
- All scientific activities, including the installation, servicing, removal, and monitoring of research devices, will apply minimum requirement concepts and be accomplished in compliance with management policies, Director's Orders, and procedures specified in the park's wilderness management plan.
- The proposed STEEP project is consistent with the park resource management plan and plan elements pertinent to seismic hazards and evaluation, earthquake prediction, and monitoring of seismic activity within the Yakataga seismic gap. The project would also be subject to the park helicopter use policy which establishes use stipulations and flight restrictions.

D. Describe Options Outside of Wilderness

Can this situation be resolved by action outside of wilderness?

Yes: ☐ **No:** X☐ **Not Applicable:** ☐

Explain:

Over 90 percent of WRST is designated as wilderness, or wilderness-suitable land; and is managed as wilderness as required by NPS policy. A majority of the segments of the Wrangell, Chugach, and St. Elias mountain ranges encompassed within the park and preserve boundaries are also situated in wilderness, as are major volcanic centers. 15 of 17 existing seismic stations in the park and preserve are situated in wilderness; 11 of 14 new STEEP stations would also be in wilderness. It is not feasible to expand the seismic monitoring program outside of wilderness and

expect to have a program that measures representative conditions of tectonics within the Yakataga seismic gap or Denali Fault. Additionally, seismometers require installation on bedrock with a clear path for data telemetry to other points in the monitoring network. A location on bedrock is of critical importance because the quality of seismic signals detected by the seismometer is directly related to the amount of signal attenuation caused by any soils or unconsolidated materials overlying the bedrock in a given area. Seismometers situated on bedrock encounter little or no attenuation of seismic signals, allowing optimal performance and significantly greater accuracy pertaining to analysis of earthquake locations, depths, magnitudes, and mechanisms. Without the installation of an expanded monitoring network with the STEEP program, the ability of researchers to accurately detect and assess seismic events in the park and preserve, or assess the potential for large magnitude seismic events, would be impeded considerably.

E. Wilderness Character

How would the proposed action contribute to the preservation of wilderness character, as described by the components listed below?

Untrammeled:
No contribution. Existing and new seismic stations in the Wrangell-St. Elias Wilderness would be evident to park visitors encountering the stations while engaged in wilderness recreation. The STEEP project may also affect others who value the intangible aspects of wilderness in knowing that the area is untrammeled and undeveloped. The existence of large wilderness landscapes in Alaska is also important to individuals who may never visit the area but value knowing that such landscapes exist in the national park system. Conversely, many of the proposed locations are very remote and difficult to access on foot given that that foot access would require dangerous traverses across icefields and other glacial features requiring a highly refined set of mountaineering skills and specialized equipment. It is conceivable that few if any park visitors would encounter the new seismic stations; instead, it is more likely that helicopter use associated with station installation and maintenance activities would be the primary influence adversely affecting a park visitor's wilderness experience.

Undeveloped:
No contribution. An adverse impact would result from the placement of additional seismic stations in a previously undisturbed area, and from helicopter use associated with site installation and maintenance.

Natural:
Neutral to minor contribution. Monitoring of seismic activity is essential for hazard forecasting given that the park and preserve are situated along a tectonically active plate boundary and contain several known volcanic centers. Seismic monitoring has occurred in Wrangell-St. Elias National Park and Preserve since 1980. The additional data from an expanded seismic station network are of benefit to park management, the public, and the park's interpretive program in regard to increasing knowledge and understanding of the Yakataga seismic gap and the geologically active region of Wrangell-St. Elias National Park and Preserve. The proposed action is unlikely to have any significant adverse effects on natural resource values due to the small physical footprint of the seismic stations—about 0.003 acre per site. Equipment huts would be gray or some other neutral color to blend with the immediate site environs and minimize visual detection. While stations may be operational for the long-term, they can readily be removed from the site locations and site disturbance restored by the permittee if at some point in the future it is determined that they are no longer needed. Helicopter use associated with site installation, maintenance, and removal would be detrimental to individuals encountering the aircraft while in pursuit of wilderness recreation.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation: No contribution. An adverse impact would result from the placement of new seismic stations in wilderness, and from helicopter noise.

