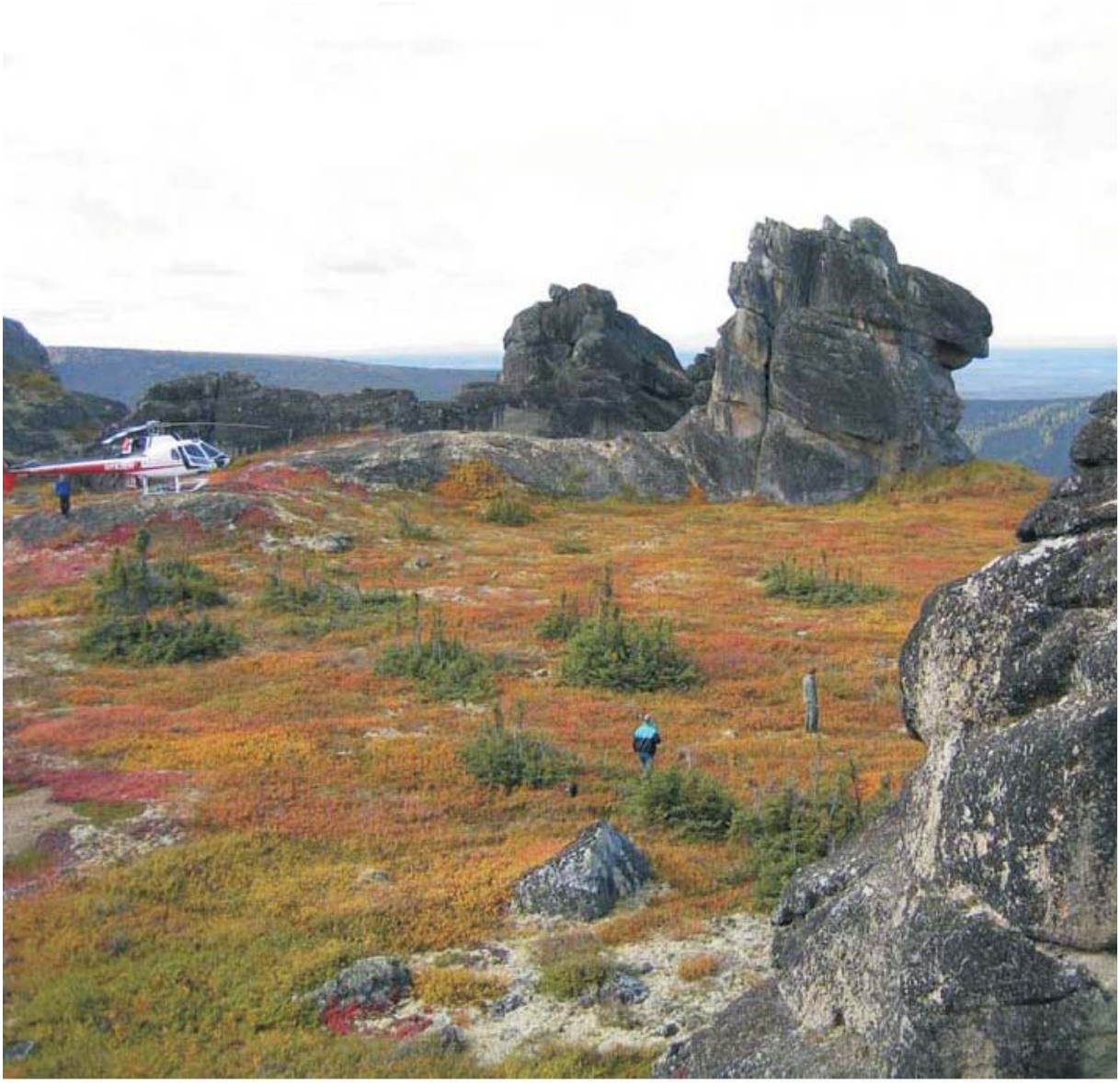
Environmental Assessment

Seismometer Installation at Castle Rocks



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1.0 PURPOSE and NEED

1.1 Purpose of Action

The National Park Service (NPS) is considering a request from the Alaska Earthquake Information Center (AEIC) (located at the University of Alaska Fairbanks Geophysical Institute) to install a new seismic monitoring station in Denali National Park and Preserve (DENA). This station would be located near the Castle Rocks by the southern edge of the northwestern preserve unit. The proposed seismometer would complement existing seismometers in DENA on Thorofare Ridge and Wickersham Dome and outside DENA at Lake Minchumina and Purkey Pile. These sites are used to monitor frequent seismic activity along and near the western portion of the Denali Fault. Data from the site would be analyzed to improve earthquake detection and hazard forecasting in the region. Figure 1 shows the location of DENA, the Denali Fault, and existing and proposed seismic monitoring devices in and around DENA.

This environmental assessment (EA) analyzes the proposed action and alternatives and their impacts on the environment. The EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and regulations of the Council on Environmental Quality (40 CFR 1508.9).

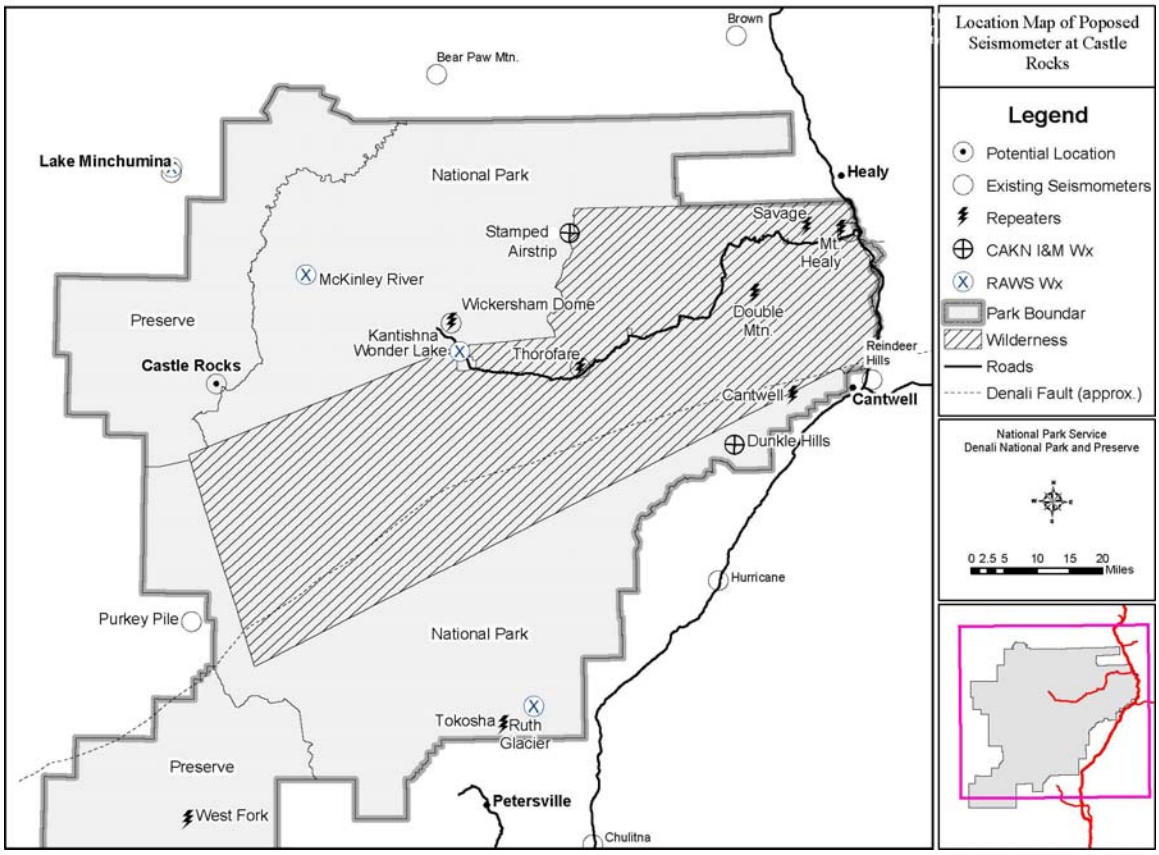

Figure 1.1. Location of proposed and existing seismic monitors and other telecom sites.

