National Park Service
U.S. Department of the Interior

Wrangell-St. Elias National Park and Preserve
Alaska

# Climate Monitoring Program Expansion
## *Environmental Assessment*
## *May 2005*

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**National Park Service**
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**Wrangell-St. Elias National Park and Preserve**
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**Note to Reviewers**

If you wish to comment on this document, you may mail comments to:

Steve Hunt
Environmental Protection Specialist
Wrangell-St. Elias National Park and Preserve
P.O. Box 439
Copper Center, AK 99573

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## ACRONYMS AND ABBREVIATIONS

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|---|---|
| ANILCA | Alaska National Interest Lands Conservation Act |
| BMPs | Best Management Practices |
| CAA | Clean Air Act |
| CAKN | Central Alaska Network |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CMP | Climate Monitoring Plan |
| CMSE | Climate Monitoring Site Evaluation |
| CWA | Clean Water Act |
| DEC | Alaska Department of Environmental Conservation |
| DO | NPS Director's Order |
| EA | Environmental Assessment |
| GMP | General Management Plan |
| GOES | Geostationary Operational Earth Satellite |
| Hypalon® | chlorosulfonated polyethylene |
| I&MP | Inventory and Monitoring Program |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NOI | Notice of Intent |
| NPS | National Park Service |
| NRCS | USDA Natural Resources Conservation Service |
| PVC | Polyvinyl Chloride |
| RAWS | Remote Automated Weather Station |
| RV | Recreational Vehicle |
| SCP | Scenic Corridor Plan |
| SNOTEL | Snowpack Telemetry (network maintained by NRCS) |
| SWE | Snow-water Equivalent |
| USACE | United States Army Corps of Engineers |
| USDA | U.S. Department of Agriculture |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |
| USGS | United States Geological Survey |
| 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 expansion of the remote automated weather station (RAWS) network at Wrangell-St. Elias National Park and Preserve (WRST). The proposed action would implement a long-term plan for climate monitoring and analysis at WRST; the expanded RAWS program would establish additional stations to collect basic climatological data including air temperature, precipitation, relative humidity, wind speed and direction, solar radiation, and snow depth. Because climate is a basic driver of ecological systems, weather measurements are important for understanding the relationship between climate and components of biotic and abiotic systems. Without climate data, it is difficult to understand and appreciate the causes of a variety of ecosystem changes.

New RAWS would be established at as many as 10 locations in WRST. Permanent RAWS would be installed and maintained at four candidate sites along a 200-mile north-south corridor transecting the major ecoregions of WRST (Figure 1-1). Mobile RAWS would be installed and maintained at up to 6 locations in WRST outside of the north-south transect. These unmanned stations, consisting of a battery-powered weather instrumentation unit and separate snowfall measuring unit, would become part of the Central Alaska Network climate monitoring system providing baseline weather information and supporting climate trend analysis.

## 1.2 NEED FOR ACTION

The Inventory and Monitoring Program is the result of the National Parks Omnibus Management Act of 1998, which directs the National Park Service "to establish baseline [resource] information and to provide information on the long-term trends in the condition of National Park System resources." To accomplish this task, the NPS has grouped parks into 32 networks characterized by their ecological similarities. One of the four networks located in Alaska, Wrangell-St. Elias National Park and Preserve, Denali National Park and Preserve, and Yukon-Charley Rivers National Preserve have been organized into the Central Alaska Network (CAKN).

The three park units of the Central Alaska Network together encompass about 22 million acres; elevations range from sea level to 20,320 feet, and latitudes reach to more than 65 degrees north. The park units contain 12 of the 32 unified ecoregions of Alaska, and include the highest mountain ranges and some of the largest rivers in North America (Figure 1-1). Climate in this vast area is extremely variable, ranging from strongly maritime to strongly continental, with large differences in temperature and precipitation.

The monitoring program has the opportunity to advance understanding of the ecosystems that encompass the network of parks. This understanding will come in the form of the monitoring data that are collected, analyzed, interpreted, and reported. Further, the NPS recognizes that while scientific work has been conducted in each of the network parks, this information needs to be incorporated with NPS monitoring efforts to improve its understanding of the holistic

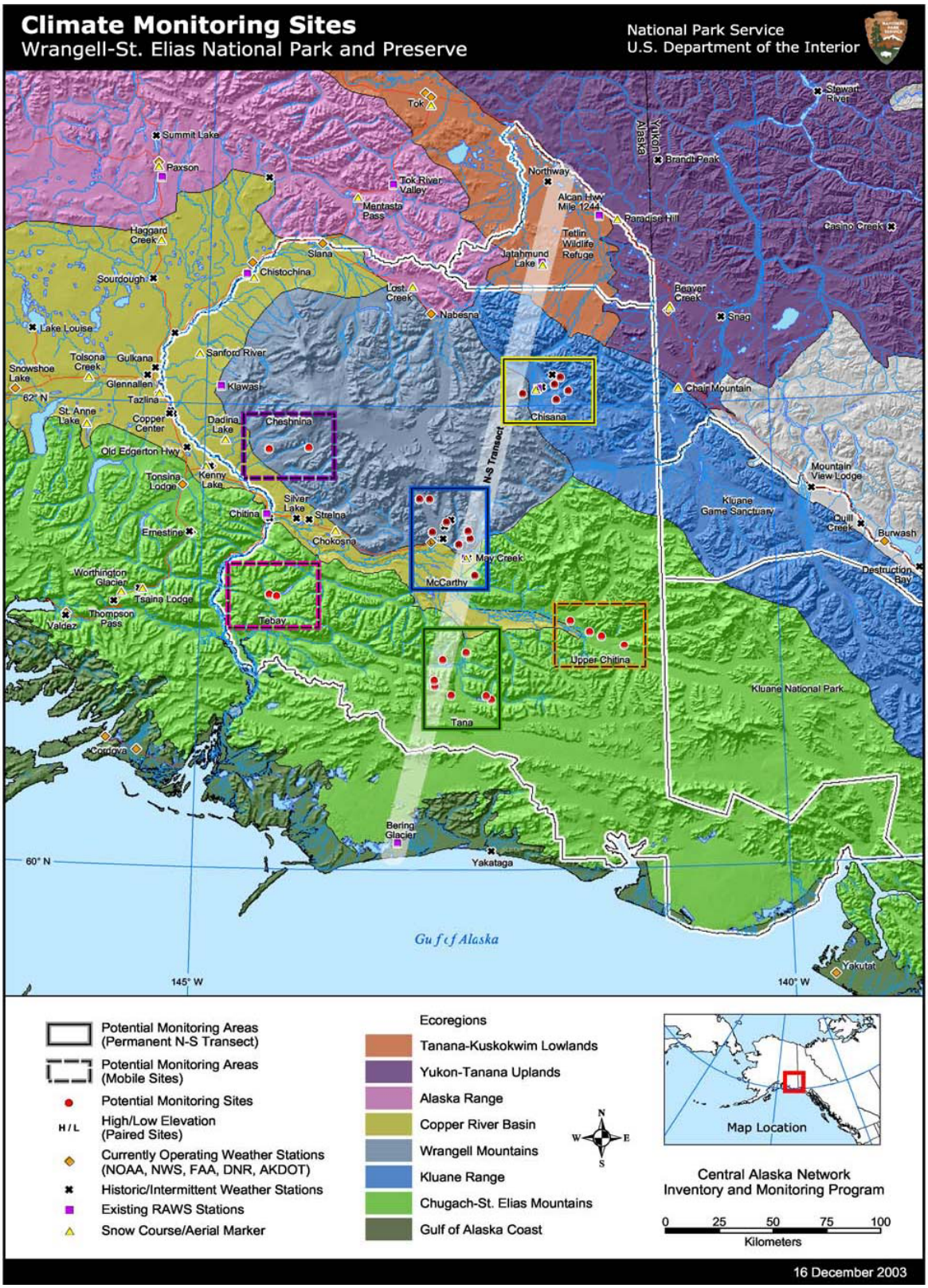


**Figure 1-1 Location of existing and potential climate monitoring sites in relation to Alaska Ecoregions, Wrangell-St. Elias National Park and Preserve**

functioning of ecosystems within the network. An understanding of our ecosystem function is important because it will best allow NPS to fulfill the legislative mandate to manage parks in a manner that leaves them "unimpaired for the enjoyment of future generations". At the most basic level, the NPS cannot evaluate appropriate ecosystem function when bounds of natural variability are not known because it is not possible to identify when conditions are outside an expected range of variation. Similarly, in this situation, reliable identification of resource trends is also difficult (MacCluskie and Oakley, 2002).

In early 2004, the technical committee for the CAKN identified the top ten prioritized vital signs for the network based on a holistic conceptual model which depicts significant ecosystem components and their relationships, and the dynamic interactions they have with one another (MacCluskie and Oakley, 2003). Climate and snowpack ranked within the top five components. The physical characteristics of a region provide a foundation that defines the fundamental parameters of that ecosystem. Changes in the physical environment, caused either by climate change or normal physical processes, can have significant impacts on the entire ecosystem. In order to properly monitor an ecosystem, the changes in the physical environment must be properly monitored and documented.

One objective of the CAKN program is to monitor and record weather conditions at representative locations in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in larger scale climate monitoring and modeling efforts. In an attempt to better understand climate variation as well as possible long-term changes in ecosystems of the Central Alaska Network, new long-term climate monitoring stations are proposed for installation throughout the three parks in the coming years.

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*).

## 1.3 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 (9.6 million acres) 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 general purposes of the conservation system units established under ANILCA, defined in sections 101 (a), (b), and (c), are as follows:

- 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.

- 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.

- 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(a) 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 following laws and associated regulations provided guidance for the development of this EA, design of the Preferred Alternative and alternatives, analysis of impacts, and creation of mitigation measures to be implemented as part of the preferred alternative.

The NPS Organic Act and the General Authorities Act 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 the importance of and need for weather and climate monitoring efforts in a number of sections.

-Section 4.7.2 *Weather and Climate* "parks containing significant natural resources will gather and maintain baseline climatological data for perpetual reference".

-Section 4.2.1 *NPS-conducted or sponsored Inventory, Monitoring, and Research Studies* Entire 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."

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 systems."…" 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.

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.

Certain provisions of Title XIII of ANILCA govern navigation aids and other facilities within conservation system units established or expanded by this act. Specifically, section 1310(a) addresses existing facilities. This provision permits reasonable access to, operation, and maintenance of existing facilities including facilities for weather and climate research in accordance to the laws and regulations applicable to conservation system units including units of the national park system. Section 1310(a) also states that "Nothing in the Wilderness Act shall be deemed to prohibit such access, operation, and maintenance within wilderness areas designated by ANILCA. In regard to new facilities for weather and climate research, section 1310(b) stipulates that such facilities are permitted; but only after consultation between the NPS and the Secretary of the Interior. Furthermore, the establishment, operation, and maintenance of new weather and climate research facilities must proceed according to the terms and conditions that may be mutually agreed to by the NPS and the Secretary of the Interior to minimize the adverse effects of such activities in the conservation system unit. Issues related to wilderness values relevant to the weather stations include soundscape, viewshed, and visitor experience.

The 2005 NPS Helicopter Use Policy for Wrangell-St.Elias National Park and Preserve (see appendix) 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.

## 1.5 PREVIOUS PLANNING FOR THE CLIMATE MONITORING PROGRAM

### Existing Climate Monitoring Sites

A network of climate monitoring sites currently exists in and around all three CAKN parks. Most sites are located at relatively low elevations in settlements surrounding the parks, and records are commonly short-term or sporadic. There are long-term National Weather Service cooperative observer weather stations in or near each of the three parks with records of daily minimum and maximum temperatures, total precipitation, and snowfall. RAWS sites were added in the 1990s as part of the fire monitoring network. Records for these stations were initially gathered during the summer fire months only, although attempts are now being made to keep them operating year-round.

### Potential New Sites

To fill some of the gaps in the existing climate monitoring network and increase NPS knowledge of climate variability across the three CAKN parks, a number of potential new sites were identified and evaluated during the summer of 2003 and documented in the Climate Monitoring

Site Evaluation (NPS, 2004). The main criteria used in locating sites were: 1) to get the best possible coverage across each park, 2) to sample different ecoregions within each park, and 3) to get a good elevational gradient between sites.

Additionally considered was the issue of access: a site must not be too difficult and/or costly to access for routine maintenance over the next many decades. Criteria used in locating sites varied by park. Each park had to be evaluated differently due to their many differences, including, for example, wilderness and historic district designations, helicopter compliance regulations, and variations in landscapes and ecoregions.

## 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

**Wilderness Values**
None of the existing RAWS are in designated wilderness; new RAWS are proposed for both designated wilderness and non-wilderness. Installation, operation, and maintenance of RAWS in designated wilderness may affect solitude and naturalness. Noise intrusions would occur during installation and maintenance of the weather stations due to presence of field crews and the aircraft used for RAWS site access; these noise intrusions would detract from the wilderness solitude. The presence and visibility of long-term monitoring equipment in designated wilderness would detract from naturalness.

**Visitor Experience**
Encountering a RAWS in WRST could have a detrimental effect on the visitor's recreational experience. None of the existing or new proposed RAWS are in locations directly accessible by road vehicles on Nabesna Road or McCarthy Road; or easily visible from popular frontcountry visitor destinations such as McCarthy or Kennecott. Over 70 percent of WRST is designated wilderness; including the lands suitable for wilderness designation, about 90 percent of WRST is managed as wilderness according to NPS policy. Therefore, the issue regarding the impacts of RAWS on the visitor experience park-wide is an impact topic presented in association with wilderness values.

**Wildlife**
Installation and maintenance of the weather stations could temporarily displace wildlife in the immediate vicinity. The RAWS footprint would have a long-term impact on small areas of wildlife habitat.