Other unique components that reflect the character of this wilderness:
Minor contribution. The major mountain ranges crossing the park and preserve, and the ongoing natural processes behind their formation, are directly associated with the public's impressions of the area as a wilderness resource. These underlying geologic processes are of interest to the public, and information is regularly presented to the public by the National Park Service interpretive programs. Scientific research, public education, and interpretation of important geologic processes such as mountain orogeny, volcanism, and tectonics are directly associated with the

character of the mountain wilderness landscape of the park and preserve. Enhanced seismic monitoring resolution of the Yakataga seismic gap could provide a measurable net benefit to public general understanding of the landscape features and seismic processes that define the diverse landscapes of Wrangell-St. Elias National Park and Preserve and its designated wilderness.

Helicopter use would be temporary and limited to accessing sites where fixed wing access is not feasible. Guidelines set forth by the Helicopter Policy for WRST will be followed. In planning flight paths, all feasible measures will be undertaken to avoid and/or minimize impacts to backcountry users. Sensitive areas, including high public use areas and high resident use areas, will be avoided by aircraft when feasible. Visitors would be notified of the STEEP program operations and made aware that they might encounter helicopter activity while engaged in wilderness recreation. Helicopter altitude and horizontal distances will be maintained according to the park helicopter use policy.

Use of helicopters during hunting season in areas of known hunting would be avoided. When potential conflicts may occur, notification would precede maintenance operations. It is very unlikely that the activity, very limited in time and space, would coincide with visitor recreation activity. Visitors would generally not be able to access the locations that are only helicopter accessible.

Describe Effects to the Public Purposes of Wilderness

F How would action support the public purposes for wilderness (as stated in Section 4(b) of the Wilderness Act) of recreation, scenic, scientific, education, conservation, and historical use?

Scientific
Action has minor contribution for scientific purposes. The primary benefit of this action is an improved scientific understanding of regional tectonics and the Yakataga seismic gap for purposes other than those directly related to preservation or enjoyment of the Wrangell-St. Elias Wilderness. The geographic distribution of seismometers greatly influences the accuracy in determining earthquake locations, magnitudes, and mechanisms. Without expansion of the seismic station monitoring network, understanding of seismic activity and associated hazards in the park and preserve would remain limited as existing seismometers are not arrayed in sufficient density in the Chugach and St. Elias mountain ranges.

Education
Action has minor contribution for educational purposes. New information that could be passed on to the public can certainly be derived from the results of the STEEP research. However, the information is highly specialized. The likelihood that there would be a measurable increase in public's general understanding of seismic processes and associated hazards in the park and preserve wilderness landscape is highly dependent on translating the information into a format suitable for presentation in the park's interpretive program.

Step 1 Decision: **Is it <u>necessary</u> to take action?**

Yes: X☐ **No:** ☐ **Not Applicable:** ☐

Explain:
Project must satisfy one of following three NPS policy criteria to be permitted in wilderness.

1. Research and monitoring devices may be installed and operated in wilderness if the desired information is essential for administration and preservation of wilderness, and cannot be obtained from a location outside of wilderness without significant loss of precision and applicability. Proposed device is the minimum requirement necessary to accomplish research objectives safely. **Project partially meets this criterion. Information provided by project is not essential for administration and preservation of wilderness. The nexus between an incremental increase in the understanding of tectonics and seismic activity to administration and preservation of wilderness is not clear. While the information is of interest**

scientifically, it has no direct application to preservation of the wilderness resource for future generations. It would be easier to justify remote automated weather stations instead of seismic stations because the argument can be made more clearly that weather data are a major component of natural systems as opposed to data on seismic events. Acquisition of information is dependent on siting new seismic stations in wilderness to assure scientific precision and applicability. Proposed devices and helicopter support are minimum requirements needed to accomplish research objectives safely. The natural processes of wilderness and the values of solitude or wilderness recreation will not be threatened if this action is not taken.