1.2 Need for Action

The AEIC proposes to install the new seismometer at Castle Rocks to identify segmentation along the Denali Fault and fault creep for improved earthquake detection and hazard forecasting. AEIC research data indicate regional seismic hazards in the Interior of Alaska are greatly influenced by the Denali Fault, which runs through the middle of the park and on the north side of Mount McKinley. To the east of the park, the Denali Fault ruptured on November 3, 2002, to produce a magnitude 7.9 earthquake, the largest in the world that year. Stress may be building in the western part of the fault in the park leading to another strong earthquake. A Castle Rocks seismometer would fill a critical regional gap in the seismic monitoring network to improve the spatial distribution of data collection and to determine more closely if stress is accumulating along unmonitored western portions of this fault system.

Currently the most active region of micro-earthquakes is associated with the fault in the vicinity of Kantishna, where micro-earthquakes may decrease the potential for large or great events. AEIC plans to study the spatial distribution of micro-earthquake activity in several regions along the fault in order to determine if micro-earthquake activity is present and to what extent the Denali Fault is segmented into smaller active segments. Seismologists believe more monitoring is needed to the west in the vicinity of the Castle Rocks to assess the possibility of more large earthquakes in the region. In the event of a large seismic event, the proposed site would provide valuable detail in researching the rupture.

The Castle Rocks site is the only location near the Denali Fault and north of the Alaska Range in the region of western DENA where it is possible to install a seismometer on or near exposed bedrock with a clear path for data telemetry to other points in the AEIC network. A location on bedrock is of critical importance because the quality of seismic signals detected by a seismometer is directly related to the amount of signal attenuation caused by any soils or unconsolidated materials overlying the bedrock in a given area. A seismometer located on bedrock would encounter little or no attenuation of seismic signals, allowing significantly greater accuracy in the analysis of earthquake locations, depths, magnitudes, and mechanisms. Stations located on bedrock tend to be more accurate than those located on unconsolidated materials.

The ability to detect and characterize micro-earthquakes (seismic events of magnitudes 0.1 to 3.0) is a function of the quality of the seismic signals that are detected. Micro-earthquakes are of particular importance in this region because their detection may reveal activity on and near the western Denali Fault and the numerous splay faults that make up the Kantishna seismic cluster. This information could tell us if significant tectonic stress is accumulating on the fault over time, which could lead to large magnitude earthquakes capable of causing significant damage. The information could also inform seismologists where the stress is being released over time by the more numerous smaller magnitude seismic events.

The seismic network gap refers to the distribution of seismometers around the area of concern. Presently, seismometers at Wickersham Dome and Thorofare Mountain are the closest stations to the area of concern and they provide coverage to the north and east. A gap exits to the west that would be partially closed by a station at Castle Rocks. The geographic distribution of seismometer locations greatly influences the accuracy of determinations of earthquake locations, magnitudes, and mechanisms. The current configuration of seismometers is skewing earthquake locations toward the existing stations in the north and east. A seismometer at Castle Rocks would allow the calculation of more accurate earthquake locations because of its location on the opposite side of the area of concern. The existing seismic station at Lake Minchumina is not located on bedrock, which limits its usefulness in accurately determining earthquake magnitudes and depth. The Lake Minchumina station is also too distant from the Denali Fault to facilitate detection of micro-earthquakes. The station recently installed at Purkey Pile has helped to close the network gap to the southwest, but it alone does not adequately counter balance the concentration of stations to the north and east.

The location of Castle Rocks near the western Denali Fault would also facilitate more accurate calculation of earthquake magnitudes and mechanisms by virtue of the station's close proximity to the fault. AEIC estimates the increase in accuracy of earthquake location and magnitude calculations in the region would be about 50%.

Without the installation of a new seismic monitoring station to fill the western Denali gap in the AEIC seismic network, scientists conclude they could not accurately detect and locate micro-earthquakes on and near the western Denali Fault. Therefore, they also find it difficult, if not impossible, to assess the potential for large magnitude seismic events on the fault in this region. A hypothetical ideal density of stations in this region to achieve the best possible accuracy would be roughly one station every 10-20 kilometers on an orthogonal grid. The scarcity of locations with bedrock at or near the surface naturally limits AEIC’s ability to achieve this. Furthermore, the need to minimize installations of equipment in areas suitable for or designated as Wilderness in Denali National Park and Preserve is another significant limiting factor. Therefore, the placement of a station at Castle Rocks is seen as part of the minimum expansion of the AEIC network necessary to achieve the desired increase in earthquake detection ability and accuracy.

An understanding of the potential for large magnitude earthquakes on the western part of the Denali Fault would allow the NPS to anticipate large scale natural events that could alter the ecosystems in the area. Landslides, ground surface ruptures, and slope failures could result from prolonged, high intensity shaking. Glaciers may be inundated with rock debris from landslides, as was the case in central and eastern Alaska Range in 2002, which would alter the annual discharge of water into glacial fed rivers and streams and change the long term response of those glaciers to climate. Stream flow and turbidity may be affected in the short term by slope failures or changes in glacier mass balance, and impoundments could create hazardous downstream flooding zones. Slope failures and landslides may alter or eliminate habitat for species that reside in steep mountainous terrain. An understanding of the frequency of large magnitude seismic events of

sufficient size to cause ecosystem level changes would improve the Park's ability to understand and anticipate long-term ecological change.

In summary, the placement of a seismometer at Castle Rocks addresses two critical needs for seismic monitoring of the western Denali Fault:

1) It closes a "gap" in AEIC network of seismic sensors, which would improve the accuracy of earthquake locations in the region by about 50%, and

2) It provides a location on bedrock that would allow the best possible detection of seismic signals.

1.3 Park Purpose and Significance

On February 26, 1917, Congress established the original Mount McKinley National Park as "… a public park for the benefit and enjoyment of the people… for recreation purposes by the public and for the preservation of animals, birds, and fish and for the preservation of the natural curiosities and scenic beauties thereof … said park shall be, and is hereby established as a game refuge." (39 Statute 938). In 1922 and 1932 subsequent legislation expanded the park boundaries to the east and north, including lands in the Wonder Lake area, for the purpose of protecting winter game habitat, especially for moose.

In 1980 Congress passed and President Carter signed the Alaska National Interest Lands Conservation Act (ANILCA). Section 202(3)(a) of ANILCA added about 3.8 million acres to Mount McKinley National Park and renamed it as Denali National Park and Preserve. The park and preserve additions are to be managed for the following purposes:

> To protect and interpret the entire mountain massif, and additional scenic mountain peaks and formations; and to protect habitat for, and populations of fish and wildlife including, but not limited to, brown/grizzly bears, moose, caribou, Dall sheep, wolves, swans and other waterfowl; 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 additions where such uses are traditional.

ANILCA Title I recognizes that the purposes for the new conservations system units includes their preservation "for the benefit, use, education, and inspiration of present and future generations … that contain nationally significant natural, scenic, … geological, scientific, wilderness, and recreational values…." Furthermore, it was the intent of Congress to, "… maintain opportunities for scientific research and undisturbed ecosystems."

Section 701 (1) of ANILCA established the Denali Wilderness of approximately 1.9 million acres, which is basically all of the former Mount McKinley National Park minus

the park entrance area and road corridor to the old boundary near Wonder Lake with various development nodes along the road corridor.

ANILCA Section 1310(b) allows for the establishment, operation, and maintenance of new navigation and other facilities within a conservation system unit after consultation with the Secretary of the Interior and in accordance with mutually agreed terms and conditions that minimize the adverse effects of such activities within such unit.

1.4 Relationship to Other Park Planning

The DENA General Management Plan and Wilderness Suitability Review (NPS 1986) addressed park management throughout the park and preserve. The Wilderness Suitability Review found all of DENA suitable for wilderness designation *except* the park entrance area, the Denali Park Road Corridor, and the Kantishna Mining District.

The DENA Wilderness Recommendation Final EIS (NPS 1988) recommended wilderness for all of the park additions *except* the Kantishna Mining District, clusters of private inholdings, and the southwest and northwest park preserve areas (including Castle Rocks). Though the NPS proposal for additional wilderness designation in DENA was recommended by the NPS Alaska Regional Director and the NPS Director, the Assistant to the Secretary of the Interior for Parks and Refuges did not recommend the action to the Secretary or President, so the proposal was never forwarded to Congress for a decision. At this time the Castle Rocks area is still in an area determined to be suitable for wilderness designation.

The Revised Draft Denali Backcountry Management Plan (NPS 2005) addresses communications facilities, and in all alternatives new facilities would be considered on a case by case basis following the Wilderness Minimum Requirements/ Minimum Tool analysis outlined in appendix E of the EIS. New structures would be attached to existing structures wherever possible. The NPS proposes to phase in the use of satellite phones in the backcountry to avoid the need for new temporary or permanent communication facilities in backcountry areas. A final EIS and Record of Decision have not yet been completed for the Denali Backcountry Management Plan.