**Vegetation**
Vegetation could be trampled during installation and maintenance of the weather stations. Small areas of vegetation may require clearing beneath and around new RAWS. The RAWS footprint would have a long-term impact on vegetation.

**Soils**
Soil compaction from foot traffic may occur during weather station installation and maintenance. Soils may be minimally disturbed by anchoring of the weather towers.

**Cultural Resources**
A few of the proposed weather station sites are located in historic areas. There is some potential that cultural resources may be disturbed during installation of the RAWS stations.

**Park Management**
Collection of climate data has implications for the future management direction of the park. Availability of reliable data has implications on the ability of the NPS and park management to understand park ecosystems and manage natural resources.

### 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**
The majority of proposed sites are not located in or adjacent to a floodplain or riparian area**.** The few sites that are located in floodplains may get flooded but would not alter floodplain processes in any way.

**Safety**
NPS would follow all appropriate Occupational Health and Safety (OSHA) guidelines.

**Socioeconomics**
Station installation and maintenance would be performed by NPS personnel. No net impact on the local economy is expected because additional personnel from the local community would not be performing RAWS 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 A.

**Threatened and Endangered Species**
There are no known state or federally listed threatened, endangered or candidate species at or near the proposed sites.

**Water Resources**
The majority of proposed weather station sites would not be located in or adjacent to any surface or groundwater. There would not be any effects on water resources at the sites that are located near surface water.

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

## 1.7 PERMITS AND APPROVALS NEEDED TO IMPLEMENT PROJECT

*Wilderness:* a minimum requirement/minimum tool analysis will be conducted for any new RAWS located in the Wrangell-St. Elias Wilderness prior to installation, operation, and maintenance.

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

*Aircraft Use:* Full compliance with the WRST Helicopter Policy (Appendix C) is required for the installation and maintenance of any RAWS site requiring helicopter support regardless of whether the site is in the WRST Wilderness.

# 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.

A description of the climate monitoring equipment applicable to the alternatives considered in this EA is provided in Appendix B. The equipment types are precipitation towers, tri-leg towers, and devices for snowfall measurement such as snow courses and aerial snow markers.

Each of the alternatives analyzed in this environmental assessment vary in their ability to fulfill the mandate of the NPS Inventory and Monitoring Program, and these differences are presented in the environmental consequences section. The inventory and monitoring program mandate seeks to augment understanding of park ecosystems and facilitate management of park natural resources. As indicated in the purpose and need for action section of this environmental assessment, certain provisions of ANILCA Title XIII allow for access, operation, and maintenance of existing and new weather and climate research facilities in WRST and other conservation system units.

## 2.1 ALTERNATIVE A: NO ACTION

Under the No Action Alternative, no additional RAWS (remote automated weather stations) would be established in WRST. The NPS would continue to collect basic climatological data using the existing network of RAWS, including the snow courses and aerial markers that are currently operating and monitoring weather and climate conditions at WRST.

In the long-term, each of the existing RAWS stations would be visited for maintenance 1-2 times a year during the summer field season. The May Creek and Chisana Town Site RAWS can be serviced with fixed wing aircraft, and the other existing RAWS would require use of a helicopter. As many as 4 fixed wing and 6 helicopter round-trips would be required annually for maintenance of the 5 existing RAWS, and about 3 RAWS can be maintained in one day.

The long-term climate monitoring plan under Alternative A (Fig 2-1) would include:

<u>Continue operating and maintaining the 5 existing RAWS located at:</u>

- May Creek in the McCarthy Area (including snow course and aerial marker)
- Chisana Town Site in the Chisana Area (including snow course and aerial marker)
- Klawasi southwest of Mount Drum
- Chititu in the McCarthy Area
- Chicken Airstrip in the Chisana Area

NPS may upgrade these stations with replacement or additional equipment as needed.


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

There are snow courses or aerial markers only at the following sites, and all would remain in operation with the No Action Alternative.

- Lost Creek in the Nabesna Area
- Chokosna in the Lower Chitina Valley area
- Tebay Cabin aerial marker in the Tebay Lakes area
- Long Glacier aerial marker in the Cheshnina area

## 2.2 ALTERNATIVE B: EXPAND PARK CLIMATE MONITORING PROGRAM (NPS PREFERRED ALTERNATIVE)

Under Alternative B, the NPS would implement a long-term climate monitoring plan at WRST that would include:

- Maintaining existing RAWS, snow courses, and aerial markers
- Installing and maintaining 4 new permanent RAWS along the north-south transect
- Installing and maintaining up to 6 mobile RAWS to test the variation that occurs off the monitoring transect and in microclimates.
- Additional snowfall measurement equipment

Seven new RAWS would be established in designated wilderness (Wrangell-St. Elias Wilderness).

Descriptions of RAWS monitoring equipment (tri-leg tower and precipitation tower) and snowfall measurement equipment are provided in the appendix of this EA.

### 2.2.1 Long-Term Climate Monitoring Program

Specifically, with Alternative B, the NPS would fully implement its long-term plan for climate monitoring at WRST. As many as ten new RAWS stations (4 permanent, 6 mobile) would be established. RAWS station installation would start in summer 2005; installation of all new RAWS proposed under this alternative may require 3 or more field seasons. About 2 new RAWS can be established in one day. The field crew would consist of two people plus a helicopter pilot.

Each of the existing RAWS stations would be visited for maintenance 1-2 times a year during the summer field season. The May Creek and Chisana Town Site RAWS can be serviced with fixed wing aircraft, and the other existing RAWS would require use of a helicopter. As many as 4 fixed wing and 6 helicopter round-trips would be required annually for maintenance of 10 RAWS, and about 3 RAWS can be maintained in one day.

Each of the existing and new RAWS stations would be visited for maintenance 1-2 times a year during the summer field season. The May Creek, Chisana Town Site, and Notch Airstrip RAWS can be serviced with fixed wing aircraft; helicopters would be required to service the other RAWS. In the long-term, as many as 6 fixed wing and 14 helicopter round-trips would be required annually for RAWS maintenance. Also, initial installation of new RAWS and relocation of one existing RAWS would require as many as 12 helicopter round-trips spread over 3-4 field seasons.

The long-term climate monitoring plan under Alternative B (Fig. 2-2) would include:

Operating and maintaining existing RAWS at the following sites

- Chicken Airstrip in the Chisana Area (including snow course and aerial marker)
- May Creek in the McCarthy Area
- Klawasi southwest of Mount Drum
- Chisana Town Site in the Chisana Area (including snow course and aerial marker)

The existing RAWS at Chititu would be relocated to establish a new RAWS at Gates Glacier in the McCarthy Area.

Maintaining existing snow courses and aerial markers at the following sites

- Lost Creek in the Nabesna Area
- Chokosna in the Lower Chitina Valley area
- Tebay Cabin aerial marker in the Tebay study area
- Long Glacier aerial marker in the Cheshnina study area

Installing and maintaining in the short-term 2 new permanent RAWS at the following sites

- Gates Glacier in the McCarthy Area (relocation of existing RAWS at Chititu)
- West Fork Knob in the Tana River Area,

Installing and maintaining in the long-term 2 additional new permanent RAWS at nunatak sites in the Tana and McCarthy study areas:

- Chugach Mountain Range
- Wrangell Mountain Range

Installing and maintaining in the short-term 2-3 and potentially up to 6 mobile RAWS stations in the long-term, at following sites

- Tebay Cabin in the Tebay area
- Long Glacier in the Cheshnina area
- Notch Airstrip in the Upper Chitina area
- Jaeger Mesa in the Nabesna River Drainage
- West end of Copper Lake
- Ptarmigan Lake in the White River drainage

Installing and maintaining aerial snow marker, snow course and/or summer precipitation gage at the Jumbo Basin and the Tana River Airstrip sites.

Installing and maintaining Natural Resources Conservation Service (NRCS) snow pillows at the following non-wilderness sites in the future

- May Creek in the McCarthy Area,
- Chisana Town Site in the Chisana Area,

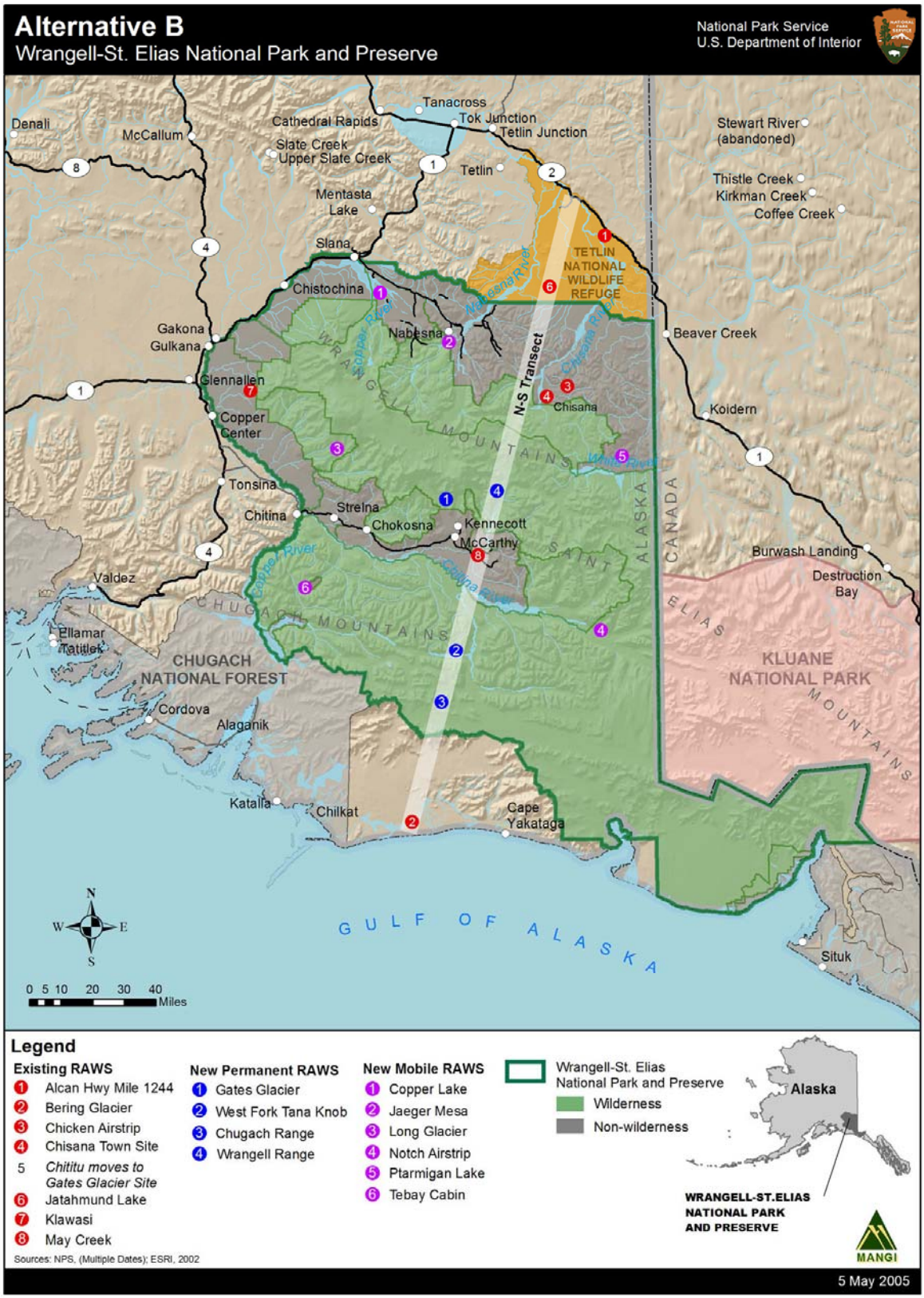


**Figure 2-2 Alternative B: Expand Park Climate Monitoring Program (NPS Preferred Alternative).**

### 2.2.2 Rationale for Site Selection

The locations of the aforementioned weather and climate monitoring sites are among the sites previously evaluated in the field by the NPS. These specific sites have been selected because they are the most representative of each WRST ecoregion along an approximate 200-mile north-south transect from the coastal area to the Tanana-Kuskowim Lowlands. Table 2-1 lists the name, area, site type, elevation, geographic coordinates, ecoregion, and likely means of access of each the potential weather station sites identified by the NPS. (See Chapter 4, Table 4-1 for additional site characteristics.)

WRST contains both coastal and interior climatic regimes as well a transition zone. Two high elevation mountain ranges disrupt movement of weather systems resulting in numerous localized climatic conditions. Because of the immensity of WRST, and the extensive amount of high elevation terrain and large number of climatic regimes, a model to characterize the climate of the area will be based upon a transect of sites perpendicular to the coast. This transect will contain south and north facing mountain range aspects, sites at high and low elevation, sites in both the coastal and interior regimes, as well as sites within the transition zone This transect will by necessity incorporate RAWS that exist outside the park boundary.

Extensive use was made of available information on different climatic regimes and representative areas in locating potential sites within the park. Sites were located along a general north-south transect through the park, utilizing several existing stations along this transect (Chisana, McCarthy, and May Creek). The NPS climate monitoring site evaluation study conducted previously for the parks of the Central Alaska Network identifies potential monitoring areas for permanent and mobile RAWS stations. The potential monitoring areas, or study areas, for the permanent RAWS stations are situated along the north-south transect and are the Chisana, McCarthy, and Tana study areas.

Study areas for the mobile RAWS stations are the Upper Chitina, Tebay, and Cheshnina study areas. The study areas for the mobile RAWS stations are not along the transect but represent different ecoregions and climatic regimes, or enhance the spatial extent of the monitoring network. Each study area contains more than one candidate site for a permanent or mobile RAWS station. The best candidate sites for new RAWS stations are identified in the two action alternatives, and analyzed in this EA.