2. Research project increase scientific knowledge, even when this serves no immediate wilderness management purpose, provided it does not compromise wilderness resources or character. **Project does not meet this criterion. While STEEP research would increase scientific knowledge of Yakataga seismic gap and regional tectonics in the Wrangell-St. Elias Wilderness, the information does not serve any immediate wilderness management purpose. Project would compromise wilderness character because permanent or long term installations (seismic stations), helicopter landings, and use of motorized equipment (helicopter) for seismic station installation and maintenance are identified as prohibitions in Wilderness Act.**
3. Desired information is essential for understanding health, management, or administration of wilderness and the project cannot be reasonably modified to eliminate or reduce the nonconforming wilderness use. **Project meets criterion. Action is needed for understanding of Yakataga seismic gap, regional tectonics, and seismic hazards associated with formation of major mountain ranges that are prominent features of the Wrangell-St. Elias Wilderness. NPS-77, Natural Resources Management Guideline, states that NPS should seek to identify significant geologic features and processes. The proposed STEEP project is consistent with the park resource management plan and plan elements pertinent to seismic hazards and evaluation, earthquake prediction, and monitoring of seismic activity within the Yakataga seismic gap. Section 201(9) of ANILCA states that the park and preserve shall be managed for several purposes, including to maintain unimpaired the scenic beauty and quality of high mountain peaks, foothills, glacial systems, lakes, and streams, valleys, and coastal landscapes in their natural state. ANILCA recognizes that conservation system units contain nationally significant geological, scientific, and wilderness values, and opportunities for scientific research and undisturbed ecosystems should be maintained. Regional tectonics and seismic events are an important element of the park and preserve, and are contributing factors to development of high mountain peaks, landscapes, scenic beauty, and quality of the Wrangell-St. Elias Wilderness. A basic understanding of these prominent landscape features and formative processes does enhance the public's appreciation of the wilderness landscape that is the essence of Wrangell-St. Elias National Park and Preserve. In addition, it is noted that:**

> **Major historic earthquakes have occurred in and near WRST that have had a significant impact on the landscape of the park and on nearby settlements. Two events occurred in the Yakutat Bay region on September 10th, 1899. A foreshock of magnitude 7.4 during the morning hours was followed by a magnitude 8.0 earthquake later that afternoon. A destructive tsunami of up to 10.6 meters (34.7 feet) in height occurred in Yakutat Bay. Strong shaking was felt in every settlement with a 400 km radius. U.S. Geological Survey observations in the decade following the earthquakes recorded extreme effects in the Yakutat Bay region. Landmasses were uplifted at much at 14.5 meters (47.5 feet) on the western side of Disenchantment Bay, and changes of up to 5 meters (16.4 feet) effected a broader region. Subsidence of up to 2 meters (6.5 feet) was observed in some areas. On March 28, 1964, the magnitude 9.2 Great Alaskan Earthquake effected a vast region immediately to the east of WRST. Uplift of as much as 11.5 meters (37.7 feet) effected an area of 520,000 square kilometers between Kodiak Island and Prince William Sound. A series of destructive tsunamis was generated by this event, causing 110 of the 125 fatalities that resulted from the Great Alaskan Earthquake.**