1.5 Background Information

Representing the AEIC the University of Alaska Fairbanks Geophysical Institute (UAF-GI) initiated discussions with park staff in fall 2003 regarding a seismic monitoring site at Castle Rocks. The UAF-GI submitted a formal application in April 2004 for a seismic site at Castle Rocks. After a study plan amendment was submitted in May 2004, the NPS replied that an EA was needed and that we could combine that analysis in an NPS EA for other new telecommunications proposals in the park. During the summer of 2004 the NPS received clarifying information from the UAF-GI on installations and communications details for the project. UAF-GI later requested permission to install a seismometer on Double Mountain near an existing seismic data relay station. In September 2004, NPS and UAF-GI staff made a site visit to Castle Rocks to investigate

biological and cultural resources at the proposed installation location. In March 2005 the NPS realized it had insufficient information for new radio repeater and wireless internet installations in the park, so the seismometer project NEPA was disengaged from the more comprehensive telecommunications EA then being prepared for the park and preserve. The Double Mountain repeater site may need to be moved, so a seismometer there would also be postponed. The AEIC would like to install a new seismometer near Castle Rocks in summer of 2005, so the NPS is proceeding with a separate EA to address this request.

Improved monitoring of the Denali Fault is also called for by the U.S. Geological Survey and the Advanced National Seismic System (ANSS). Stations within the Alaska Earthquake Information Center's seismic statewide monitoring network are also part of the ANSS network. Published in 2002, the "Technical Guidelines for the Implementation of the Advanced National Seismic System" contains the following language regarding desired station locations and density and refers specifically to monitoring of activity on the Denali Fault:

> Active fault monitoring stations are designed for detailed seismic observation of moderately to highly active earthquake sources to capture the near future strong to major earthquakes in the country (M6.5+) and seismicity associated with active volcanoes. This monitoring in both urban and remote settings is targeted on well-known high-activity faults and source zones (e.g., San Andreas fault zone, Wasatch fault zone, Denali fault, and the Eastern Sierran fault system), moderate activity fault systems and regions of concentrated historic seismicity (e.g., Cascadia subduction one, Puget Sound region, Teton fault zone(?), New Madrid zone, and Charleston, SC, and volcanoes in the Pacific Northwest, Hawaii, and Alaska). This kind of monitoring requires 10 km or closer spacing of stations that have high clipping levels and good micro earthquake detection, with broadband instruments at 50- to 70-km spacing. Data obtained from monitoring stations near significant earthquakes even in areas remote from urban areas are urgently needed to improve ground motion predictive models for high-amplitude motions on a wide range of site geologic conditions from rock to very soft soils.

The proposed station at Castle Rocks would fit the criteria of both strong ground motion and broadband instrumentation. The Castle Rocks station would be significantly more distant from the nearest broadband seismometers than desired for the ANSS network, but the lack of other suitable locations in the western Denali region make this the best possible location to improve station density and network coverage.

1.6 Issues Considered for Evaluation

To focus the EA, the NPS selected specific issues for further analysis. Discussions of the affected environment and environmental consequences related to each alternative focus on the selected issue topics. A brief rationale for the selection of each issue is given below.

1.6.1 Effects on Geo-hazard Monitoring and Human Safety

Gaps in seismic monitoring of active earthquake zones exist to the east and west of the Kantishna Hills area of Denali National Park and Preserve. Flat spaces are needed for equipment shelters, communication antennae, and helipads, but site structures need to be placed outside a helipad zone for operational safety.

1.6.2 Effects on Natural Sound Environment

Helicopters are used for site installation and annual maintenance, and they produce loud, pulsating, mechanical noises that would disrupt natural sounds in the park. Larger and louder helicopters would be used to transport and install new equipment than for routine annual maintenance.

1.6.3 Effects on Vegetation

The project could result in the removal or disturbance of small plots of tundra vegetation where instruments are installed and where helicopters land.

1.6.4 Effects on Visual Quality and Aesthetics

Equipment shelters and antenna sizes, color, and shapes could all affect site visibility and scenic qualities in the area. Solar panels associated with remote communications facilities could affect the natural scenic integrity of the park at greater distances.

1.6.5 Effects on Wilderness

The proposed seismic monitoring site at Castle Rocks occurs outside designated wilderness but is within an area found suitable for wilderness designation in the GMP and Wilderness Suitability Review (NPS 1986). The area is not within an area the NPS proposed for wilderness, however, in the Wilderness Recommendations FEIS (NPS 1988). NPS policies state the NPS will take no action that would diminish the wilderness suitability of an area possessing wilderness characteristics until the legislative process on wilderness designation has been completed (NPS 2001).

1.6.6 Effects on Wildlife and Habitat

A raptor nest occurs on the rocky crags near Castle Rocks and helicopter access to a seismic station could disrupt nesting. Bears and small mammals could visit alpine sites with communications equipment and be attracted to and damage wires, solar panels, and other equipment.

1.7 Issues Dismissed from Further Evaluation

These topics were considered but dismissed from further evaluation because of the reasons provided below.

1.7.1 Effects on Cultural Resources

Any new site would have reviews and clearance pursuant to Section 106 of the 1966 National Historic Preservation Act. Park Cultural Resources Specialist Ann Kain found no evidence of archeological sites, such as artifacts, markings, or other indications of potential historic or pre-historic sites. No surface water is available locally, making the

site unlikely as a camp or occupation site. A description of historical activities in the vicinity around Castle Rocks makes no mention of use at the proposed site.

1.7.2 Effects Endangered, Threatened, Species of Special Concern

An active raptor nest exists in the Castle Rocks area, which could be used by the American peregrine falcon that was recently removed from the endangered species list. There are no known other threatened and endangered species or their habitat at the proposed seismic monitoring site. No rare plants were found at the site during the ecological survey that was performed in conjunction with the soil survey in 2003. A floristic inventory of the park was completed in 2004 and didn't identify any plant species of concern in the immediate vicinity of Castle Rocks (Roland, 2004).

1.7.3 Effects on Floodplains and Wetlands

Because the seismic monitoring site would be located on a dry alpine site, the seismic installation and recurring maintenance activities would not have any effect on floodplains or wetlands.

1.7.4 Effects on Minority and Low-Income Populations

Executive Order 12898 requires federal agencies to incorporate environmental justice into their missions by identifying and addressing high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed project would not result in disproportionately high direct or indirect adverse effects on any minority or low-income population or community.

1.7.5 Effects on Subsistence Resources and Uses

Possible effects on subsistence user and subsistence resources from the proposed seismic monitoring site would be negligible. An ANILCA Section 810 subsistence evaluation is included in Appendix A.

1.8 Permit and Approval Needed to Complete the Project

The NPS would convert the special use permit to the UAF Geophysical Institute (operating the seismometers for AEIC) to a Research Permit. A Research Permit would detail the permitted station location, limits of installation, and use of the NPS facilities and other locations to safely manage fuel and landing of helicopters in the park. A Research Permit would be issued for five years; renewable upon a detailed project review. Investigator's Annual Reports (IARs) would be submitted to the NPS to assess the progress and effectiveness of the seismic monitoring program. Each research permitted project undergoes annual internal park review, when park personnel would discuss specific fieldwork schedules and plans for the upcoming UAF-GI field season. Park personnel would assess environmental effects and contact UAF-GI personnel for assistance in resolving any problems. The monitoring program would be evaluated after five years, after which a Research Permit could be re-issued. If any significant upgrades to the

seismograph stations or new stations are proposed, then additional NEPA compliance would be required.

2.0 DESCRIPTION of the ALTERNATIVES

2.1 Alternative A – No Action

This alternative would maintain the status quo, and no new seismic monitoring equipment would be installed by AEIC in Denali National Park and Preserve at Castle Rocks. As indicated in figure 1.1, two seismic monitoring sites would be retained at Wickersham Dome and Thorofare Ridge and seismic data relay stations would be maintained at Double Mountain and Mount Healy. A temporary wireless internet test site is collocated with the seismic relay station on Double Mountain. Periodic access to these sites for facility maintenance would be by small helicopter about once every year.

2.2 Alternative B – AEIC Proposal to Install New Seismometer at Castle Rocks in 2005 (NPS Preferred)

The UAF-GI proposes to install a new seismic monitoring station for AEIC at Castle Rocks (63.4193°N by 152.0760°W and about 1,880 feet elevation), in the National Preserve, about five miles outside the western boundary of the designated Denali Wilderness (See figure 2.1). Data would be telecommunicated from Castle Rocks to Lake Minchumina where a reliable satellite data uplink exists, so no data receiver or repeater upgrade or would be needed at Wickersham Dome. Access to Castle Rocks would be by contract helicopter, which would be needed four to six trips over two to three days to transport and install the monitoring station equipment. A helicopter would also be needed for access to perform routine annual maintenance for a few hours at the site about once per year for one day at the site.