**Permanent RAWS Stations.** These existing stations are at relatively low elevations, so sites for proposed new stations were located mostly in higher areas in order to get an elevational as well as latitudinal gradient between sites.

**Mobile RAWS Stations.** The monitoring transect is driven by ecoregions, climate, and elevation. The monitoring transect is assumed to be representative of the park's aspect, relief, and rain shadow. Mobile sites are intended

**Accommodating Changing Station Requirements.** NPS may install a station at a preferred site but determine later that it is not operating properly or is incapacitated by conditions. Therefore, the EA analyzes the impacts of installation and maintenance at all potential sites

**Table 2-1 Potential weather station sites identified for WRST.**

| Site | Area | Site Type | Elev (ft) | Latitude (NAD27) | Longitude (NAD27) | Ecoregion | Subsection | Access* |
|---|---|---|---|---|---|---|---|---|
| **Gates Peninsula** | McCarthy | high elevation | 4060 | 61° 36' 10.41" | 143° 00' 47.54" | Wrangell Mtns | McCarthy Mtns | H |
| **Kennicott Glacier** | McCarthy | high elevation | 3900 | 61° 36' 15.57" | 143° 05' 59.34" | Wrangell Mtns | McCarthy Mtns | F/H |
| **Jumbo** | McCarthy | high elevation | 3700 | 61° 30' 20.36" | 142° 51' 50.38" | Wrangell Mtns | McCarthy Mtns | Trail |
| **Fireweed** | McCarthy | high elevation | 3770 | 61° 27' 40.06" | 142° 59' 10.30" | Wrangell Mtns | McCarthy Mtns | H |
| **Nikolai Mine** | McCarthy | high elevation | 4700 | 61° 27' 58.85" | 142° 40' 33.26" | Wrangell Mtns | McCarthy Mtns | H |
| **Nikolai Pass** | McCarthy | high elevation | 4400 | 61° 25' 58.88" | 142° 39' 34.24" | Wrangell Mtns | McCarthy Mtns | F/H |
| **Sourdough Ridge** | McCarthy | high elevation | 4160 | 61° 24' 29.07" | 142° 45' 26.20" | Wrangell Mtns | McCarthy Mtns | H |
| **Chititu** | McCarthy | high elevation | 4600 | 61° 16' 26.44" | 142° 37' 08.71" | Chugach-St. Elias Mtns | W St. Elias Foothills | H |
| **Iceberg Lake** | Tana River | mod elevation | 3300 | 60° 47' 44.55" | 142° 58' 05.74" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | F/H |
| **Iceberg Bench** | Tana River | high elevation | 3990 | 60° 49' 08.53" | 142° 58' 17.17" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | H/F |
| **Tana Glacier Seismic** | Tana River | high elevation | 4150 | 60° 45' 17.68" | 142° 49' 43.18" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | H© |
| **Ross Green Bench** | Tana River | mod elevation | 2520 | 60° 44' 08.47" | 142° 29' 03.23" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | H/F |
| **Twelvemile Ck** | Tana River | mod elevation | 3080 | 60° 45' 05.95" | 142° 31' 40.96" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | H/F |
| **West Fork Tana** | Tana River | mod elevation | 3450 | 60° 54' 29.79" | 142° 53' 58.61" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | H |
| **Tana River** | Tana River | low elevation | 1440 | 60° 56' 22.18" | 142° 41' 51.68" | Chugach-St. Elias Mtns | Tana Valley | F |
| **Euchre** | Chisana | high elevation | 6860 | 62° 03' 19.89" | 142° 11' 04.36" | Kluane Ranges | S Nutzotin Hills & Mtns | H©/S |
| **Chicken Airstrip** | Chisana | high elevation | 5260 | 62° 07' 27.64" | 141° 50' 42.76" | Kluane Ranges | S Nutzotin Hills & Mtns | F/H/S |
| **Gold Hill** | Chisana | high elevation | 5930 | 62° 05' 36.45" | 141° 54' 00.48" | Kluane Ranges | S Nutzotin Hills & Mtns | H/F/S |
| **California Creek** | Chisana | high elevation | 5480 | 62° 03' 55.23" | 141° 46' 42.63" | Kluane Ranges | S Nutzotin Hills & Mtns | H/F/S |
| **Beaver Lake** | Chisana | high elevation | 5450 | 62° 01' 38.20" | 141° 53' 04.86" | Kluane Ranges | S Nutzotin Hills & Mtns | H/F/S |
| **Chitina Glacier Seismic** | Upper Chitina | mobile | 4950 | 60° 57' 54.69" | 141° 20' 16.28" | Chugach-St. Elias Mtns | University-Centennial Mtns | H© |
| **Notch Airstrip** | Upper Chitina | mobile | 2600 | 61° 00' 22.41" | 141° 31' 55.89" | Chugach-St. Elias Mtns | Chitina & Logan Glaciers | F |
| **Huberts** | Upper Chitina | mobile | 2200 | 61° 01' 36.96" | 141° 38' 05.16" | Copper River Basin | Chitina Valley | F/H |
| **Barnard Glacier** | Upper Chitina | mobile | 1900 | 61° 04' 31.91" | 141° 47' 56.80" | Chugach-St. Elias Mtns | Chitina Moraines | H/F |
| **Tebay** | Tebay Lakes | mobile | 2000 | 61° 11' 17.33" | 144° 24' 01.34" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | F/H |
| **Tebay Cabin** | Tebay Lakes | mobile | 1880 | 61° 10' 54.12" | 144° 20' 15.95" | Chugach-St. Elias Mtns | N Chugach Cirque-Glacier | H/F |
| **Cheshnina** | Cheshnina | mobile | 4940 | 61° 48' 46.41" | 144° 25' 46.39" | Wrangell Mtns | Cheshnina Plateaus & Valleys | H |
| **Long Glacier** | Cheshnina | mobile | 4820 | 61° 49' 19.84" | 144° 04' 40.59" | Wrangell Mtns | Cheshnina Plateaus & Valleys | H/F |

* Access: (H) helicopter; (F) fixed-wing aircraft; (S) snowmachine/ATV; (H©) helicopter, co-located with seismic station or radio repeater, listed in order of most likely type of access

Source: Climate Monitoring Site Evaluation report. (NPS, 2004.)

and identifies alternative locations where the original stations would be reestablished should the preferred installation fail. The NPS may convert one or more of the mobile sites to permanent sites at a later date. The NPS intends to permanently install and maintain an aerial snow marker and/or snow course to gather precipitation data at the preferred mobile station sites in each mobile station area.

**High-Elevation Sites.** The NPS has a need to establish two permanent high-mountain elevation or nunatak sites, one each in the McCarthy Area and Tana River area. The locations of these sites can only be described in general terms because of the exposure and environmental conditions these sites are exposed to during the winter; most likely, they will be situated on nunataks in the Wrangell and Chugach mountain ranges. One high-elevation site has already been established at Kenai Fjords National Park, and WRST staff will take the performance and effectiveness of this site in consideration in the location of such monitoring sites at WRST.

## 2.3 ALTERNATIVE C: LIMITED EXPANSION OF PARK CLIMATE MONITORING PROGRAM

With Alternative C, the NPS the National Park Service would continue to monitor weather and assess climate change using the existing network of RAWS stations including the snow courses and aerial markers that are currently operating and monitoring weather and climatic conditions at WRST. One new permanent and 4 new mobile RAWS would be established. RAWS station installation would start in summer 2005; installation of all new RAWS proposed under this alternative may require 2-3 field seasons. About 2 new RAWS can be established in one day. The field crew would consist of two people plus a helicopter pilot.

No new RAWS would be located in designated wilderness (Wrangell-St. Elias Wilderness).

Each of the existing and new RAWS stations would be visited for maintenance 1-2 times a year during the summer field season. The May Creek and Chisana Town Site RAWS can be serviced with fixed wing aircraft; helicopters would be required to service the other RAWS. In the long-term, as many as 4 fixed wing and 16 helicopter round-trips would be required annually for maintenance of RAWS, and about 3 RAWS can be maintained in one day. Also, initial installation of one new RAWS would require 2 helicopter round-trips.

The long-term climate monitoring plan under Alternative C (Fig. 2-3) would include:

<u>Operate and maintain the 5 existing RAWS located at:</u>

- May Creek in the McCarthy Area (including snow course and aerial marker)
- Chisana Town Site in the Chisana Area (including snow course and aerial marker)
- Klawasi southwest of Mount Drum
- Chititu in the McCarthy Area
- Chicken Airstrip in the Chisana Area

NPS may upgrade these stations with replacement or additional equipment as needed.

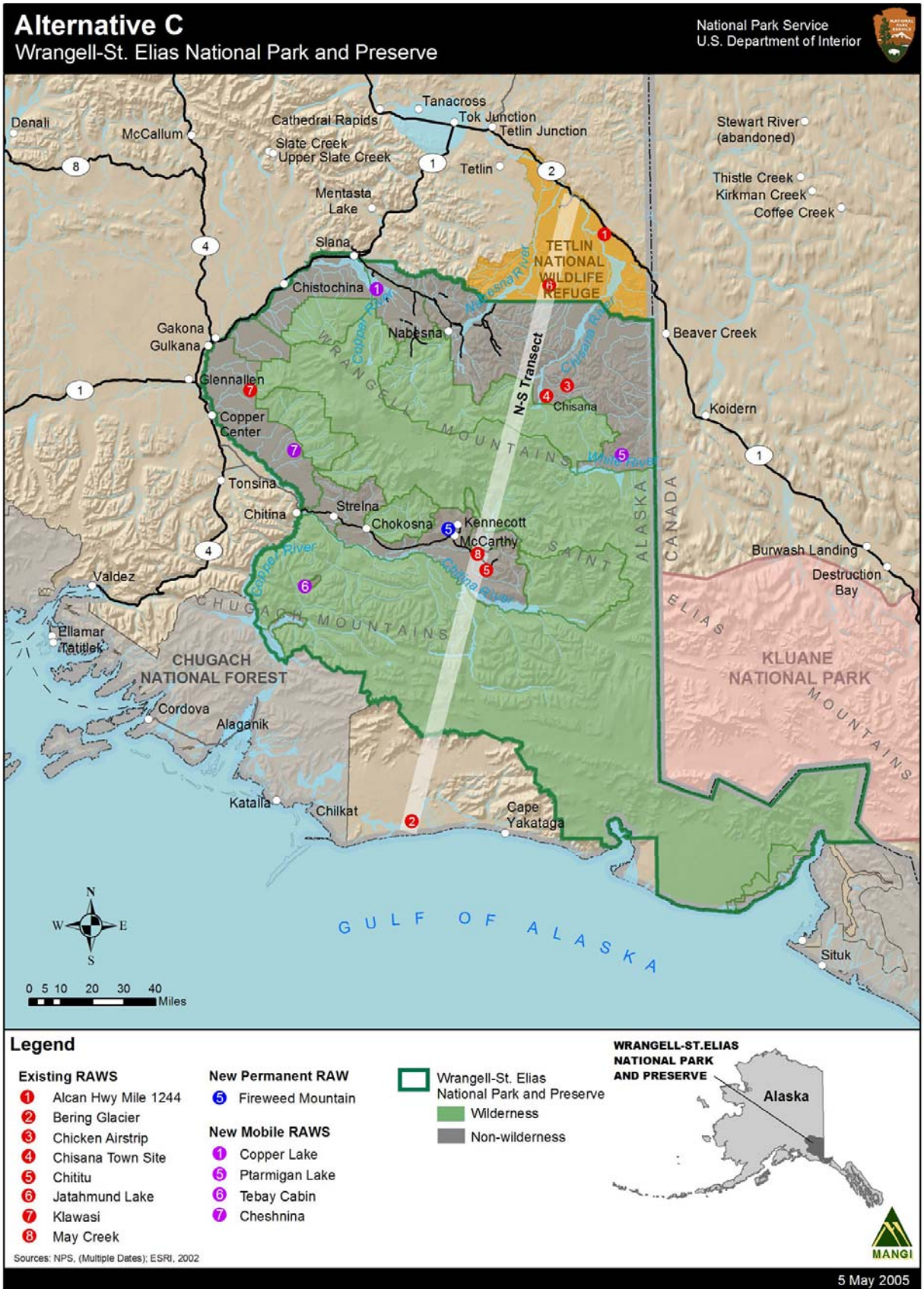


**Figure 2-3. Alternative C: Limited Expansion of Climate Monitoring Program**

There or snow courses or aerial markers at the following sites and all would remain in operation under Alternative C:

- Lost Creek in the Nabesna Area
- Chokosna in the Lower Chitina Valley area
- Tebay Cabin aerial marker in the Tebay Lakes area
- Long Glacier aerial marker in the Cheshnina area

Install and maintain one new permanent RAWS at Fireweed Mountain in the McCarthy Area

Install and maintain as many as 4 mobile stations would be established at

- Tebay Cabin in the Tebay study area
- Cheshnina in the Cheshnina study area
- West end of Copper Lake
- Ptarmigan Lake in the White River Area

## 2.4 MITIGATION MEASURES

### 2.4.1 Wilderness Values

**Solitude and Naturalness**
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.

Fixed wing aircraft would be used instead of helicopter to access the RAWS for maintenance at May Creek, Chisana Town Site, and in most instances, Notch Airstrip.

The NPS Inventory and Monitoring Program has taken special consideration to minimize impacts on wilderness values by making the stations as compact as possible. RAWS have a small footprint, low-impact anchoring systems, and are powered year-round with solar panels. They are also equipped with a sealed lead-acid battery enclosed within an insulated cargo container. Where possible, the antenna/tower would be installed in such a way so as not to protrude beyond the silhouette/horizon of the nunatak or ridge. Antenna and towers would be painted with appropriate colors to blend in with each environment.