Following the Sumatra earthquake and tsunami of December 2004, NOAA's National Weather Service (via its tsunami warning centers located in Alaska and Hawaii) and the U.S. Geological Survey (and by extension the AEIC) were tasked with improving tsunami detection and warning systems for coastal areas of the United States, as well as for other coastal nations. Monitoring and detection of tsunamis that can generate earthquakes is necessarily the first link in the chain that leads to the issuing of tsunami warnings. As such, every new seismic monitoring station that is installed in a region where tsunami-genic earthquakes can occur will enhance our nation's ability to issue timely warnings in the event of an emergency. Real-time data from all stations in the AEIC/USGS statewide network of seismometers are made available to the National Weather Service's West Coast/Alaska Tsunami Warning Center (WC/ATWC) in Palmer, Alaska. The stations proposed for installation in WRST under the STEEP project will provide additional seismic data to the WC/ATWC that will improve their ability to detect tsunami-genic earthquakes in south-central Alaska; a region that produced the Great Alaskan Earthquake of 1964 which was the second largest earthquake in history and which generated destructive tsunamis that killed 110 people in Alaska, British Columbia, and California.

The project will affect wilderness character by the establishment of several additional monitoring devices in designated wilderness which are dependent on helicopter use for installation and maintenance. However, the devices have a minimal development footprint, and site maintenance frequency will be once every four years for each seismic station. In addition, when no longer needed, the devices and associated equipment can easily be removed from the park and preserve. Given the expanse of the Wrangell-St. Elias Wilderness relative to the high mountain peaks, scenic landscapes, and regional tectonics, it is not possible to expand the seismic monitoring network without affecting wilderness. In addition, many of the new sites locations are surrounded by extensive glacial features and icefields that make them, for all practical purposes, inaccessible on foot by the casual wilderness recreationist. Given the fundamental role that tectonics and seismic events play in the landscape, associated visitor experience, long-term ecological processes, and the contribution the information can make to public health and safety, the proposed action can, on balance, meet the minimum requirement for administration of the area as wilderness.

This minimum requirement finding is made with the understanding that no other external equipment or other types of transmission equipment will be placed on the sites beyond the devices and equipment described in the environmental assessment without additional environmental review. The installation of the new seismic monitoring stations in Wrangell-St. Elias National Park and Preserve is authorized because of the low profile design, minimal development footprint (0.03 acre per site), and low maintenance requirements.

If action is necessary, proceed to Step 2 to determine the minimum tool for accomplishing the proposed action.

Step 2: Determine the minimum tool.

Description of Alternative Actions

For each alternative, succinctly describe what methods and techniques will be used, when the action will take place, where the action will take place, what mitigation measures are necessary, and then the general effects to elements of wilderness character whether beneficial or adverse. (Develop separate sheets for each reasonable alternative)

Description:
The alternatives are described in the environmental assessment prepared for the project. Applicable mitigation for any of the action alternatives selected would include the following.

Guidelines set forth by the Helicopter Use Policy for WRST will be followed, including that the use of helicopters in the Wrangell-St. Elias Wilderness requires a determination by the project manager that it is the minimum tool necessary to accomplish the task. In planning flight paths, all feasible measures will be undertaken to avoid and/or minimize impacts to backcountry users. Sensitive areas, including high public use areas and high resident use areas, will be avoided by aircraft when feasible. Visitors would be notified of the climate monitoring program operations and made aware that they might encounter park helicopter operations in Helicopter altitude and horizontal distances will be maintained according to the park helicopter use policy.

Visitors would be notified of the expanded seismic monitoring program and made aware that they might encounter monitoring station equipment or helicopter-supported maintenance operations in the backcountry. Use of helicopters during hunting season in areas of known hunting would be avoided.

To the extent possible, installation and maintenance activities would be timed to avoid sensitive periods, such as nesting season. Aircraft would not fly over wildlife. If animals (e.g., Dall sheep or bears) are observed near the proposed sites, flights would be rerouted or rescheduled in order to avoid or minimize disturbance. No helicopter flights will be made over Dall sheep habitat (above the 4000-foot contour north of the Chitina River) from August 5 through September 20.