The footprint for the new seismic monitoring station at Castle Rocks would be about 120 square feet. A specially designed fiberglass hut would house an antenna, electronic equipment, and gel cell batteries that are charged by a solar panel array attached to the hut. The hut would be gel-coated a color to blend with surrounding area so it would not be highly visible (see figures 2.2 and 2.3). A seismometer would be attached to the bedrock at each new location up to 50 meters from the equipment huts. The seismometer is housed in a plastic “seismic drum”, roughly the size and shape of a 55-gallon barrel. The seismic drum is placed in a similarly-sized hole, directly on bedrock, and is cemented to the bedrock with a 2-4” veneer of concrete (Figure 12). A layer of concrete is also poured inside the seismic drum, on which the seismometer sits. This design assures secure, adequate coupling between the seismometer and bedrock. A ground line would connect the seismometer to the communications hut, which would be in a shallow cut in the tundra mat to prevent disruption from animals and other natural phenomena (See figure 2.4). Three options for a seismometer at Castle Rocks and the NPS preferred site are shown in figure 2.5 and 2.6.

Figure 2.1. Alaska High Altitude Photograph (Color Infrared) of project area at a scale of about 1:60,000, north is up. The proposed alternative is within the indicated area. National Park/Preserve boundary is approximate.

Figure 2.2. Typical fiberglass seismic hut, same as is proposed for the Castle Rocks installation. Solar panels provide power, guy wires prevent movement. Door is on opposite side. Hut is 16 square feet (4'x4'), 5 feet high, and gray to limit visibility.

Figure 2.3. Inside of typical hut where instruments are housed. Huts are locked or bolted closed to prevent animals from intruding.

Figure 2.4. Example of seismic drum and buried cable to equipment hut.

Figure 2.5. View of proposed seismic site from approx 500' AGL looking ENE. Installation requires unobstructed view to the north for data transmission to station at Minchumina. Installation requires adequate southern exposure for solar powered system to be effective. Installation requires direct contact of seismometer (in plastic barrel) with bedrock. A site consists of a fiberglass hut that houses data transmission instruments and a plastic barrel that houses the seismometers. The hut and seismometer need to be separated by about 50' to reduce vibrations, they're connected by a wire set below the tundra mat. Sites A, B, and C meet the technical needs of the project and were evaluated during the site visit on 09/03/04. Site A is the NPS preferred site that is being evaluated.

2.3 Alternatives Considered but Eliminated from Further Consideration

The UAF GI verbally requested permission to install a seismometer at the Double Mountain data repeater site. This site is co-located with an NPS wireless internet site, however, which may need to be moved to a better location to provide communications along the Denali Park Road corridor. The NPS is testing and evaluating optimum locations for wireless internet communications and new radio repeaters during summer 2005, and a subsequent EA would evaluate new communications site proposals along with the proposed new seismometer at Double Mountain. Also, NPS personnel asked if data from the existing Wickersham Dome and Thorofare seismometer sites could be routed through a new Castle Rocks site and the Double Mountain repeater removed. AEIC indicated to NPS that the Thorofare station does not have a clear line to Castle

Rocks and no other telemetry path exists from the Thorofare Station. The NPS also notes the distance from Thorofare to Castle Rocks is about 35 miles, which is too far for reliable data transmission. The NPS believes, however, the Thorofare data could be relayed to the Wickersham station (which is currently done in the opposite direction) and then to Castle Rocks (about 22 miles from Castle Rocks and within the range of reliable data transmission), and out from Lake Minchumina via satellite. Removing the Double Mountain repeater, however, would defeat a standing proposal to collocate a new seismometer there with an NPS wireless internet relay station.

Figure 2.6. View of proposed site A, looking north. Person is standing approximately where hut would be located. Seismometer would be adjacent to rock approximately 40' south of person. Location is outside of main "castle".

2.4 Environmentally Preferred Alternative

The no action alternative is the environmentally preferred alternative because no new impacts to park resources and values would occur from the installation of a new seismometer at Castle Rocks.

2.5 Summary Table of Impacts of the Alternatives

Impact Topic	Alt. A – No Action	Alt. B – Proposed Action *NPS Preferred*
Geohazards & Human Safety	No effect on human health and safety or hazard forecasting.	Moderate beneficial effect on seismic monitoring and forecasting in the park.
Noise	No impacts to natural sounds in the area.	Minor adverse impact to the sound environment of the area.
Vegetation	No new impacts to vegetation.	Minor effect on 120 ft^2 of park tundra vegetation.
Visual Quality	No new impacts to visual quality of the area.	Minor effect on the visual quality and scenic integrity of the area.
Wilderness	No new impacts on wilderness.	No direct impacts on the Denali Wilderness, but an area suitable for wilderness designation would be adversely affected.
Wildlife & Habitat	No new impacts on wildlife and habitat.	Negligible impacts with mitigation measures to avoid critical bird nesting and migration periods

3.0 AFFECTED ENVIRONMENT

3.1 Geo-hazard Monitoring and Human Safety

Research data has indicated that regional seismic hazards in the Interior of Alaska are greatly influenced by the presence of the Denali Fault. On November 3, 2002 the Denali Fault ruptured creating a magnitude 7.9 earthquake. Also, it is essential to increase monitoring to study the possibility of another great earthquake rupturing through Denali Park and Preserve. The occurrence of high concentrations of micro-earthquakes on the fault could indicate that portions of the fault system are experiencing a seismic creep, thus decreasing the potential for large or great events. Currently, the most active region associated with the fault is the area in the vicinity of Kantishna. To monitor this region, AEIC has two seismic instruments that were established within the park boundary (Wickersham Dome and Thorofare). More recent seismometers have been established on the north side of this part of the Denali Fault at Bearpaw Mountain, Lake Minchumina, and Purkey Pile (see Figure 1.1). NPS and AEIC found a helicopter landing location safely distant from three site options for seismograph installations. See Figures 3.1 and 3.2.

3.2 Natural Sound Environment

The natural soundscape of the proposed site at Castle Rocks is relatively free from motorized intrusions. In this area, the existing amount of natural sound disturbance is no more than one motorized noise intrusion each day exceeding natural ambient sound (i.e., motorized noise does not exceed 40 dBA) and no more than 5% of any hour, essentially the duration of an overflight (military, commercial, or recreational) (NPS 2005).

3.3 Soils and Vegetation

The Castle Rocks area is part of the Alpine Low Mountains Subsection of the Kuskokwim Mountains Ecoregion. This part of the low mountains comprises an interior alpine biome in the western portion of Denali. The area receives a mean annual precipitation of 356mm to 549mm (14 to 22 inches) of precipitation and has a mean annual temperature of -2.8 to -2.0 degrees Celsius (27 to 28.4 degrees F).

The common name for the soil map unit is *Alpine Low Schist Mountain Summits with Continuous Permafrost*. The soil comes primarily from parent materials of mica-rich loess and schist cryoturbation. The parent materials are silty eolian deposits over gravelly cryoturbation derived from schist. There is a strong contrasting textural stratification at 0 to 33cm (13 inches) and permafrost at 88 to 150 cm (35 to 59 inches). The soils are moderately well drained, with no surface or shallow ground water evident at the site.

Vegetation covering the area is low birch, ericaceous (plants in Heath Family like blueberry, bearberry, and Labrador Tea) shrub, and sedge scrub. The 2004 Soil Survey

describes the potential natural vegetation as interior-tussock and ericaceous shrub/sedge scrub/shrub birch scrub.

3.4 Visual Quality and Aesthetics

The Castle Rocks area is a relatively high and open area in a region of the park that is otherwise generally lowlands characterized by open woodland, wetlands, and black-spruce forests. From Castle Rocks, one can see the Kantishna Hills, the Alaska Range, the Snohomish Hills near Lake Minchumina, and Bearpaw Mountain and others north of the park, and Castle Rocks could be seen from these locations that are 40 to 60 miles distant. It is a visually striking and unique place in that area with a generally circular pattern of rocks protruding from the otherwise bald hill, forming a shape that many feel resembles the profile of a castle. The site is prominent in the area, with the only obviously exposed bedrock for a large distance. There are no human structures easily visible from Castle Rocks, significant due to the expansive viewshed from the site.