**Visitor Experience**
Visitors would be notified of the climate monitoring program and made aware that they might encounter monitoring station equipment or helicopter-supported maintenance operations in the backcountry. Signs would be posted on the weather 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. When potential conflicts may occur, notification would precede maintenance operations.

### 2.4.2 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 weather station 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. Maintenance visits requiring aircraft may also be scheduled during winter months when wildlife would be less likely to be present.

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 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.

### 2.4.3 Vegetation

The climate monitoring sites would be surveyed prior to equipment installation for the presence of rare plant species as designated by the Alaska Natural Heritage Program. Where practicable, all efforts will be taken to mitigate effects on rare plants by impact avoidance.

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 will be minimized. If rocks need to be moved or used to fill gabions, the surface rocks with lichen on them will be carefully set aside and rocks from underneath will be used. Rocks with lichens on them will be left lichen-side up and in their original location when possible. Where other plants are present, care will be taken to minimize disturbance (e.g., stepping on rocks where possible rather than on plants and clearing the minimal amount of vegetation necessary).

### 2.4.4 Soils

The weather 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. Soil

compaction would be minimized by walking and setting down supplies on rock rather than on plants and soils.

Measures would be taken to prevent or control accidental spills of oils, lubricants, and other chemicals from contaminating soils. An emergency spill kit, containing absorption pads, absorbent material, shovel or rake, and other cleanup items, would be readily available on-site in the event of an accidental spill.

On sites with developed soils, construction would not be conducted when soils are saturated, such as during or immediately following rain events.

### 2.4.5 Cultural Resources

Site surveys have indicated no artifacts or other cultural features are present in or near the proposed locations of any of the preferred or other potential climate monitoring sites. 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.

Culturally important viewsheds would be protected to the extent feasible. By positioning the equipment out of line of sight of visitors, NPS would ensure that equipment proposed for installation or for upgrades at sites within the Chisana and Kennicott Historic District would not adversely affect the cultural landscape at these districts.

### 2.4.6 Park Management

No mitigation needed for preferred alternative.

## 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 B (Preferred

**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)

Alternative) is the environmentally preferred alternative because it would attain the widest range of beneficial uses of the environment with minimal degradation, risk to health and safety, or other undesirable and unintended consequences.

## 2.6 ALTERNATIVES CONSIDERED BUT REJECTED

Expansion of the climate monitoring program based on a different north-south transect was considered but rejected. There are already several existing RAWS situated along the transect between the Gulf of Alaska coast and the Tanana-Kuskokwim Lowlands. Using a different transect may not be as representative or span as many ecoregions. Regardless of any alternative transect location, it would not be possible to avoid locating new RAWS in the Wrangell-St. Elias Wilderness.

## 2.7 COMPARISON OF ALTERNATIVES

Table 2-2 compares the potential environmental impacts associated with the no action and both 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***

| Resource Topic | Alternative A (No Action) | Alternative B (Expand Climate Monitoring Program – NPS Preferred Alternative) | Alternative C (Limited Expansion of Park Climate Monitoring Program) |
|---|---|---|---|
| **Wilderness Values** **Solitude** | Negligible, temporary, and long-term adverse impacts. Up to 4 fixed wing and 6 helicopter round-trips during 4 days of field season for RAWS maintenance.<br><br>Including maintenance of existing and proposed seismic stations, up to 4 fixed wing and 41 helicopter round-trips over 2 weeks of field season at 40 RAWS and seismic sites. | Negligible, temporary, and long-term adverse impacts. Up to 6 fixed wing and 22 helicopter round-trips during 6-7 days of field season for RAWS maintenance.<br><br>Including maintenance of existing and proposed seismic stations, up to 6 fixed wing and 57 helicopter round-trips over nearly 3 weeks of field season at 49 RAWS and seismic sites. | Negligible, temporary, and long-term adverse impacts. Up to 4 fixed wing and 16 helicopter round-trips during 5-6 days of field season for RAWS maintenance.<br><br>Including maintenance of existing and proposed seismic stations, up to 4 fixed wing and 51 helicopter round-trips over nearly 3 weeks of field season at 45 RAWS and seismic sites. |
| **Naturalness** | Negligible, temporary, and long-term adverse impacts from existing RAWS and snowfall measurement devices.<br><br>No existing RAWS in wilderness or wilderness-suitable lands. | Minor, temporary, and long-term adverse impacts from expansion of RAWS and snowfall measurement devices in designated wilderness and wilderness suitable lands. | Minor, temporary, and long-term adverse impacts from limited expansion of RAWS and snowfall measurement devices in wilderness suitable lands. |
| **Visitor Experience** | Park visitors encountering RAWS at close range or subjected to overhead aircraft noise would have diminished wilderness experience.<br><br>*Minor adverse cumulative impacts on wilderness values.* | Park visitors encountering RAWS at close range or subjected to overhead aircraft noise would have diminished wilderness experience.<br><br>*Minor adverse cumulative impacts on wilderness values.* | Park visitors encountering RAWS at close range or subjected to overhead aircraft noise would have diminished wilderness experience.<br><br>*Minor adverse cumulative impacts on wilderness values.* |
| **Wildlife** | Temporary, localized displacement of wildlife from maintenance and human presence at existing RAWS. Negligible long-term direct adverse impacts on habitat from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on wildlife.* | Temporary, localized displacement of wildlife from maintenance and human presence at expanded RAWS network. Negligible long-term direct adverse impacts on habitat from RAWS and seismic stations.<br>*Minor adverse cumulative impacts on wildlife.* | Temporary, localized displacement of wildlife from maintenance and human presence at expanded RAWS network. Negligible long-term direct adverse impacts on habitat from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on wildlife.* |

*Table 2-2. Comparison of Alternatives*

| Resource Topic | Alternative A (No Action) | Alternative B (Expand Climate Monitoring Program – NPS Preferred Alternative) | Alternative C (Limited Expansion of Park Climate Monitoring Program) |
|---|---|---|---|
| **Vegetation** | Negligible, localized, temporary impacts on vegetation from foot traffic around RAWS. Negligible long-term direct impacts on vegetation from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on vegetation.* | Negligible, localized, temporary impacts on vegetation from foot traffic around expanded RAWS network. Negligible long-term direct impacts on vegetation from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on vegetation.* | Negligible, localized, temporary impacts on vegetation from foot traffic around expanded RAWS network. Negligible long-term direct impacts on vegetation from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on vegetation.* |
| **Soils** | Negligible, localized, temporary impacts on soils from foot traffic around RAWS. Negligible long-term direct impacts on soils from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on soils.* | Negligible, localized, temporary impacts on soils from foot traffic around expanded RAWS network. Negligible long-term direct impacts on soils from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on soils.* | Negligible, localized, temporary impacts on soils from foot traffic around expanded RAWS network. Negligible long-term direct impacts on soils from RAWS and seismic stations.<br><br>*Minor adverse cumulative impacts on soils.* |
| **Cultural Resources** | No impacts to cultural resources expected. *Minor adverse cumulative impacts on cultural resources given past mining development, human habitation, roads, buildings, and land applications within WRST.* | No impacts to cultural resources expected. *Minor adverse cumulative impacts on cultural resources given past mining development, human habitation, roads, buildings, and land applications within WRST.* | No impacts to cultural resources expected. *Minor adverse cumulative impacts on cultural resources given past mining development, human habitation, roads, buildings, and land applications within WRST.* |
| **Park Management** | No action alternative would impede NPS ability to fulfill inventory and monitoring program mandate, understand park ecosystems, and manage natural resources.<br><br>*Moderate adverse cumulative impact on park management.* | Expanded RAWS network would enhance NPS ability to fulfill inventory and monitoring program mandate, understand park ecosystems, and manage natural resources.<br><br>*Moderate beneficial cumulative impact on park management.* | Limited expansion of RAWS network would slightly enhance NPS ability to fulfill inventory and monitoring program mandate, understand park ecosystems, and manage natural resources.<br><br>*Minor beneficial cumulative impact on park management.* |

# CHAPTER 3: AFFECTED ENVIRONMENT

General discussions of the characteristics of the environment that would be affected by an expanded climate monitoring program are provided in this section. Descriptions of the individual site characteristics are presented in Table 4-1 (environmental consequences section). Additional site details and photographs are provided in the Climate Monitoring Site Evaluation report (NPS, 2004).

While the Wrangell-St. Elias Wilderness and wilderness-suitable lands are generally considered pristine, there is minor evidence of past use and human occupancy. Fixed-wing aircraft can land in wilderness. Two public use cabins are situated in wilderness. Snowmachine use commonly occurs in wilderness. There are existing weather and climate research facilities in WRST; notable features are seismic stations, repeater sites, and RAWS (Figure 3-1).

## 3.1 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 weather 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 candidate RAWS sites.


**Figure 3-1. Existing Weather Monitoring and Seismic Stations at Wrangell-St. Elias National Park and Preserve and Vicinity**

### 3.1.1 Solitude and Naturalness

The ambient sounds at the potential weather 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 airline, authorized helicopter for research and routine park management operations as well as 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 located near trails or where limited visitor access is possible.

Views at the potential weather station sites include expansive vistas of mountains, glaciers, undulating hills, grassy knolls, plateaus, or river valleys. As a few sites can be accessed by trails or are in close proximity to private lands or hunting camps (NPS, 2004), it is possible that weather stations at these sites could be seen. It may also be possible to see the weather stations at locations within sight distance of valleys or inhabited areas (e.g., the Sourdough Ridge site in the McCarthy area may be seen from the Chitina River valley). Candidate sites with potential viewshed concerns are identified in Table 4-1.

### 3.1.2 Visitor Experience

None of the existing or new proposed RAWS 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.

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, such as a weather station as could occur during NPS installation and maintenance of the weather stations. Most of the potential weather station sites are remote and inaccessible other than by aircraft (NPS, 2004) and are not likely to be visited or seen or by other than NPS staff involved in station construction or maintenance. However, a number of station sites might be encountered by park visitors due to their close proximity to trails (the Jumbo Trail, Fireweed Mountain, Nikolai Pass, and Sourdough Ridge sites in the McCarthy area), private lands (the Nikolai Mine site in the McCarthy area), backcountry visitor fly-in sites (the Iceberg Lake site in the Tana River area), or hunting areas (the Notch Airstrip and Huberts Cabin sites in the Upper Chitina area).

## 3.2 WILDLIFE

Wildlife species that may be found in the areas of the proposed weather 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 into the north and west side of the park and preserve. Extensive populations of Dall sheep inhabit the Wrangell

Mountains. Brown and black bears range throughout the area. 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.

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, 2005). Birds that may be found at the proposed weather station areas include snow bunting, golden-crowned sparrow, Say's phoebe, rosy finch, Lapland longspur, gyrfalcon, hawks, ptarmigans, and corvids such as jays, crows, and magpies.

## 3.3 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).

Potential weather station sites, both on the transect and outside the transect, occur in different ecoregions. The vegetation at these sites was assessed from ecological subsection descriptions (NPS, 2001) and on-the-ground evaluations of each site that were conducted in July 2003 (NPS, 2004).

Potential weather station sites in the McCarthy area are in the McCarthy Mountains subsection of the Wrangell Mountains ecoregion. The McCarthy Mountains are rugged but relatively low in elevation and have little permanent ice and snow. High elevations 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. Some depressional areas have black spruce woodland or low shrubs and sedges.

Potential weather station sites in the Tana area and the Tebay area are in the Northern Chugach Cirque-Glacier Mountains subsection of the Chugach-St. Elias Mountains ecoregion. These mountains are rugged with sparse alpine vegetation 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.

One site in the Tana area occurs in the Tana Valley subsection that covers the valley bottoms and forested lower slopes. Vegetation consists of open white spruce forest with a deciduous shrub understory. Some black spruce forest occurs in wet depressions. The main fork of the Tana River

is mostly unvegetated sand and gravel with sparse vegetation of shrubs and herbs in places. Along the west fork of the Tana River, dense shrubs, and wet herbaceous and emergent vegetation are found.

Potential weather station sites in the Cheshnina area are in the Cheshnina Plateaus and Valleys subsection of the Wrangell Mountains ecoregion. Vegetation consists of open white spruce forest with a low shrub understory. Early successional alluvium and higher elevations have deciduous shrubs or shrubs and poplar forest. Plateau surfaces have dwarf shrub tundra, with denser shrubs at lower elevation. Plateau slopes have scree or shrubs, ranging from sparse dwarf shrubs at higher elevations to dense low- to mid-height shrubs at low elevations.

Potential weather station sites in the Upper Chitina area occur in four different subsections of three different ecoregions. One site is in the Chitina Valley subsection of the Copper River Basin ecoregion. Much of this subsection consists of sparsely vegetated gravel bars of the braided Chitina River. Open white spruce forest or mixed spruce and hardwoods occur as distance increases from the active channel. Some late successional areas near the foot of bluffs have open black spruce forest or woodland.

Three sites in the Upper Chitina area occur in the Chugach-St. Elias Mountains ecoregion. One site in the Chitina Moraines subsection is sparsely vegetated or unvegetated, but is being rapidly colonized by shrubs and herbaceous vegetation. Another site is in the Chitina and Logan Glaciers subsection where vegetation consists of sparse shrubs and herbs on rubble at low elevations and deciduous shrubs, with open white spruce forest in the far west. The third site is in the University-Centennial Mountains subsection where vegetation consists of open and closed deciduous shrubs with an open spruce overstory in places. Other areas in this subsection that are mostly bare rock, scree, talus, snow, and ice have no vegetation or have a few herbaceous plants and shrubs that have colonized the glacial rubble at low elevations.