In addition to meeting all Federal Aviation Administration and NPS helicopter policy and aircraft requirements, mitigation common to all alternatives for helicopter flight paths will include:

- Maintenance of a 1,500 foot vertical or horizontal clearance from traditional summer and calving or other habitats supporting reproduction as well as adult animals whenever feasible. This includes brown and black bear, moose, caribou, Dall sheep, and wolves.
- Pilots shall not hover, circle, harass, or pursue wildlife in any way.
- Where feasible, flight paths will avoid known Dall sheep breeding areas from May 15 through June 15.
- A minimum quarter-mile clearance will be maintained from all active bald eagle nests. All nests are considered active from March 1 to May 31. Nests used for nesting activity are considered active through August 31.
- Flight paths will avoid known wilderness users and areas where users are known to concentrate or visit frequently.
- Pilots will not compromise safety.

The new seismic monitoring sites would be surveyed immediately prior to equipment installation for the presence of rare plant species as designated by the Alaska Natural Heritage Program and cultural resources. All efforts will be taken to mitigate effects on rare plants and cultural resources by impact avoidance. If previously unidentified archaeological features are encountered during equipment installation, work would cease immediately and the park superintendent would be notified to ensure protection of cultural resources.

Step 2 Decision: What is the Minimum Tool to Accomplish Objectives?

The selected alternative is:

Describe the rationale for selecting this alternative:

Describe any specific monitoring and reporting requirements:

Please check any Wilderness Act Section 4(c) uses approved in this alternative:

X☐ mechanical transport

☐ motorized equipment

☐ motor vehicles

☐ motorboats

X☐ landing of aircraft

☐ temporary road

X☐ structure or installation

Be sure to record and report any authorizations of Wilderness Act Section 4(c) uses according to agency procedures.

Approvals	*Signature*	Name	Position	Date
Prepared by:		Steve Hunt	Environmental Officer, WRST	4/5/06
Reviewed:				
Recommended:				
Approved by:				

Appendix E

US Fish and Wildlife Consultation Letter

2006096

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Anchorage Fish & Wildlife Field Office
605 West 4th Avenue, Room G-61
Anchorage, Alaska 99501-2249

in reply refer to
AFWFO

March 10, 2006

Mr. Steve Hunt
Wrangell-St. Elias National Park and Preserve
106.8 Richardson Hwy
P.O. Box 439
Copper Center, AK 99573-0439

Re: Wrangell-St. Elias National Park and Preserve Seismic Monitoring
(*consultation number 2006096*)

Dear Mr. Hunt,

On February 27, 2006, we received your request for information regarding the presence of species protected under the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq., as amended; Act) in the vicinity of a proposed project in Wrangell-St. Elias National Park and Preserve. You propose to permit the installation and operation of 22 new, long-term seismic monitoring stations, and upgrade two existing stations. Helicopters will be used to access the installation sites, which are atop mountain peaks. Some of the sites are on nunataks, which are mountain peaks surrounded by ice (i.e., glaciers). As many as three helicopter visits to each site will be required for installation, and each site will be visited via helicopter one time per year thereafter for maintenance. Three people will camp at each station for 2-3 days during installation. The footprint of each seismic monitoring station is about 120 square feet.

Our records indicate that there are no federally listed or proposed species and/or designated or proposed critical habitat in the vicinity of this proposed project. With that said, as per our discussion on February 27, 2006, Kittlitz's murrelets (*Brachyramphus brevirostris*), a candidate species, may nest in the high elevation talus slopes of the peaks identified as proposed sites for seismic monitoring stations. Although only a few dozen nests have ever been described, Kittlitz's murrelets are thought to nest from the Alaska Peninsula to Glacier Bay, in unvegetated scree-fields, coastal cliffs, barren ground, rock ledges, and talus above timberline in coastal mountains, generally in the vicinity of glaciers, cirques near glaciers, or recently glaciated areas (Day 1995, Day et al. 1983, Day et al. 1999, Piatt et al. 1999). Nests have been found up to 75 km inland (Day and Stickney 1996). As we previously discussed, we are concerned that helicopter and human disturbance may negatively affect the nest success of Kittlitz's murrelets.