3.5 Wilderness

The proposed site is in an area managed as suitable wilderness (NPS 1986). It has many of the qualities of designated and proposed wilderness, but has no formal designation (NPS 1988). The NPS manages all categories of wilderness including suitable, study, proposed, recommended, and designated as wilderness until the legislative process is completed (NPS 2001, Management Policies Section 6.3.1.) There are many wilderness qualities evident at the site, as defined by the 1964 Wilderness Act. It is an area where the earth and its community of life are untrammeled by man. It is an area of undeveloped land retaining its primeval character and influence, without permanent improvements or human habitation. The site appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable and has outstanding opportunities for solitude or a primitive and unconfined type of recreation. Wilderness may also contain ecological, geological, and other features of scientific, educational, scenic, or historical value.

3.6 Wildlife and Habitat

The site is in an area of suitable habitat for black bear, grizzly bear, marmot, pica, porcupine, caribou, moose, wolf, and various migratory and passerine birds. Areas of potential raptor nesting were observed, and suitable perch locations are abundant. Large flocks of sandhill cranes have been observed to land on the ridge to the southeast of the site during migration periods. No mammal den locations or evidence of recent use of the area by large mammals were observed during a September 2004 site visit.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Alternative A – No Action

4.1.1 Effects on Geo-Hazard Monitoring and Human Safety

Understanding of seismic activity in the western region of the park would remain limited because the seismometers are not arrayed in sufficient density along this part of the Denali Fault system. The ideal seismic array according to the U.S.G.S. and Advanced National Seismic System for important fault zones is 10-20 kilometers between each seismic station. The current distances between Wickersham Dome, Lake Minchumina, Purkey Pile, and Bearpaw Mountain stations are about 50 to 60 kilometers. The distance between Wickersham Dome and Thorofare seismic stations is a little less than 30 kilometers. The error of an earthquake location is highly dependent on a number of parameters (e.g. distance to nearest station, azimuthal coverage of seismic stations, depth to the hypocenter, and number of sensors). The situation for the western Denali Fault area is affected greatly by a large gap in the azimuthal coverage, which greatly increases the precision error and also has an adverse effect on the accuracy of the location. Typically the location suffers from trade-offs between the range toward the large gap in the network versus the depth and origin time of the earthquake.

Precision errors from the AEIC catalog range from a few kilometers to 10's of kilometers for particular events. When trying to assess the hazard from particular faults and fault types, it is difficult due to the uncertainty of the production of seismic events attributable to the various splay faults in the vicinity of the Denali Fault and the complicated region of the Kantishna cluster. The current array of seismic stations is skewing earthquake locations toward the east and north of Wickersham Dome and Thorofare Mountain. The accurate detection of fault creep, the location of micro-earthquakes and large events, and the build up or reduction of stress on various faults in the area would remain low with the current seismic station array.

Cumulative Effects: UNAVCO (www.unavco.org), a non-profit member-governed organization that supports Earth Science with high-precision geodetic and strain meter techniques, proposes to install 3 plate boundary observatory (PBO) sites within Denali National Park and Preserve in the next few years. These sites would be located near Wonder Lake, Yentna River, and Kahiltna Glacier. The highly accurate GPS sites would also improve the measurement of minor and major earth movements, possibly indicating if strain in earth's crust from seismic activity is occurring. The AEIC would like to install a seismometer with its relay station on Double Mountain once the NPS determines where collocated wireless internet equipment should be positioned. AEIC is also considering a future request for seismometers in Eagle Gorge of the McKinley River and somewhere on the north side of the Denali Fault between Birch Creek and Cache Creek. These two sites would further refine seismic monitoring along the Denali Fault in areas not yet monitored and closer to the fault line than Thorofare, Wickersham, or the proposed Castle Rocks sites.

Conclusions: The no action alternative would have no additional effect on human health and safety or hazard forecasting, nor would it affect the future potential for scientific research in the park as supported in ANILCA Title I.

4.1.2 Effects on the Natural Sound Environment

The no–action alternative would have no new effect on the natural soundscape of the park or preserve. Maintenance of existing seismometers and data repeaters with helicopter support would continue on Wickersham Dome, Thorofare Mountain, Double Mountain, and Mount Healy.

Cumulative Effects: Other effects to the soundscape in the project area would be from the occasional military, passenger jet, or small aircraft overflight or from helicopters operating in the area during firefighting season or for park inventory and monitoring activities, which would be an average of three or fewer perturbations per day. Other upcoming proposals such as PBO GPS sites and additional seismometers in the park as described in 4.1.1 would not affect the sound environment in the Castle Rocks area.

Conclusions: The no-action alternative would result in no additional impacts to natural sounds in the area, nor would it result in the impairment of the natural purposes and values for which the park was established.

4.1.3 Effects on Vegetation

No additional impact to vegetation and soils would occur under the no-action alternative.

Cumulative Effects: The PBO installations and other remote radio communications and weather stations in the park impact small areas of alpine vegetation, but these areas amount to less than one acre of effect, which has a measurable but minor effect to the hundreds of thousands of acres of alpine vegetation in the park and preserve.

Conclusions: The no-action alternative would result in no new impacts to vegetation in the park and preserve, nor would it result in the impairment of the ecosystem purposes and values for which the park was established.

4.1.4 Effects on Visual Quality

Visual quality/aesthetics would not change under the no-action alternative. Small seismic stations and repeaters would remain on Mount Healy, Double Mountain, Thorofare Mountain, and Wickersham Dome where they are collocated with NPS radio repeaters and other communications equipment.

Cumulative Effects: There are no existing or other proposed human constructions within sight of Castle Rocks, but two shared-use cabins used mostly by qualifying subsistence trappers exist within 10 miles of the Castle Rocks; one is at the southwest corner of Castle Rocks Lake about 6 miles south and the other on the western side of Live Trap Lake about 8 miles north. There are virtually no cumulative visual impacts to scenic quality of the area.

Conclusions: The no-action alternative would result in no new impacts to visual quality of the area, nor would it result in the impairment of the scenic purposes and values for which the park was established.

4.1.5 Effects on Wilderness

The no-action alternative would have no new impacts to designated wilderness areas or areas suitable for wilderness designation.

Cumulative Effects: : Three permanent communications and seismometer sites already exist within the designated Denali Wilderness. These are shown in figure 1.1 and are located at Thorofare Mountain, Double Mountain, and Savage Ridge. The Thorofare Mountain site was established before ANILCA designated the Denali Wilderness. The park allowed a seismometer information relay station to be installed on Double Mountain in 2001 after the seismometers were upgraded from analog to digital systems. A temporary wireless communications site was collocated there a couple years later. Six other permanent remote communications sites occur within the park extension and are in areas suitable for wilderness and proposed by the NPS for future wilderness designation. The West Yenta River radio repeater is in the preserve, which was not proposed for wilderness designation (NPS 1988). The NPS is considering proposing one more radio repeater in the vicinity of the Toklat Road Camp to improve communications to that administrative location. These communications sites and facilities are considered necessary to meet the minimum requirements for the administrative purposes of the area and consistent with the Wilderness Act provisions (see appendix B).

Conclusions: The no-action alternative would have no new impacts on wilderness, nor would it result in the impairment of wilderness purposes and values for which the park was established.

4.1.6 Effects on Wildlife and Habitat

The no-action alternative would have no new impacts on wildlife and habitat.

Cumulative Effects: A few existing small communications and seismometer sites already exist within the park as shown in figure 1.1. The potential future PBO installations and other remote radio communications and weather stations in the park are would result in additional small areas of habitat loss and short-term displacement of wildlife. When combined these sites impact less than one acre of habitat. Helicopter operations for installation and maintenance of these sites have had and would continue to create short-term noise disturbances to alpine wildlife such as Dall sheep, caribou, grizzly bears, wolves, and other species.

Conclusions: The no-action alternative would have no new impacts on wildlife and habitat, nor would it result in the impairment of wildlife and habitat purposes and values for which the park was established.

4.2 Alternative B – Proposed Installation of Seismometer at Castle Rocks

4.2.1 Effects on Geo-Hazard Monitoring and Human Safety

AEIC has obtained the modern instrumentation necessary to vastly improve the recording of ground motions within the northern edge of the Park and particularly to augment the instrumentation operating in the greater Kantishna area. The Castle Rocks site would reduce the distance between existing seismic monitors in the region from 50 to 60 kilometers to about 30 kilometers. This would improve the resolution of seismic event location and analysis for activity near Kantishna and on the western portion of the Denali Fault by an estimated 50%. Research of local phenomena and understanding of the Denali Fault system, including the Kantishna fault complex, would be enhanced through this installation. Associated research and interpretations of the seismology, tectonics, and structural geology of the region would be enhanced with the new data stream. Seismic hazard identification and forecasting may be improved. The new seismometer near the active Denali Fault zone could provide valuable earthquake forecasting and hazard information to help prepare the public for a large or great earthquake in this region of Alaska. The NPS preferred alternative site location at Castle Rocks would not result in any safety hazards with regards to helicopter landings and equipment installations and maintenance.