The nunatak sites in the Chugach Mountains and Wrangell Mountains would be located on relatively level slopes likely with exposed bedrock and sparse or no ground cover.

## 3.4 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.

Soils for each of the subsection corresponding to vegetation descriptions above are characterized here (NPS, 2001).

Soils in the McCarthy Mountains subsection (McCarthy area) 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.

Soils in the Northern Chugach Cirque-Glacier Mountains subsection (Tana and Tebay areas) are mostly 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 probably 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 Tana Valley subsection (Tana area) are mostly loamy soils with abundant stones, generally well-drained, with a thin surface organic layer. Some wet soils with a thicker organic surface layer are present in depressions, possibly with permafrost. Along the main fork of the Tana River, soil is coarse-grained alluvium with very weak or no development. Along the west fork there are wet soils of stratified sand, gravel, and silt, with little development other than reduction, buried organic layers and, in places, a surface organic layer. Permafrost is probably absent, except perhaps on slightly higher terrace surfaces.

Soils in the Cheshnina Plateaus and Valleys subsection (Cheshnina area) are well-drained and rocky with a coarse-loamy matrix. Horizonation is minimal except for a thin organic surface layer under dense shrubs. Permafrost is lacking in some areas, and where present, the active layer may be about 1 m on gentle plateau surfaces and deeper elsewhere. In the river valley, soils are highly variable due to succession and differences in wetness.

Soils of the Chitina Valley subsection (Upper Chitina area) are mostly stratified sand and gravel with little or no horizon development. A loamy surface layer generally increases in thickness with distance from the channel. A surface organic layer is present under the more densely vegetated areas. Soils are generally well drained and lack permafrost, except possibly under black spruce forest.

Soils in the Chitina Moraines subsection (Upper Chitina area) are loamy or sandy with many coarse fragments, good drainage, and little or no profile development. Some areas may have a surface organic layer. Permafrost status is uncertain, but most likely to be present in depressions.

Soils in the Chitina and Logan Glaciers subsection (Upper Chitina area) are mostly rock, rubble and ice with no soil in some areas and rock rubble with a loamy matrix and little soil development in other areas.

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

## 3.5 CULTURAL RESOURCES

There are no archeological or historic resources at any of the potential climate monitoring station sites. Some of the existing weather station sites are located in historic districts and may be visible to visitors (Chisana Town Site, Chicken Air Strip). However, two of the potential sites are located within the boundaries of historic districts.

In the McCarthy area, the Jumbo Trail site is located in the Kennicott historic district and is accessible via a trail by foot or ATV but the site is not visible from the trail or the McCarthy or Kennicott locations. In the Chisana Area, Gold Hill is located within the Chisana Historic District but is not visible from the town.

# 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 was 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 weather station installation, upgrade, 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, upgrade 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 climate monitoring 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 climate monitoring 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 solitude, naturalness, 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.

Naturalness 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 the location of any remote 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, human habitation, roads, buildings, and land applications; about 1,286,024 acres are not considered suitable for wilderness designation. Within WRST, there are existing RAWS (5), 15 existing seismic stations, and proposed seismic stations (15-20 proposed, several of which may be in designated wilderness). Descriptions of RAWS equipment are in the appendix. Descriptions of the existing and proposed seismic station development footprints are in the affected environment section of this EA.

Of the 15 existing seismic stations, 14 are in designated wilderness. The footprint of each seismic station directly affects about 10 square feet of land surface; total surface disturbance for all 15 existing seismic stations is 0.003 acre. Facilities include a 10-foot high antenna and an attached 2-foot by 3-foot solar panel for power. Instruments are situated on the ground within a 36-inch diameter corrugated steel culvert inverted vertically in the ground about 2 feet above the

ground surface. Title XIII of ANILCA governs navigation aids and other facilities within conservation system units; specifically, ANILCA Section 1310(a) authorizes access, operation, and maintenance of such existing facilities in WRST.

The NPS is currently reviewing a research permit application to install 15-20 additional seismic stations in WRST beginning in 2006. Known as the Saint Elias Erosion and Tectonics Project (STEEP), the project would enhance the Alaska early warning seismic network with an improved understanding of geodynamics; STEEP has global implications for emergency preparedness. Surface and subsurface seismic data, and field specimens, would be collected and analyzed to test research hypotheses on orogenic forces and dynamics at WRST. Installation and maintenance of the new seismic stations for STEEP would require helicopter use. Several new seismic stations may be established in the Wrangell-St. Elias Wilderness; a final determination of the proposed locations is pending additional site reconnaissance field work.

The footprint of the new STEEP seismic stations would consist of a 4-foot by 4-foot fiberglass weatherproof hut about 5 feet high, a seismometer placed in a small polyethylene drum with less than a 2-foot diameter and approximately 2-3 feet high. A buried cable in flexible conduit would link the seismometer with telemetry equipment inside the hut. Cable length would range from 5 to 20 feet; the average length of cable would be 10 feet. The footprint of each new STEEP seismic station would be about 20 square feet; total surface disturbance for 15-20 sites would be about 0.009 acre. It is assumed that each STEEP seismic station would be visited once annually during the summer field season for maintenance using helicopter and field crew of 3 people, including pilot. For the purposes of analysis, it is assumed that installation of the STEEP stations would take 3 weeks during the 2006 summer field season, and that annual station maintenance thereafter would take 4 hours or less per station, or less than one week in the field. Title XIII of ANILCA governs navigation aids and other facilities within conservation system units; specifically, ANILCA Section 1310(b) authorizes access, operation, and maintenance of new research facilities such as the ones described above in WRST.

The existing five RAWS are located at May Creek and Chititu in the McCarthy Area, Chisana Town Site and Chicken Airstrip in the Chisana Area, and Klawasi southwest of Mount Drum; none are situated in designated wilderness. Descriptions of RAWS facilities and snowfall measurement devices are provided in the Appendix of this EA.

Several candidate RAWS sites are located in both wilderness and non-wilderness. Two of the six candidate sites in the McCarthy study area are in wilderness. All seven candidate sites in the Tana study area are in wilderness. All four candidate mobile sites in the Upper Chitina study area are in wilderness. The two mobile sites in Tebay study area are in non-wilderness. One mobile candidate site in the Cheshnina study area is in wilderness and the other is in non-wilderness. Descriptions of RAWS facilities are provided in Appendix B.

All of the candidate 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 (Table 4-1).

## Table 4-1 Descriptions of candidate climate monitoring sites.

| Site | Area | Access | Wilder-ness? | Historic District | Viewshed Concerns | Visitor Use | Site Description |
|---|---|---|---|---|---|---|---|
| **Gates Peninsula** | McCarthy | H | Y | N | N | N | Several small, grassy knolls on ridge between Gates and Packsaddle Glaciers; wide open to glaciers to south, east and west; ridge rises to north. |
| **Kennicott Glacier** | McCarthy | F/H | Y | N | N | L | Rolling, undulating hilly area adjacent to Kennicott Glacier; high mountains rise to west; open views of glacier in all other directions. Level site in dry tundra. |
| **Jumbo** | McCarthy | Trail | N | Y | Y | M | Meadow ~22 x 25 m, on slight slope, surrounded by alder thickets 2–3 m high; at treeline in relatively protected bowl, north exposure blocked by 20 m high hill. |
| **Fireweed** | McCarthy | H | N | N | L | L | Rolling, open terrain on eastern flank of Fireweed Mountain, ~1700' above Kennicott Glacier. Low dwarf birch shrub and alpine tundra surrounding slightly sloping lichen/forb clearing. |
| **Nikolai Mine** | McCarthy | H | N | N | N | L | Rounded bedrock knob with rubble in middle of large bowl, protected on all sides by large mountains. Dry alpine tundra, no shrubs. |
| **Nikolai Pass** | McCarthy | F/H | N | N | L | L | Large, round knob above Nikolai Pass; extremely large, level site. Dry tundra, no shrubs. |
| **Sourdough Ridge** | McCarthy | H | N | N | L | L | Long ridgeline descending gradually to southwest with intermittent small, flat knolls; expansive, open views out to Chitina River valley. Dry tundra, somewhat stony ground. |
| **Chititu installed in 2004 existing now** | McCarthy | H | N | N | N | N | Broad hilltop in rolling hills with open exposure in all directions; out of river wind corridors. Dry tundra, slightly hummocky but level ground. |
| **Unknown Mountain Site 1** | Wrangell Range | H | Y | N | N | N/L | A site north of the McCarthy area in the Wrangell Mountains. |
| **Iceberg Lake** | Tana River | F/H | Y | N | L | L | Exposed moraine bench at about highest terrace above lake. Level, but very rocky (cobbles–small boulders). |
| **Iceberg Bench** | Tana River | H/F | Y | N | N | N | Promontory on high bench to northeast of lake, across canyon from glaciers feeding lake; high moraine rises ~30 m to NE behind site, otherwise open to lake and glaciers. Level; tundra with low willow scrub. |
| **Tana Glacier Seismic** | Tana River | H© | Y | N | N | N | Rocky knob at confluence of Tana Glacier and unnamed tributary; 1 km to cliffs behind (NW); exposed to major glaciers (Tana and Bagley Icefield). Flat, patchy tundra between bedrock outcrops; ~1 km down to glacier. |
| **Ross Green Bench** | Tana River | H/F | Y | N | N | N | Centrally located in Granite Creek valley on old medial moraine paralleling Ross Green Lake; representative of Chugach valley bottoms; level, good exposure. Completely covered with dwarf birch ~1 m high (would require extensive brushing). |

| Site | Area | Access | Wilder-ness? | Historic District | Viewshed Concerns | Visitor Use | Site Description |
|---|---|---|---|---|---|---|---|
| **Twelvemile Creek** | Tana River | H | Y | N | N | N | Broad knoll across Granite Creek valley from Ross Green Lake, out of main Tana River wind corridor; representative of Chugach ecosystem. Large flat granite outcrops surrounded by willow and dwarf birch. |
| **West Fork Tana** | Tana River | H | Y | N | N | N | Large, flat bench, ~1 km away from mountain to northeast, expansive and open in other directions; 2000' above river bottom; out of main Tana River wind corridor; at treeline. Slightly hummocky tundra (thin veneer over bedrock) mixed with dwarf birch and willow shrubs ~1 m high. |
| **Tana River** | Tana River | F/H | Y | N | Y | L | Flat Tana River floodplain (lichen-covered silt), somewhat protected in broad "embayment" in adjacent spruce forest. |
| **Unknown Mountain Site 2** | Chugach Range | H | Y | N | N | N | A site south of the Tana River area in the Chugach Mountains. |
| **Chicken Airstrip, installed in 2004, existing now** | Chisana | F/H | N | Y | N | L | Broad, rolling hills on south side of Nutzotin Mountains, slightly hummocky dry tundra interspersed with low shrubs. |
| **Euchre** | Chisana | H©/S | N/boun dary | N | N | N | Large, rounded summit located directly at terminus of Chisana Glacier and above Chisana town site; completely open and exposed on all sides. Stony substrate with scattered grasses and forbs. |
| **Gold Hill** | Chisana | H/F/S | N | Y | N | N | Large, flat plateau; open in all directions above Chisana lowlands; dry, slightly hummocky tundra, no shrubs. |
| **California Creek** | Chisana | H/F/S | N/boun dary | N | N | N | Gentle, rolling hills above Beaver Lakes, all open. Level, slightly hummocky dry tundra, no shrubs. |
| **Beaver Lake** | Chisana | H/F/S | Y | N | N | N | Rounded, rolling hills with vast, open on all sides, with views of Chisana Glacier, Chisana lowlands, and Beaver Lake. Very level, dry alpine tundra with no shrubs. |
| **Chitina Glacier Seismic** | Upper Chitina | H© | Y | N | N | N | Gently rounded, broad knob above confluence of Chitina and Logan Glaciers; wide open exposure to Chitina river valley and Chitina and Logan Glaciers; slightly hummocky but level site. Mostly dry tundra with sparse willow (<1 m high). |
| **Notch Airstrip** | Upper Chitina | F/H | Y | N | Y | L | Large, level, gravelly clearing, ~100 m across, surrounded by spruce forest; protected from Chitina Glacier on south by old moraines. (Old river channel skirting glacier, now long abandoned.) |
| **Huberts** | Upper Chitina | F/H | Y | N | Y | L | Three possible sites on bluff above and downstream from cabin; good south exposure over Chitina Valley, sheltered by dense spruce forest to north (would require quite a bit of clearing). |

| Site | Area | Access | Wilder-ness? | Historic District | Viewshed Concerns | Visitor Use | Site Description |
|---|---|---|---|---|---|---|---|
| **Barnard Glacier** | Upper Chitina | H/F | Y | N | N | N | Large, clearing on Barnard Glacier lateral moraine (old spillover channels, long abandoned); sheltered by surrounding spruce forest. Slightly sloping, but with some small flat areas. |
| **Tebay** | Tebay Lakes | F/H | boundary | N | N | L | Large, level meadow areas in undulating terrain; protected by rocky outcrops and tall willow and alder thickets. ~1 km from Upper Tebay Lake, and 30 m above lake; out of lake wind corridor. |
| **Tebay Cabin** | Tebay Lakes | H/F | N | N | N | N | Open forest and meadow near treeline, nestled on vegetated alluvial between bedrock ridges. Mosaic of bark beetle killed spruce trees. |
| **Cheshnina** | Cheshnina | H | boundary | N | N | N | Broad, flat plateau extending down from Mt. Wrangell (andesite flow), very exposed with expansive views in all directions. Stony dry tundra; high alpine windblown environment. |
| **Long Glacier** | Cheshnina | H/F | Y | N | N | N | Broad, rolling hills on high plateau (old andesite flow) above Long Glacier and below Cheshnina Glacier; very open in all directions. Flat, high alpine windblown environment; dry tundra, a little hummocky, but not stony. |
| **Unknown** | Black Mountain | H | U | N | | | |
| **Unknown** | White River | H | N | N | | | |
| **Unknown** | Jacksina Plateau | H | Y | N | | | |

* Access: (H) helicopter; (F) fixed-wing aircraft; (S) snowmachine/ATV; (H©) helicopter, co-located with seismic station or radio repeater, listed in order of most likely type of access

Fixed-wing aircraft are allowed and will continue to land in park wilderness. There are about 85 remote landing strips in WRST. Future patrols using aircraft will also continue on a regular basis for such purposes as research, visitor contacts and transportation of personnel to and from the backcountry. Park visitors also can charter with private air taxi operators for transportation to and from designated wilderness.