Under section 7(a)(4) of the Act, conferences, or informal discussions between the Service and an action agency, provides a mechanism for identifying ways to voluntarily avoid or minimize adverse effects to proposed or candidate species. In our meeting on February 27, 2006, we discussed the potential adverse affects to nesting Kittlitz's murrelets, and potential ways to avoid those adverse affects. Although not required by the Act, we appreciate your agency's proactive consideration of Kittlitz's murrelets, a species that may warrant future protection under the Act.

Given our minimal understanding of Kittlitz's murrelet, in particular their nesting locations, it is difficult to predict the potential effects of helicopter and human disturbance on nesting. Their nests have been extremely difficult to locate, due to the extreme habitats they favor. Rather than attempt a costly survey for nesting Kittlitz's murrelet in your project area, we suggest that avoidance of the potential nesting areas during nesting season is an effective way to reduce or eliminate the possibility of negatively affecting Kittlitz's murrelets that may nest along the mountain-tops proposed in this action.

As a conservation recommendation, we suggest that proposed seismic stations less than or equal to 75 km of the coastline be avoided until August 10, when Kittliz's murrelet young are expected to have fledged from nests (Day 1996). Proposed seismic station installations occurring further than 75 km from the coast are not expected to present any risk of disturbance to nesting Kittlitz's murrelets. Avoiding disturbance during their nesting period may satisfy your agency's consultation requirements under section 7 of the Act if the Kittlitz's murrelet is listed in the future.

We would also like to raise the topic of potential disturbance to other rare and unique biota that may be found in these untrammeled habitats that are proposed for seismic monitoring. As I'm sure you and your staff are well aware, similar habitat has been found to be a refugium for a number of plant species that have never before been documented in Alaska (Cook and Roland 2002). As such, we strongly recommend that a National Park Service or other highly qualified botanist be present at each proposed seismic monitoring site to inventory for rare plants and insects, and to prevent harm to potentially unique or at risk species.

This letter relates only to federally listed or proposed species and/or designated or proposed critical habitat under our jurisdiction. It does not address species under the jurisdiction of National Marine Fisheries Service, or other legislation or responsibilities under the Fish and Wildlife Coordination Act, Clean Water Act, National Environmental Policy Act, Migratory Bird Treaty Act, or Bald and Golden Eagle Protection Act.

This concludes the section 7 consultation on the Wrangell-St. Elias NPP Seismic Monitoring Project. Thank you for your cooperation in meeting our joint responsibilities under section 7 of the Act. If you have any questions, please feel free to contact me at (907) 271-1467. In future correspondences regarding this project please refer to consultation number 2006096.

Sincerely,

Ellen W. Lance
Endangered Species Biologist

Literature Cited:

Cook MB, Roland CA. 2002. Notable vascular plants from Alaska in Wrangell-St. Elias National Park and Preserve with comments on the floristics. The Canadian Field-Naturalist 116(2): 192-304.

Day RH. 1995. New information on Kittlitz's Murrelet nests. Condor 97: 271–273.

Day RH. 1996. Nesting phenology of Kittlitz's Murrelet. Condor 98: 433–437.

Day RH, Oakley KL, Barnard DR. 1983. Nest sites and eggs of Kittlitz's and Marbled Murrelets. Condor 85: 265–273.

Day RH, Kuletz KJ, Nigro DA. 1999. Kittlitz's Murrelet (*Brachyramphus brevirostris*). *In* The Birds of North America, No. 435 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Day RH, StickneyAA. 1996. Kittlitz's Murrelet surveys at Remote Air Force sites in Alaska, 1995. Unpubl. Final Rep. prepared for U.S. Air Force, Elmendorf AFB, AK, by ABR, Inc., Fairbanks, AK.

Piatt JF, Naslund NL, van Pelt TI. 1999. Discovery of a new Kittlitz's Murrelet nest: clues to habitat selection and nest-site fidelity. Northwestern Naturalist. 80: 8–13.

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