Cumulative Effects: The UNAVCO PBO sites proposed within Denali National Park and Preserve in the next few years would further enhance the seismic monitoring and effects measurements. These sites would be located near Wonder Lake, Yentna River, and Kahiltna Glacier. The highly accurate GPS sites would also improve the measurement of minor and major earth movements, possibly indicating if strain in earth's crust from seismic activity is occurring. The AEIC would like to install a seismometer with its relay station on Double Mountain once the NPS determines where collocated wireless internet equipment should be positioned. AEIC is also considering a future request for seismometers in Eagle Gorge of the McKinley River and somewhere on the north side of the Denali Fault between Birch Creek and Cache Creek. These sites would further refine seismic monitoring in the active Kantishna Hills area and along the Denali Fault in areas not yet monitored and closer to the fault line than Thorofare, Wickersham, or the proposed Castle Rocks sites.

Conclusions: The proposed seismometer installation at Castle Rocks would result in a moderate beneficial effect on seismic monitoring and forecasting in the park, and this scientific endeavor would be consistent with one of the purposes for the conservation system units as articulated in ANILCA Title I.

4.2.2 Effects on the Natural Sound Environment

The natural soundscape would be intruded approximately one day per year by helicopter access to the Castle Rocks site for maintenance, with one flight in and one flight out. Initial installation could require multiple flights over the course of one to three days.

Cumulative Effects: Other effects to the soundscape in the project area would be from the occasional military, passenger jet, or small aircraft overflight and from helicopters

operating in the area during firefighting season, for park inventory and monitoring activities, and for annual maintenance of existing park radio repeaters, existing seismometers and relay stations, and remote automated weather stations. These overflights would be an average of three or fewer perturbations per day. Other upcoming proposals such as PBO GPS sites and additional seismometers in the park as described in 4.1.1 would not affect the sound environment in the Castle Rocks area. The additional noise intrusions from helicopter access to this remote area would not likely exceed current natural sound conditions.

Conclusions: The proposed seismometer facility installation and annual maintenance with helicopters would have a minor adverse impact to the sound environment of the area, and it would not result in the impairment of the natural purposes and values for which the park was established.

4.2.3 Effects on Vegetation

The footprint of the entire seismic monitoring station is approximately 120 square feet. The installation would require covering or removal of up to 120 square feet of high brush tundra vegetation; approximately 16 square feet for the seismometer, 30 square feet for the instrument hut, 10 square feet for guy anchors, and some disturbance where a 50 meter cable is buried beneath the tundra between the seismometer and hut. It is expected that the area beneath the cable could remain vegetated, with only minor disturbance to the surface mat. Vegetation would be lost beneath the seismometer and instrument hut. There would be some soil compaction beneath the instrument hut.

Cumulative Effects: Similar seismometer and communications sites within the park and preserve have affected similar small-sized plots, but the cumulative effects on park alpine tundra and high brush tundra vegetation is minor relative to the area of these vegetation types within the park and preserve.

Conclusions: The proposed seismograph installation would have a very minor effect on park tundra vegetation, and it would not result in the impairment of the ecosystem purposes and values for which the park was established.

4.2.4 Effects on Visual Quality/Aesthetics

The visual quality and aesthetics at Castle Rocks would be affected by the seismometer and instrument hut. The hut would be painted to blend in with the site and the seismometer is mostly buried, but both would be visible to visitors to the site, and from certain aspects, from a distance of one to two miles because the installation is located on an exposed ridge. Visitors would not be able to see the installation from within the "castle", but would easily discover the installation if they travel around the area. The instrument hut could be visible on the skyline to visitors within a short distance (up to two miles) of Castle Rocks, or to those passing by in a low-flying aircraft.

Cumulative Effects: Two cabins are located within ten miles of the project site, but these are located in lower lying areas that are forested. They likely have little to no effect

on the visual quality and scenic integrity of the area. The cumulative effect of scenic qualities in the area from these three facilities would be minor.

Conclusions: The proposed seismometer installations would have a minor effect on the visual quality and scenic integrity of the area, and it would not result in the impairment of the scenic purposes and values for which the park was established.

4.2.5 Effects on Wilderness

This project site would have no effect on the designated Denali Wilderness, but the area does retain all qualities of wilderness because it is within an area found suitable for wilderness designation (NPS 1986). This site lies about one mile outside of the area NPS proposed for wilderness designation (NPS 1988.) Some wilderness values may be compromised, such as a reduction in the opportunity for solitude from a permanent structure and periodic helicopter transport to and from the site for periodic maintenance. Scientific research, public education, and interpretation of the mountain massif would be enhanced with data from the installation. Human effects at the site would be evident to visitors and others who value the intangible aspects of wilderness such as knowing the area is untrammeled and undeveloped. The location is so remote that very few park visitors get there; however, those who do may be greatly surprised and disturbed by the installation.

Cumulative Effects: Three permanent communications and seismometer sites already exist within the designated Denali Wilderness. These are shown in figure 1.1 and are located at Thorofare Mountain, Double Mountain, and Savage Ridge. The Thorofare radio repeater site was established before ANILCA established the Denali Wilderness, but the seismometer was co-located there later. The park allowed a seismometer information relay station to be installed on Double Mountain in 2001 after the seismometers were upgraded from analog to digital systems. A temporary wireless communications site was collocated there a couple years later. Six other remote, permanent communications sites occur within the 1980 park additions and are in areas determined suitable for wilderness (NPS 1986) and proposed by the NPS for future wilderness designation (NPS 1988). The West Yenta River radio repeater is in the preserve, which is not recommended for wilderness designation at this time. The NPS is considering proposing one more radio repeater in designated wilderness near the Toklat Road Camp to improve communications to that administrative location. These communications sites and facilities are considered necessary to meet the minimum requirements for the administrative purposes of the area and consistent with the Wilderness Act provisions (see appendix B).

The addition of a seismometer at Castle Rocks would have no direct effect on designated wilderness, but helicopter overflights to the site may adversely affect a fewer than 10 wilderness visitors annually because sight and sounds of helicopters and a small permanent structure would disrupt visitor experiences of solitude. The project would have a small but lasting impact on an area found suitable for wilderness (NPS 1986), but such an installation would not prevent the area from being established as wilderness pursuant to the Wilderness Act and ANILCA. Though this site is within an area suitable for

wilderness designation, the preserve area including the subject Castle Rocks site was not included in the NPS Final EIS and proposal for additional wilderness in Denali National Park and Preserve (NPS 1988). The Secretary of the Interior took no action on the NPS proposal, which was never forwarded to Congress.

Conclusions: The proposed Castle Rocks seismometer would have no direct impacts on the Denali Wilderness, but an area suitable for wilderness designation would be adversely affected. The proposed action would not result in the impairment of wilderness purposes and values for which the park was established.

4.2.6 Effects on Wildlife and Habitat

Helicopter activity would be scheduled outside of normal raptor nesting or crane migration periods. The area is not important habitat for bears, wolves, wolverines or ungulates such as moose or caribou, and the area of affected habitat would be very small.

Cumulative Effects: A few existing small communications and seismometer sites already exist within the park as shown in figure 1.1. The potential future PBO installations and other remote radio communications and weather stations in the park would result in additional small areas of habitat loss and short-term displacement of wildlife. When combined these sites impact less than one acre of habitat. Helicopter operations for installation and maintenance of these sites have had and would continue to create short-term noise disturbances to alpine wildlife such as Dall sheep, caribou, grizzly bears, wolves, and other species. There is virtually no other effect on wildlife and their habitat in the Castle Rocks area except perhaps for subsistence trapping near the two small cabins within a ten–mile radius of the Castle Rocks.

Conclusions: Effects of the proposed seismometer on wildlife and habitat would be negligible with mitigation measures to avoid critical bird nesting and migration periods. The proposed seismometer installation and maintenance would not result in the impairment of wildlife and habitat purposes and values for which the park was established.

5.0 CONSULTATION and COORDINATION

Site Visit:

Park Physical Scientist Guy Adema has coordinated the seismic monitoring network proposals by the UAF Geophysical Institute for the Alaska Earthquake Information Center with Bob Grove and State Seismologist Roger Hansen.