Helicopter use in WRST is subject to compliance with the park helicopter policy (Appendix) regardless of whether helicopter use is required for internal NPS resource management projects, search and rescue missions, permitted research projects by external researchers, or fire management. Helicopters would be used to install and maintain new or existing STEEP seismic stations, RAWS, and other weather monitoring equipment when foot access or fixed wing aircraft use are not feasible or practical.

## 4.3 ALTERNATIVE A: NO ACTION

### 4.3.1 Wilderness Values

Under the No Action Alternative, no new RAWS would be installed. As many as 4 fixed wing and 6 helicopter round-trips to existing RAWS for maintenance would affect solitude when the aircraft are flying over designated wilderness; maintenance would require parts of 4 days during the field season. Because helicopter-produced sound can be heard at long distances, wilderness solitude would be diminished. These intrusions of solitude would be temporary and of short duration.

Snow courses and aerial markers mark points on the ground and none of the existing RAWS are in designated wilderness or wilderness-suitable lands; there would be negligible impacts on naturalness.

**No Action Alternative Existing Sites**

Sites with existing RAWS:
- Klawasi southwest of Mount Drum
- Chititu in the McCarthy Area
- Chicken Airstrip in the Chisana Area

Sites with RAWS and snow courses only:
- May Creek in the McCarthy Area
- Chisana Town Site in the Chisana Area

Sites with snow courses:
- Lost Creek in the Nabesna Area
- Chokosna in the Lower Chitina Valley area

Sites with aerial markers only:
- Tebay Cabin in the Tebay Lakes
- Long Glacier in the Cheshnina area

NPS may upgrade these stations with replacement or additional equipment as warranted.

Possible upgrades to the existing monitoring stations with replacement or additional equipment would further detract from wilderness naturalness.

Park visitors encountering RAWS and monitoring equipment at close range, or subjected to overhead aircraft noise during RAWS maintenance, would have a diminished visitor experience.

*Cumulative Impacts*

Fixed-wing aircraft flights occur on a daily basis in WRST by NPS, general aviation, or air taxi operators. Fixed wing aircraft are allowed to fly over and land in designated wilderness or wilderness-suitable lands; there are approximately 85 known landing strips throughout WRST. Noise intrusions and disruptions to solitude from these flights would be temporary and of short duration to individuals on the ground.

Helicopter use would be required to access existing RAWS, existing and future seismic stations. These helicopter flights are point to point and of limited duration, thus noise intrusions would be temporary although spread throughout WRST and designated wilderness. Helicopters would be used to install new STEEP seismic stations as well as accessing them for routine maintenance. For the purposes of analysis, it is assumed that a total of three to four RAWS or seismic stations would be maintained during each summer field day; each RAWS would be maintained 1-2 times a year; and each seismic station would be visited for maintenance once annually. There are 5 existing RAWS, 15 existing seismic stations (of which 14 are in designated wilderness), and as many as 20 proposed STEEP stations (several of which could be in designated wilderness). Therefore, maintenance of 40 existing RAWS, existing seismic stations, and proposed STEEP seismic stations would require as many as 4 fixed wing and 41 helicopter round trips over the course of 10-14 days each field season. Several NPS and permitted research projects would also use helicopters each field season. Flight paths would traverse designated wilderness and aircraft would land in designated wilderness. There would be minor adverse cumulative impacts on wilderness solitude.

The presence and operation of 5 RAWS (none in designated wilderness or wilderness-suitable lands), and as many as 35 seismic stations in WRST (of which 34 could be in designated wilderness) would have minor adverse cumulative impacts on wilderness naturalness.

Park visitors contacting RAWS and seismic equipment at close range, and exposed to noise from aircraft flying over and landing in designated wilderness to install or maintain equipment would have a diminished visitor experience. There would be minor adverse cumulative impacts on the wilderness visitor experience.

*Conclusion*
Alternative A would have negligible, temporary, and long-term adverse impacts on wilderness values.

There would be minor adverse cumulative impacts on wilderness solitude, naturalness, and visitor experience.

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.

### 4.3.2 Wildlife

Impacts currently occurring at the five existing RAWS and at the four sites with snow courses or aerial markers would continue; specifically, site maintenance and the presence of humans on site would cause temporary, localized displacement of wildlife. Snow courses and aerial markers mark points on the ground, and have a negligible footprint on habitat. RAWS have a footprint of about 100 square feet, or about 0.002 acre; total direct impact to wildlife habitat from RAWS and monitoring equipment is about 0.01 acre. Possible upgrades to the existing monitoring stations with replacement or additional equipment would temporarily displace wildlife in the immediate vicinity during installation. Disturbance would be temporary as upgrades would likely require only one day at each site for up to eight hours per day. Maintenance at the sites is already

occurring, so wildlife disturbance from any additional maintenance on new equipment would be negligible. The footprint of additional equipment would directly affect wildlife habitat in the long term, but the area of habitat loss would be negligible.

*Cumulative Impacts*
Existing RAWS have directly affected about 0.01 acre of habitat. Existing seismic stations have directly affected about 0.003 acre of habitat. Future STEEP seismic stations would affect an additional 0.009 acre of habitat. In total, RAWS and seismic equipment would directly affect 0.02 acre of wildlife habitat. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, would cause localized, temporary displacement of wildlife. Given past mining development, human habitation, roads, buildings and land applications within WRST, there would be minor adverse cumulative impacts on wildlife.

*Conclusion*
Alternative A would have negligible, temporary, localized, adverse impacts to wildlife and negligible, long-term, localized, adverse impacts to wildlife habitat.

There would be minor adverse cumulative impacts on wildlife.

The level of impact to wildlife 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 Vegetation
Impacts currently occurring at the five existing monitoring stations and at the four sites with only snow courses or aerial markers would continue. Snow courses and aerial markers mark points on the ground, and have a negligible footprint. RAWS have a footprint of about 100 square feet, or about 0.002 acre; total direct impact to vegetation from RAWS and monitoring equipment is about 0.01 acre. Some of the existing monitoring stations may receive possible upgrades with replacement or additional equipment. Vegetation could be trampled or destroyed by anchoring equipment and small areas of vegetation may require clearing. The area of vegetation trampling from foot traffic during installation and maintenance would likely be minimal and limited to the area immediately surrounding the weather stations. Disturbance would be temporary as upgrades would likely require only one day at each site for up to eight hours per day. Maintenance at the sites is already occurring, so vegetation disturbance from any additional maintenance on new equipment would be negligible. The footprint of additional equipment would directly vegetation habitat in the long term, but the area of land cover loss would be negligible.

*Cumulative Impacts*
Existing RAWS have directly affected about 0.01 acre of vegetation. Existing seismic stations have directly affected about 0.003 acre of vegetation. Future STEEP seismic stations would affect an additional 0.009 acre of vegetation. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause localized, temporary trampling of vegetation. Given past mining development, human habitation, roads,

buildings and land applications within WRST, there would be minor adverse cumulative impacts on vegetation.

*Conclusion*
Alternative A would have negligible, temporary, localized, adverse impacts, and negligible, long-term, localized, adverse impacts to vegetation.
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.

### 4.3.4 Soils

Impacts currently occurring at the five existing monitoring stations and at the four sites with only snow courses or aerial markers would continue. Some of the existing monitoring stations may receive possible upgrades with replacement or additional equipment. Soils may be minimally disturbed by anchoring of the equipment. The area of soil compaction from foot traffic during installation and maintenance would likely be minimal and limited to the area immediately surrounding the weather stations.

*Cumulative Impacts*
Existing RAWS have directly affected about 0.01 acre of soils. Existing seismic stations have directly affected about 0.003 acre of soils. Future STEEP seismic stations would affect an additional 0.009 acre of soils. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, could cause localized, temporary trampling of the ground surface. Given past mining development, human habitation, roads, buildings and land applications within WRST, there would be minor adverse cumulative impacts on soils.

*Conclusion*
Alternative A would have negligible, temporary, localized, adverse impacts, and negligible, long-term, localized, adverse impacts to soils.

There would be minor adverse cumulative impacts on soils.

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.

### 4.3.5 Cultural Resources

With the No Action alternative, no new RAWS would be established. The existing remote automated weather stations at the Chisana Town Site and Chicken Air Strip are located within the Chisana Historic District. These stations would be maintained under this alternative, however, the stations are not in any way materially affecting the character of these historic districts and their maintenance should not require activities that would affect the district. As a result, no impacts to cultural resources would be expected.

*Cumulative Impacts*
Given past mining development, human habitation, roads, buildings and land applications within WRST, there would be minor adverse cumulative impacts on cultural resources.

*Conclusion*
Alternative A would likely result in no impacts on cultural resources.

There would be minor adverse cumulative impacts on cultural resources.

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.

### 4.3.6 Park Management
With the no action alternative, the ability of WRST management and the NPS to fulfill the inventory and monitoring program, understand ecosystems, and adequately manage natural resources would be impeded.

*Cumulative Impacts*
There would be moderate long-term adverse cumulative impacts on the ability of WRST management to fulfill national mandates for environmental monitoring and resource management.

*Conclusion*
Alternative A would have moderate long-term adverse impacts on park management arising from incomplete information essential for understanding ecosystems and adequately managing park resources.

## 4.4 ALTERNATIVE B: EXPAND PARK CLIMATE MONITORING PROGRAM (NPS PREFERRED ALTERNATIVE)

### 4.4.1 Wilderness Values

Under Alternative B, 4 new permanent RAWS, 6 new mobile RAWS, and 4 other monitoring devices would be installed over a period of 3-5 years. In the long-term, after installation of new RAWS and other monitoring devices, as many as 6 fixed wing and 22 helicopter round-trips to existing and new RAWS for maintenance would affect solitude when the aircraft are flying over and landing in designated wilderness. Maintenance of RAWS would occur during 6-7 days of the field season. Because helicopter-produced sound can be heard at long distances, wilderness solitude would be diminished. These intrusions of solitude would be temporary and of short duration.

Snow courses and aerial markers mark points on the ground; the operation and maintenance of new RAWS in designated wilderness and wilderness-suitable lands would have minor adverse impacts on naturalness.

Park visitors encountering RAWS and monitoring equipment at close range, or subjected to overhead aircraft noise during RAWS maintenance, would have a diminished visitor experience.

**Alternative B Preferred Sites**

**Existing SITES**
**RAWS**:
Klawasi southwest of Mount Drum
Chicken Airstrip in the Chisana Area
**RAWS and snow courses only**:
May Creek in the McCarthy Area
Chisana Town Site in the Chisana Area
**Sites with snow courses or aerial markers**:
Lost Creek in the Nabesna Area
Chokosna in the Lower Chitina Valley area
Tebay Cabin in the Tebay Lakes area
Long Glacier in the Cheshnina area

**New SITES:**
**Permanent RAWS**
Gates Glacier in the McCarthy Area
(relocation of existing RAWS at Chititu)
West Fork Knob in the Tana River Area
Nunatak site in Chugach Mountain Range
Nunatak site in the Wrangell Mountains
**Mobile RAWS**
Tebay Cabin in the Tebay Lakes area
Long Glacier in the Cheshnina area
Notch Airstrip in the Upper Chitina area
Jaeger Mesa in the Nabesna River Drainage
West end of Copper Lake
White River drainage
**Aerial snow marker, snow course and/or summer precipitation gage**
Jumbo Basin
Tana River Airstrip
**NRCS snow pillows**
May Creek
Chisana Town Site

*Cumulative Impacts*

Fixed-wing aircraft flights occur on a daily basis in WRST by NPS, general aviation, or air taxi operators. Fixed wing aircraft are allowed to fly over and land in designated wilderness or wilderness-suitable lands; there are approximately 85 known landing strips throughout WRST. Noise intrusions from these flights would be temporary and of short duration.

Helicopter use would be required to access existing and new RAWS, existing and future seismic stations. These helicopter flights are point to point and of limited duration, thus noise intrusions would be temporary although spread throughout WRST and designated wilderness. Helicopters would be used to install new STEEP seismic stations as well as accessing them for routine maintenance. For the purposes of analysis, it is assumed that a total of three to four RAWS or seismic stations would be maintained during each summer field day; each RAWS would be maintained 1-2 times a year; and each seismic station would be visited for maintenance once

annually. There would be 14 RAWS (of which 7 would be in designated wilderness), 15 existing seismic stations (of which 14 are in designated wilderness), and as many as 20 proposed STEEP stations (several of which could be in designated wilderness). Therefore, maintenance of 49 RAWS, existing seismic stations, and proposed STEEP seismic stations would require as many as 6 fixed wing and 57 helicopter round trips over the course of 13-17 days each field season. Several NPS and permitted research projects would also use helicopters each field season. Flight paths would traverse designated wilderness, and aircraft would land in designated wilderness. There would be minor adverse cumulative impacts on wilderness solitude.

The presence and operation of 8 RAWS in designated wilderness or wilderness-suitable lands, and as many as 35 seismic stations in WRST (of which 34 could be in designated wilderness) would have minor adverse cumulative impacts on wilderness naturalness.

Park visitors contacting RAWS and seismic equipment at close range, and exposed to noise from aircraft flying over and landing in designated wilderness to install or maintain equipment would have a diminished visitor experience. There would be minor adverse cumulative impacts on the wilderness visitor experience.

*Conclusion*
Alternative B would have negligible, temporary, and long-term minor adverse impacts on wilderness values.

There would be minor adverse cumulative impacts on wilderness solitude, naturalness, and visitor experience.

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.

### 4.4.2 Wildlife

Impacts currently occurring at existing RAWS and snow measurement devices remaining in operation would continue to affect wildlife. Snow courses and aerial markers mark points on the ground, and have a negligible footprint. The two snow pillows would directly affect a total of 72 square feet of wildlife habitat. RAWS have a footprint of

***Fig 4.1. Kennicott Glacier Site (Gates Glacier Site on ridge in background) in McCarthy Area***

about 100 square feet, or about 0.002 acre; total direct impacts to wildlife habitat from RAWS and related monitoring equipment would be about 0.03 acre. Possible upgrades to the existing monitoring stations with replacement or additional equipment would temporarily displace wildlife in the immediate vicinity during installation. Disturbance would be temporary as upgrades would likely require only one day at each site for up to eight hours per day. Maintenance at the sites is already occurring, so wildlife disturbance from any additional maintenance on new equipment would be negligible. The footprint of additional equipment would directly affect wildlife habitat in the long term, but the area of habitat loss would be extremely minor.

*Cumulative Impacts*
RAWS and related snow measurement devices would directly affect about 0.03 acre of habitat. Existing seismic stations have directly affected about 0.003 acre of habitat. Future STEEP seismic stations would affect an additional 0.009 acre of habitat. In summary, 49 RAWS and seismic stations would directly affect about 0.04 acre of wildlife habitat. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, would cause localized, temporary displacement of wildlife. Combined with past mining development, human habitation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on wildlife.

*Conclusion*
Alternative B would likely result in negligible, temporary, localized, adverse impacts to wildlife and negligible, long-term, localized, adverse impacts to wildlife habitat from possible new equipment at existing sites.

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.

### 4.4.3 Vegetation
Snow courses and aerial markers mark points on the ground, and have a negligible footprint. Two snow pillows would directly affect 72 square feet of vegetation. RAWS have a footprint of about 100 square feet; total direct impacts to vegetation would be about 0.03 acre. There would also be localized vegetation trampling from foot traffic. The sites range in vegetation cover and height from sparse and low (such as at Notch Airstrip in the Upper Chitina area) to dense and knee-high and screened by tree-growth (such as at Tebay Cabin in the Tebay Lakes area) (NPS, 2004). Gabions filled with rocks would surround each of the four legs of the precipitation tower and anchor down the base in the center (Martin, 2005). The gabions around the legs measure approximately two by six feet and the central gabion is four by four feet. The tri-leg tower would be anchored down with rebar with rocks piled up in a two by two foot area around each leg. In addition to vegetation being trampled or destroyed by these anchoring techniques, small areas of vegetation may require clearing beneath and around the towers depending on the site. The area of vegetation trampling from foot traffic during installation and maintenance would likely be minimal and limited to the area immediately surrounding the weather stations.

*Cumulative Impacts*
RAWS and related snow measurement devices would directly affect about 0.03 acre of vegetation. Existing seismic stations have directly affected about 0.003 acre of vegetation. Future STEEP seismic stations would affect an additional 0.009 acre of vegetation. In summary, 49 RAWS and seismic stations would directly affect about 0.04 acre of vegetation. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, would cause localized, temporary trampling of vegetation. Combined with past mining development, human habitation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on vegetation.

*Conclusion*
Alternative B would likely result in negligible, temporary, localized, adverse impacts and negligible, long-term, localized, adverse impacts to vegetation.

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.

### 4.4.4 Soils
Snow courses and aerial markers mark points on the ground, and have a negligible footprint. Two snow pillows would directly affect 72 square feet of surface. RAWS have a footprint of about 100 square feet; total direct impacts to soils would be about 0.03 acre. There would also be localized trampling of surface soils from foot traffic. It is likely that soil thickness varies considerably among sites, from none to relatively thick. Where soils are patchy or do not exist (such as on nunataks in the high-mountain elevation sites), impacts on soils would be negligible or non-existent. The area of soil compaction from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment.

*Cumulative Impacts*
Installation and maintenance of new and existing RAWS and seismic stations would have negligible adverse short- and long-term impacts on soils. Park visitation in the backcountry, and the presence of field crews performing station maintenance would also have negligible adverse impacts on soils from localized, temporary trampling of the ground surface. Combined with past mining development, human habitation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on soils.

*Conclusion*
Alternative B would result in minor, localized, long-term, adverse impacts to soils from soil disturbance and compaction during installation and maintenance of RAWS.

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.

### 4.4.5 Cultural Resources

The existing remote automated weather stations at the Chisana Town Site and Chicken Air Strip located in the Chisana Historic District would be maintained under this alternative, however, these stations are not in any way materially affecting the character of these historic districts and their maintenance should not require activities that would affect the district.

The Jumbo Trail site in the McCarthy area, a preferred location for installation of a snow course/snow marker or summer precipitation gauge, is located in the Kennicott Mines National Historic Landmark. Installation and operation of the device would not affect the character of the national historic landmark, and the device would not be visible from the trail, McCarthy, or Kennecott.

*Cumulative Impacts*

Given past mining development, human habituation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on cultural resources.

*Conclusion*

Alternative B would likely result in negligible impacts to 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.

### 4.4.6 Park Management

With Alternative B, the ability of WRST management and the NPS to fulfill the inventory and monitoring program, understand ecosystems, and adequately manage natural resources would be enhanced.

*Cumulative Impacts*

There would be moderate long-term adverse cumulative impacts on the ability of WRST management to fulfill national mandates for environmental monitoring and resource management.

*Conclusion*

Alternative B would have moderate long-term beneficial impacts on park management arising from increased knowledge and information essential for understanding ecosystems and adequately managing park resources.

## 4.5 ALTERNATIVE C: LIMITED EXPANSION OF PARK CLIMATE MONITORING PROGRAM

### 4.5.1 Wilderness Values

With Alternative C, one new permanent RAWS and up to 4 mobile RAWS would be established. As many as 4 fixed wing and 16 helicopter round-trips to these RAWS for maintenance would affect solitude when the aircraft are flying over and landing in designated wilderness. Maintenance of RAWS would require parts of 5-6 days of the field season. Because helicopter-produced sound can be heard at long distances, wilderness solitude would be diminished. These intrusions of solitude would be temporary and of short duration.

Snow courses and aerial markers mark points on the ground; the operation and maintenance of new RAWS (1 in designated wilderness and 3 in wilderness-suitable lands) would have minor adverse effects on naturalness.

Park visitors encountering RAWS and monitoring equipment at close range, or subjected to overhead aircraft noise during RAWS maintenance, would have a diminished visitor experience.

*Cumulative Impacts*

Fixed-wing aircraft flights occur on a daily basis in WRST by NPS, general aviation, or air taxi operators. Fixed wing aircraft are allowed to fly over and land in designated wilderness or wilderness-suitable lands; there are approximately 85 known landing strips throughout WRST. Noise intrusions from these flights would be temporary and of short duration.

**Alternative C Sites**

**Existing SITES**

**Sites with existing RAWS**:
- Klawasi southwest of Mount Drum
- Chititu in the McCarthy Area
- Chicken Airstrip in the Chisana Area

**Sites with RAWS and snow courses only**:
- May Creek in the McCarthy Area
- Chisana Town Site in the Chisana Area

**Sites with snow courses**:
- Lost Creek in the Nabesna Area
- Chokosna in the Lower Chitina Valley area

**Sites with aerial markers only**:
- Tebay Cabin in the Tebay Lakes area
- Long Glacier in the Cheshnina area

(NPS may upgrade these stations with replacement or additional equipment as needed.)

**New SITES**

**New permanent RAWS site**:
- Fireweed Mountain in the McCarthy Area

**Potential mobile station sites**:
- Tebay Cabin in the Tebay Lakes Area
- Cheshnina in the Cheshnina Area
- West end of Copper Lake
- Ptarmigan Lake

Helicopter use would be required to access existing and new RAWS, existing and future seismic stations. These helicopter flights are point to point and of limited duration, thus noise intrusions would be temporary although spread throughout WRST and designated wilderness. Helicopters would be used to install new STEEP seismic stations as well as accessing them for routine maintenance. For the purposes of analysis, it is assumed that a total of three to four RAWS or seismic stations would be maintained during each summer field day; each RAWS would be maintained 1-2 times a year; and each seismic station would be visited for maintenance once annually. There would be 10 RAWS (of which 1 would be in designated wilderness and 3 in wilderness-suitable lands), 15 existing seismic stations (of which 14 are in designated wilderness), and as many as 20 proposed STEEP stations (several of which could be in designated wilderness). Therefore, maintenance of 45 RAWS, existing seismic stations, and proposed STEEP seismic stations would require as many as 4 fixed wing and 51 helicopter round

trips over the course of 13-17 days each field season. Several NPS and permitted research projects would also use helicopters each field season. Flight paths would traverse designated wilderness, and aircraft would land in designated wilderness. There would be minor adverse cumulative impacts on wilderness solitude.

The presence and operation of 4 RAWS in designated wilderness or wilderness-suitable lands, and as many as 35 seismic stations in WRST (of which 34 could be in designated wilderness) would have minor adverse cumulative impacts on wilderness naturalness.

Park visitors contacting RAWS and seismic equipment at close range, and exposed to noise from aircraft flying over and landing in designated wilderness to install or maintain equipment would have a diminished visitor experience. There would be minor adverse cumulative impacts on the wilderness visitor experience.

*Conclusion*
Alternative C would have negligible, temporary, and long-term minor adverse impacts on wilderness values.

There would be minor adverse cumulative impacts on wilderness solitude, naturalness, and visitor experience.

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.

### 4.5.2 Wildlife
Impacts currently occurring at existing RAWS and snow measurement devices remaining in operation would continue to affect wildlife. Snow courses and aerial markers mark points on the ground, and have a negligible footprint. RAWS have a footprint of about 100 square feet, or about 0.002 acre; total direct impacts to wildlife habitat from RAWS and related monitoring equipment would be about 0.02 acre. Possible upgrades to the existing monitoring stations with replacement or additional equipment would temporarily displace wildlife in the immediate vicinity during installation. Disturbance would be temporary as upgrades would likely require only one day at each site for up to eight hours per day. Maintenance at the sites is already occurring, so wildlife disturbance from any additional maintenance on new equipment would be negligible. The footprint of additional equipment would directly affect wildlife habitat in the long term, but the area of habitat loss would be extremely minor.

*Cumulative Impacts*
RAWS and related snow measurement devices would directly affect about 0.02 acre of habitat. Existing seismic stations have directly affected about 0.003 acre of habitat. Future STEEP seismic stations would affect an additional 0.009 acre of habitat. In summary, 49 RAWS and seismic stations would directly affect about 0.03 acre of wildlife habitat. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, would cause localized, temporary displacement of wildlife. Combined with past mining development,

human habitation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on wildlife.

*Conclusion*
Alternative C would likely result in negligible, temporary, localized, adverse impacts to wildlife and negligible, long-term, localized, adverse impacts to wildlife habitat from possible new equipment at existing sites.

There would be minor adverse cumulative impacts on wildlife.

The level of impact to wildlife 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 Vegetation

Snow courses and aerial mark points on the ground, and have a negligible footprint. RAWS have a footprint of about 100 square feet; total direct impacts to vegetation would be about 0.002 acre. There would be localized vegetation trampling from foot traffic. The sites range in vegetation cover and height from sparse and low (such as at Cheshnina in the Cheshnina area) to dense and knee-high (such as at Tebay Cabin in the Tebay Lakes area) (NPS, 2004). Gabions filled with rocks would surround each of the four legs of the precipitation tower and anchor down the base in the center (Martin, 2005). The gabions around the legs measure approximately two by six feet and the central gabion is four by four feet. The tri-leg tower would be anchored by rebar with rocks are piled up in a two by two foot area around each leg. In addition to vegetation being trampled or destroyed by these anchoring techniques, small areas of vegetation may require clearing beneath and around the towers depending on the site. The area of vegetation trampling from foot traffic during installation and maintenance would likely be minimal and limited to the area immediately surrounding the weather stations.

*Cumulative Impacts*
RAWS and related snow measurement devices would directly affect about 0.02 acre of vegetation. Existing seismic stations have directly affected about 0.003 acre of vegetation. Future STEEP seismic stations would affect an additional 0.009 acre of vegetation. In summary, 45 RAWS and seismic stations would directly affect about 0.03 acre of vegetation. Park visitation in the backcountry, and the presence of field crews maintaining RAWS and seismic stations, would cause localized, temporary trampling of vegetation. Combined with past mining development, human habituation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on vegetation.

*Conclusion*
Alternative C would have negligible, temporary, localized, adverse impacts and negligible, long-term, localized adverse impacts to vegetation.

There would be minor adverse cumulative impacts to vegetation.

The level of impacts to vegetation anticipated from Alternative C would not result in an 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 Soils

Snow courses and aerial markers mark points on the ground, and have a negligible footprint. RAWS have a footprint of about 100 square feet; total direct impacts to soils would be about 0.02 acre. There would also be localized trampling of surface soils from foot traffic. It is likely that soil thickness varies considerably among sites, from none to relatively thick. Where soils are patchy or do not exist (such as on nunataks in the high-mountain elevation sites), impacts on soils would be negligible or non-existent. The area of soil compaction from foot traffic during installation and maintenance would be minimal and limited to the area immediately surrounding the equipment.