On September 3, 2004, Guy Adema, Philip Hooge, Ann Kain, Roger Hansen, and Josh Stacknik visited the Castle Rocks area to assess installation options and cultural and natural resources in the area. They identified three suitable sites in the area as shown in EA figure 2.5.

Ann Kain found no evidence of archeological sites. There were no artifacts, markings, or other indications of potential historic or pre-historic sites. No surface water is available locally.

A description of historical activities in the vicinity around Castle Rocks makes no mention of use at the proposed site.

Philip Hooge found evidence of a raptor nest on the rocks, which could be either from a peregrine falcon, gyrfalcon, or other rock-nesting raptor. He recommends that helicopter activity be postponed until after the critical nesting period in early summer.

The Environmental Assessment was Prepared by:

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Jon Paynter, Denali National Park and Preserve
Joe Van Horn, Denali National Park and Preserve
Bud Rice, NPS Alaska Regional Office

The following persons were consulted in preparing the EA:

Roger Hansen, State Seismologist
Bob Grove, AEIC
Rebecca Sanchez, UAF-Geophysical Institute
Steve Carwile, Denali National Park and Preserve
Heather Rice, NPS Alaska Regional Office
Terry Humphrey, NPS Alaska Regional Office
Dick Anderson, NPS Alaska Regional Office

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APPENDIX A

SUBSISTENCE - SECTION 810(a) OF ANILCA
SUMMARY EVALUATION AND FINDINGS

I. INTRODUCTION

This section was prepared to comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA). It summarizes the evaluation of potential restrictions to subsistence uses in Denali National Park and Preserve that could result from the installation and maintenance of a new seismometer near the Castle Rocks in the northwestern preserve of Denali National Park and Preserve.

II. THE EVALUATION PROCESS

Section 810(a) of ANILCA states:

> "In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands . . . the head of the federal agency . . . over such lands . . . shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be affected 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. Denali National Park and Preserve was created by ANILCA Section 202(3)(a):

> "The park additions and preserve shall be managed for the following purposes, among others: To protect and interpret the entire mountain massif, and additional scenic mountain peaks and formations; and to protect habitat for, and populations of, fish and wildlife, including, but not limited to, brown/grizzly bears, moose, caribou,

> Dall sheep, wolves, swans and other waterfowl; and to provide continued opportunities, including reasonable access, for mountain climbing, mountaineering, and other wilderness recreational activities."

Title I of ANILCA established national parks for the following purposes:

> ". . . 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 subarctic 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."

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. . . ." (Section 810(a))

III. PROPOSED ACTION ON FEDERAL LANDS

Alternatives 1 and 2 are described in detail in the environmental assessment. Customary and traditional subsistence use on NPS lands will continue as authorized by federal law under all alternatives. Federal regulations implement a subsistence priority for rural residents of Alaska under Title VIII of ANILCA.

The NPS proposes to permit the installation and maintenance of seismometer and telecommunications equipment near the Castle Rocks in the northwestern preserve area of Denali National Park and Preserve. The installation is less than a mile from the boundary of the Denali Wilderness. The installation would complement existing seismometers in the park at Wickersham Dome and Thorofare Ridge and would be used to monitor the active seismic area north of the Denali Fault and to help forecast large earthquakes and warn people of earthquake hazards in the area.

IV. AFFECTED ENVIRONMENT

Subsistence uses within Denali National Park and Preserve are permitted in accordance with Titles II and VIII of ANILCA. Section 202(3)(a) of ANILCA authorizes subsistence uses, where traditional, in the northwestern and southwestern preserves of Denali National Preserve. Lands within former Mount McKinley National Park are closed to subsistence uses.

A regional population of approximately 300 eligible local rural residents qualifies for subsistence use of park resources. Resident zone communities for Denali National Park and Preserve are Cantwell, Minchumina, Nikolai, and Telida. By virtue of their residence, local rural residents of these communities are eligible to pursue subsistence activities in the new park additions. Local rural residents who do not live in the designated resident zone communities, but who have customarily and traditionally engaged in subsistence activities within the park additions, may continue to do so pursuant to a subsistence permit issued by the Park Superintendent in accordance with state law and regulations.

The NPS realizes that Denali National Park and Preserve may be especially important to certain communities and households in the area for subsistence purposes. The resident zone communities of Minchumina (population 22) and Telida (population 3) use park and preserve lands for trapping and occasional moose hunting along area rivers. Nikolai (population 122) is a growing community and has used park resources in the past. Cantwell (population 147) is the largest resident zone community for Denali National Park and Preserve, and local residents hunt moose and caribou, trap, and harvest firewood and other subsistence resources in the new park area.

The main subsistence species, by edible weight, are moose, caribou, furbearers, and fish. Varieties of subsistence fish include coho, king, pink and sockeye salmon. Burbot, dolly varden, grayling, lake trout, northern pike, rainbow trout and whitefish are also among the variety of fish used by local people. Beaver, coyote, land otter, weasel, lynx, marten, mink, muskrat, red fox, wolf and wolverine are important furbearer resources. Rock and willow ptarmigan, grouse, ducks and geese complete the park/preserve subsistence small game list.

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 any given year many vary considerably from previous years because of such factors as weather, migration patterns and natural population cycles. However, the pattern is assumed to be generally applicable to harvests in recent years with variations of reasonable magnitude.

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:

- the potential to reduce important subsistence fish and wildlife populations by (a) reductions in numbers; (b) redistribution of subsistence resources; or (c) habitat losses;
- the affect the action might have on subsistence fishing or hunting access; and
- the potential to increase fishing or hunting competition for subsistence resources.

The potential to reduce populations:

Land use activities could have temporary and/or long-term impacts on wildlife habitat, depending on the nature and extent of the disturbance.

The alternatives would not adversely affect the distribution or migration patterns of subsistence resources. Therefore, no change in the availability of subsistence resources is anticipated as a result of the implementation of the proposed action.

Restriction of Access:

All rights of access for subsistence harvests on NPS lands are granted by Section 811 of ANILCA. Denali National Park and Preserve is managed according to legislative mandates, NPS management policies and the park's General Management Plan. No actions under the alternatives described in the environmental assessment should affect the access of subsistence users to natural resources in the park and preserve.

Increase in Competition:

The alternatives should not produce any increase in competition for resources to subsistence users.

If, and when, it is necessary to restrict taking, subsistence uses are the priority consumptive users on public lands of Alaska and will be given preference on such lands over other consumptive uses (ANILCA, Section 802(2)).

Continued implementation of provisions of ANILCA should mitigate any increased competition, however significant, from resource users other than subsistence users. Therefore, the proposed action would not adversely affect resource competition.

VI. AVAILABILITY OF OTHER LANDS

Choosing a different alternative would not decrease the impacts to park resources for subsistence. The preferred alternative is consistent with the mandates of ANILCA, including Title VIII, and the NPS Organic Act.

VII. ALTERNATIVES CONSIDERED

The alternatives considered for this project were limited to the **1)** continue to rely on the two existing seismometers in the park to monitor seismic activity and earthquake hazards (no

action); **2)** permit the Alaska Earthquake Information Center (AEIC) to install and maintain a third seismometer in the park and preserve near the Castle Rocks area of Denali National Preserve.

VIII. FINDINGS

This analysis concludes that the preferred alternative would not result in a significant restriction of subsistence uses.

APPENDIX B

Minimum Requirment Analysis – Castle Rocks Seismic Installation

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

Description: ***Briefly describe the situation that may prompt action.***

The Alaska Earthquake Information Center would like to install a new seismometer at Castle Rocks (63.4193°N by 152.0760°W and about 1,880 feet elevation), in the Denali National Preserve, about five miles outside the western boundary of the designated Denali Wilderness, to improve earthquake detection and hazard forecasting. This area was found to be suitable for wilderness designation in the 1986 General Management Plan for Denali NP & P. AEIC research data indicate regional seismic hazards in the Interior of Alaska are greatly influenced by the Denali Fault, which runs through the middle of the park and on the north side of Mount McKinley. To the east of the park, the Denali Fault ruptured on November 3, 2003, to produce a magnitude 7.9 earthquake, the largest in the world that year. Stress may be building in the western part of the fault in the park leading to another strong earthquake. Currently the most active region of micro-earthquakes is associated with the fault in the vicinity of Kantishna, where micro-earthquakes may decrease the potential for large or great events. Seismologists believe more monitoring is needed to the west in the vicinity of the Castle Rocks to assess the possibility of more large earthquakes in the region. In the event of a large seismic event, the proposed site could provide invaluable detail in researching the rupture. Data from the site would be analyzed to identify segmentation along the Denali Fault and within regions of fault creep. Eventually, studies of the waveforms recorded on the new broadband instruments could be integrated with new geodetic studies from projects like the Plate Boundary Observatory.