*Cumulative Impacts*

Installation and maintenance of new and existing RAWS and seismic stations would have negligible adverse short- and long-term impacts on soils. Park visitation in the backcountry, and the presence of field crews performing station maintenance would also have negligible adverse impacts on soils from localized, temporary trampling of the ground surface. Combined with past mining development, human habitation, roads, buildings, and land applications within WRST, there would be minor adverse cumulative impacts on soils.

*Conclusion*

Alternative C would result in minor, localized, long-term, adverse impacts to soils from soil disturbance and compaction during installation and maintenance of RAWS.

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.

### 4.5.5 Cultural Resources

The existing remote automated weather stations at the Chisana Town Site and Chicken Air Strip are located within the Chisana Historic District. These stations would be maintained under this alternative, however, the stations are not in any way materially affecting the character of these historic districts and their maintenance should not require activities that would affect the district. As a result, no impacts to cultural resources would be expected.

*Cumulative Impacts*

Given past mining development, human habitation, roads, buildings and land applications within WRST, there would be minor adverse cumulative impacts on cultural resources.

*Conclusion*

Alternative C would likely result in no or negligible impacts to cultural resources.

There would be minor adverse cumulative impacts on cultural resources.

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.

### 4.5.6 Park Management

With Alternative C, the ability of WRST management and the NPS to fulfill the inventory and monitoring program, understand ecosystems, and adequately manage natural resources would be enhanced.

*Cumulative Impacts*

There would be minor long-term adverse cumulative impacts on the ability of WRST management to fulfill national mandates for environmental monitoring and resource management.

*Conclusion*

Alternative C would have minor long-term beneficial impacts on park management arising from increased knowledge and information essential for understanding ecosystems and adequately managing park resources.

# 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

**U.S. Department of the Interior, National Park Service**
Steve Hunt, NEPA Coordinator/Contracting Officers Representative, WRST
Danny Rosenkrans, Geologist, WRST
Vicki Snitzler, Park Planner, WRST
Pam Sousanes, Environmental Protection Specialist, Denali National Park and Preserve
Glen Yankus, Environmental Protection Specialist, Alaska Regional Office
Judy Alderson, Wilderness Coordinator, Alaska Regional Office

**The Mangi Environmental Group**
Phil Sczerzenie, Project Manager and Senior Analyst
Eveline Martin, Biologist, NEPA Specialist
Tim Gaul, GIS Mapping
Julia Yuan, GIS Mapping

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# Appendix A

# ANILCA SECTION 810(a)

# SUMMARY EVALUATION AND FINDINGS

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# ANILCA SECTION 810(a) SUMMARY EVALUATION AND FINDINGS

## I. INTRODUCTION

This analysis was prepared to comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA), which requires that the impact of federal actions on subsistence activities be analyzed. Specifically, it summarizes the evaluations of potential restrictions to subsistence activities which could result from installing and maintaining remote automated weather monitoring stations (RAWS) at as many as 10 additional locations within Wrangell-St. Elias National Park and Preserve. The weather stations would become part of the Central Alaska Network climate monitoring system providing baseline weather information and supporting climate trend analysis.

## 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" (ANILCA, section 810(a)).

## III. PROPOSED ACTION ON FEDERAL LANDS

The National Park Service is considering three alternatives for the installation and maintenance of remote automated weather monitoring stations (RAWS) at as many as 10 locations within Wrangell-St. Elias National Park and Preserve. Each unmanned station would consist of a battery-powered weather instrumentation unit and a separate snowfall measuring unit. Four of the stations would be permanent and up to six would be mobile units. The proposed new sites will supplement already existing weather monitoring sites in the park. The weather stations would become part of the Central Alaska Network climate monitoring system providing baseline weather information and supporting climate trend analysis. The Central Alaska Network is part of the National Park Service's Inventory and Monitoring Program. A full discussion of the alternatives and their anticipated effects is presented in the Environmental Assessment (EA) for the Climate Monitoring Program. The alternatives are summarized briefly below.

**Alternative A – No Action:** The National Park Service (NPS) would continue to monitor weather and assess climate change using the existing network of remote automated weather stations, including snow courses and aerial markers, that currently operate in Wrangell St. Elias. Currently, there are five RAWS sites, and snow courses or aerial markers are located at another four sites. No new weather stations would be established.

**Alternative B – Expand Park Climate Monitoring Program** (NPS preferred alternative): In addition to the continued use of existing weather monitoring stations, new RAWS sites would be established at as many as ten additional locations along a north-south corridor transecting the major ecosystems within the park and preserve. Several of the sites proposed for the new weather stations would be located in higher elevation sites, to complement the existing sites, many of which are at lower elevation locations. Helicopters or fixed-wing aircraft would be used to carry personnel and equipment to the sites for installation and periodic maintenance.

**Alternative C – Limited Expansion of Park Climate Monitoring Program:** The NPS would continue to monitor weather and assess climate change using existing weather and climate monitoring stations. In addition, it would install and maintain one new permanent RAWS and as

many as four mobile stations. No climate monitoring equipment would be installed at sites within the Wrangell-St. Elias wilderness. Helicopters or fixed-wing aircraft would be used to carry personnel and equipment to the sites for installation and periodic maintenance.

## 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 Management 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 that could be impacted.

The evaluation criteria are:

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;

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

The potential to reduce populations:

The proposed installation and maintenance of the weather stations has no potential to affect subsistence fish resources, their distribution or habitat. Installation and maintenance of the weather stations could temporary displace wildlife in the immediate vicinity. The footprint of the weather stations is quite small, 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 along with the other alternatives discussed in this analysis would have no direct impact on allowed means of subsistence access, nor would they affect the areas open to subsistence users or access routes to those areas. Thus, the proposed action as well as the other alternatives discussed in this analysis should have no effect on 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. 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 B
# CLIMATE MONITORING EQUIPMENT

## CLIMATE MONITORING EQUIPMENT

**RAWS.** Each station would consist of two towers: a precipitation tower and a tri-leg tower. The precipitation tower would be a 15.5-foot tall steel tower, securely anchored to the ground with steel pins. The base of the tower also would be weighted with a rock-filled gabion. These are the design specifications used for the RAWS on Harding Ice Field in Kenai Fjords National Park; actual height and anchoring technique may vary slightly according to site conditions prevailing at WRST. The tower has 4 legs on a 5-foot wide base and tapers to 1.5 feet wide at the top. A 4-foot diameter windscreen made up of aluminum flaps is situated on the top. This tower would hold a precipitation gauge and possibly other instruments. An 8-inch diameter PVC pipe antifreeze reservoir would extend through the length of the tower. The pipe would be filled with an antifreeze mixture consisting of 45% propylene glycol, 45% ethyl alcohol and 10% water. The antifreeze mixture melts frozen precipitation (snow, sleet, hail) and is displaced by the accumulating precipitation. The displaced fluid flows through a tube and into a tipping-bucket rain gauge, and then flows through a tube into 5-gallon jerry cans or other similar containers located at the base of the tower. The concentration of the antifreeze mixture (which is constantly diluted as precipitation is added) must remain strong enough to prevent freezing during anticipated winter temperatures of up to minus 40 degrees F. All potentially hazardous materials would be protected by secondary containment, and all containers would be highly resistant to damage by animals. The precipitation gauge described above is used by the U.S. Geological Service. NPS may consider using a rocket type accumulating precipitation gauge used by NRCS for snow telemetry (SNOTEL) sites. The precipitation gauge would be constructed from irrigation pipe with a pressure transducer in the bottom of the device. A mixture of propylene glycol would be used in the reservoir to melt falling snow; the propylene glycol would be contained in the system. The height of the gauge would extend 4 inches above the maximum annual snowfall and would vary from site to site.

The second tower would be a ten-foot mast on a tripod base, and would utilize a Campbell Scientific, Inc. CR10X datalogger and Seimac High Data Rate GOES satellite data transmitter. Basic instrumentation would include air temperature, relative humidity, wind speed and direction, and incoming solar radiation. Helicopters or fixed-wing aircraft will be used to carry personnel and equipment to the sites for installation and to carry staff for periodic maintenance

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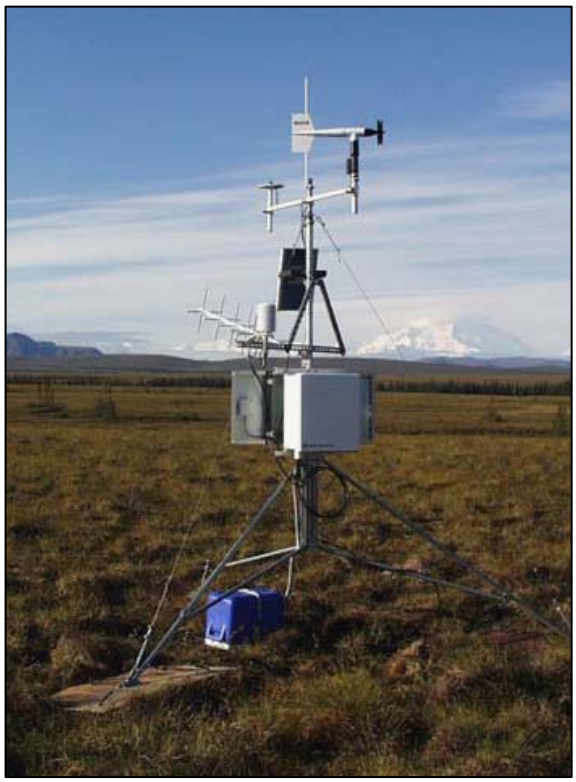


**Tri-leg Tower**

**Precipitation Tower**

**Snow Courses.** A snow course is a permanent site that represents snowpack conditions at a given elevation in a given area. The snow course is generally a 100' long transect with five sampling points. The sampling points are marked with a 4' to 6' (depending on the annual snow at the location) Carsonite marker that has been driven into the ground. The information collected for the snow surveys includes snow depth, length of snow core, and sample weight. Snow density and snow water equivalent (SWE) are calculated from the collected data. Figure 2 shows an example of a snow course within Denali National Park and Preserve.

**Example of Snow Course at Stampede, Denali, AK**

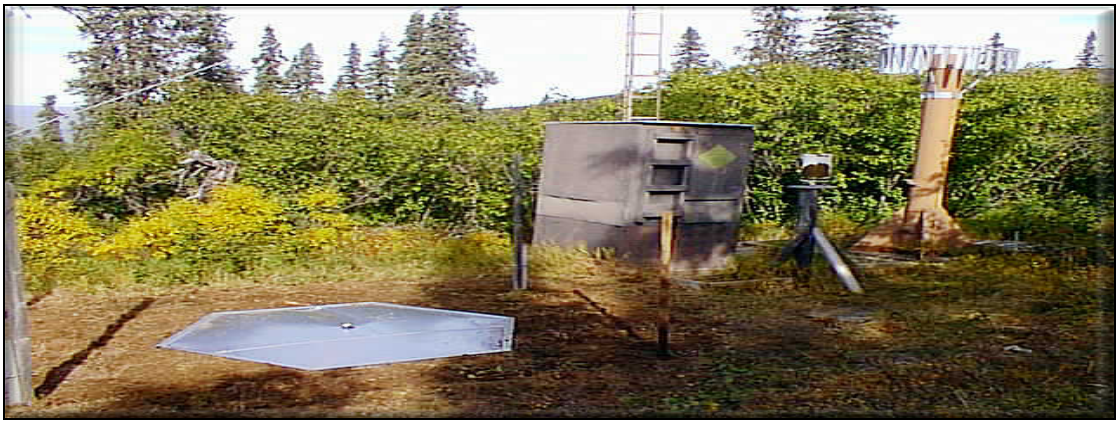
**Aerial Snow Markers.** An aerial snow marker is essentially a one-point snow course. An aerial marker consists of a vertical support or post to which crossbars are attached at predetermined intervals (see Figure 3). The post is 8' to 12' high depending on the local snow conditions. The crossbars are made of 6" x 24" x 1/8" steel painted red, and 6" x 12" x 1/8" steel painted black. An aerial observer counts the cross pieces on the marker and draws a line across the diagram on the field data sheet to record the depth of the snow.

**Example of an aerial snow marker**

**SNOTEL.** Each SNOTEL station will include a 10' tripod with meteorological sensors attached, a rocket type year-round precipitation gauge and a small shelter (4' x 4' x 8') with a 20' tower attached for a solar panel and telemetry antenna. The precipitation gauge would be constructed from irrigation pipe with a pressure transducer in the bottom of the device. The gauge will have an Alter shield attached to the top. A mixture of propylene glycol would be used in the reservoir to melt the falling snow (the glycol and precipitation would be contained in the system). The shelter will sit on 16" x 16" concrete pads at each corner. The precipitation gauge will also be anchored on a 16" x 16" concrete pad. The precipitation gauge height would be 2-3' above the average snow depth.

**Example of SNOTEL site at Coldfoot**

**Snow Pillow.** A snow pillow consists of a 6' Hypalon snow pillow that is filled with propylene glycol encased in a frame and sheeting (Fig. 4). Below the pillow is a pressure transducer that measures the amount of snow that falls on the pillow surface. Snow pillows are usually co-located with a snow course or a SNOTEL site described below.



**Example of a snow pillow**

# Appendix C

## 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 manager[1] 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

[1] Definitions for these positions can be found in Chapter 2 of the Interagency Helicopter Operations Guide (http://www.nifc.gov/ihog/).