The Denali Fault and its related processes is also the source for many distinct landform features in the park that are associated with the public's impressions of the Denali Wilderness. These underlying geologic processes are of interest to the public and information on them is regularly presented to the public by the National Park Service. Information from the seismic monitoring would be available for use in these education programs.

Data would be telecommunicated from Castle Rocks to Lake Minchumina where a reliable satellite data uplink exists, or would be transmitted to Wickersham Dome with repeater uplinks to the park entrance area. Access to Castle Rocks would be by contract helicopter, which would be needed for two to three days to install the monitoring station equipment. A helicopter would also be needed for access to perform routine annual maintenance at the sites about once per year for one day.

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

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

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

Explain:
Section 1310 of ANILCA provides some exceptions for certain types of navigational aids and other weather and climate facilities in wilderness, but no exceptions are provided for seismic sites.

B. Describe Requirements of Other Legislation

Do other laws require action?

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

Explain:
No other laws require action, but the importance of geologic resources and processes were mentioned in ANILCA for the area of this proposed project. In 1980 Congress passed and President Carter signed the Alaska National Interest Lands Conservation Act (ANILCA). Section 202(3)(a) of ANILCA added about 3.8 million acres to Mount McKinley National Park and renamed it as Denali National Park and Preserve. The park and preserve additions are to be managed for the following purposes:

> To protect and interpret the entire mountain massif, and additional scenic mountain peaks and formations; and to protect habitat for, and populations of fish and wildlife including, but not limited to, brown/grizzly bears, moose, caribou, Dall sheep, wolves, swans and other waterfowl; 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 additions where such uses are traditional.

ANILCA Title I recognizes that the purposes for the new conservations system units includes their preservation "for the benefit, use, education, and inspiration of present and future generations … that contain nationally significant natural, scenic…geological, scientific, wilderness, and recreational values…." It was also the intent of Congress to "… maintain opportunities for scientific research and undisturbed ecosystems."

C. Describe Other Guidance

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

Yes: X No: Not Applicable:

Explain:
National Park Service Management Policies (2001) state that wilderness policy directives apply regardless of the category of wilderness, and all management decisions affecting wilderness must be consistent with the minimum requirement concept. These policies require that the management action must be appropriate or necessary for administration of the area as wilderness

6.3.1 General Policy

For the purposes of applying these policies, the term "wilderness" will include the categories of suitable, study, proposed, recommended, and designated wilderness. *Potential wilderness may be a subset of any of these five categories.* ***The policies apply regardless of category.*** *In addition to managing these areas for the preservation of the physical wilderness resources, planning for these areas must ensure that the wilderness character is likewise preserved. This policy will be applied to all planning documents affecting wilderness.*

6.3.5 Minimum Requirement

All management decisions affecting wilderness must be consistent with the minimum requirement concept. *This concept is a documented process used to determine whether administrative activities affecting wilderness resources or the visitor experience are necessary, and how to minimize impacts. The minimum requirement concept will be applied as a two- step process that determines:*

- ***Whether the proposed management action is appropriate or necessary for administration of the area as wilderness and does not pose a significant impact to wilderness resources and character****; and the techniques and types of equipment needed to ensure that impact to wilderness resources and character is minimized.*
- *In accordance with this policy, superintendents will apply the minimum requirement concept to the context of wilderness management planning, as well as to all other administrative practices, proposed special uses, scientific activities, and equipment use in wilderness. When determining minimum requirement, the potential disruption of wilderness character and resources will be considered before, and given significantly more weight than, economic efficiency and convenience. If a compromise of wilderness resources or character is unavoidable, only those actions that preserve wilderness character and/ or have localized, shortterm(sic) adverse impacts will be acceptable.*

The policies recognize scientific research as an important use of wilderness, but like any other use of wilderness the costs must be weighed against the benefits for providing

enduring wilderness resource in situations where there is the potential for impacts to occur.

The policies provide more specific guidance for those scientific activities which involve prohibitions identified in Section 4 (c) of the Wilderness Act. The research must either 1) provide essential information for the understanding, health, management, or administration of wilderness, or 2) if it has no direct relationship to wilderness, it must not compromise wilderness resources or character. Additionally, scientific monitoring devices that are operated in wilderness must provide information that is essential for the administration and preservation of wilderness.

6.3.6 Scientific Activities in Wilderness

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

6.3.6.1 General Policy

Scientific activities involving prohibitions identified in Section 4(c) of the Wilderness Act (16 USC 1133(c)) may be conducted within wilderness when:

- ***The desired information is essential for the understanding health, management or administration of wilderness****, and the project cannot be reasonably modified to eliminate or reduce the nonconforming wilderness use(s);* ***or if it increases scientific knowledge, even when this serves no immediate wilderness management purposes, provided it does not compromise wilderness resources or character****. The preservation of wilderness resources and character will be given significantly more weight than economic efficiency and/ or convenience.*

Research and monitoring devices (e. g., video cameras, data loggers, meteorological stations) may be installed and operated in wilderness if (1) ***the desired information is essential for the administration and preservation of wilderness, and cannot be obtained from a location outside of wilderness without significant loss of precision and applicability****; and (2) the proposed device is the minimum requirement necessary to accomplish the research objective safely.*

Devices located in wilderness will be removed when determined to be no longer essential. Permanent equipment caches are prohibited within wilderness. Temporary caches must be evaluated using the minimum requirement concept.

All scientific activities, including the installation, servicing, removal, and monitoring of research devices, will apply minimum requirement concepts and be

accomplished in compliance with Management Policies, Director's Orders, and procedures specified in the park's wilderness management plan.

D. Describe Options Outside of Wilderness

Can this situation be resolved by action outside of wilderness?

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

Explain:
The Castle Rocks site is the only location near the Denali Fault and north of the Alaska Range in the region of western DENA where it is possible to install a seismometer on or near exposed bedrock with a clear path for data telemetry to other points in the AEIC network. A location on bedrock is of critical importance because the quality of seismic signals detected by a seismometer is directly related to the amount of signal attenuation caused by any soils or unconsolidated materials overlying the bedrock in a given area. A seismometer located on bedrock would encounter little or no attenuation of seismic signals, allowing significantly greater accuracy in the analysis of earthquake locations, depths, magnitudes, and mechanisms. Stations located on bedrock tend to be more accurate than those located on unconsolidated materials.

Without the installation of a new seismic monitoring station to fill the western Denali gap in the AEIC seismic network, scientists conclude they could not accurately detect and locate micro-earthquakes on and near the western Denali Fault. Therefore, they also find it difficult, if not impossible, to assess the potential for large magnitude seismic events on the fault in this region. A hypothetical ideal density of stations in this region to achieve the best possible accuracy would be roughly one station every 10-20 kilometers on an orthogonal grid. The scarcity of locations with bedrock at or near the surface naturally limits AEIC's ability to achieve this. AEIC estimates the increase in accuracy of earthquake location and magnitude calculations in the region would be about 50%. The placement of a station at Castle Rocks is seen as part of the minimum expansion of the AEIC network necessary to achieve the desired increase in earthquake detection ability and accuracy.

Presently, seismometers at Wickersham Dome and Thorofare Mountain are the closest stations to the area of concern and they provide coverage to the north and east. A gap exits to the west that would be closed by a station at Castle Rocks. The geographic distribution of seismometer locations greatly influences the accuracy of determinations of earthquake locations, magnitudes, and mechanisms. The current configuration of seismometers is skewing earthquake locations toward the existing stations in the north and east. A seismometer at Castle Rocks would allow the calculation of more accurate earthquake locations because of its location on the opposite side of the area of concern. The existing seismic station at Lake Minchumina is not located on bedrock, which limits its usefulness in accurately determining earthquake magnitudes and depth. The Lake Minchumina station is also too distant from the Denali Fault to facilitate

detection of micro-earthquakes. The station recently installed at Purkey Pile has helped to close the network gap to the southwest, but it alone does not adequately counter balance the concentration of stations to the north and east.

E. Wilderness Character

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

Untrammeled:

No contribution. This project site would have no effect on the designated wilderness, but the area is classified as suitable, and does retain all qualities of wilderness. Installations at the site would be evident to visitors and affect others who value the intangible aspects of wilderness such as knowing the area is untrammeled and undeveloped. This existence value of large wilderness landscapes is a special characteristic of the large landscapes of national park and wilderness quality lands in Alaska, and is important to many members of the public who may never visit the area. The location is so remote that very few park visitors get there; however, those who do may be greatly surprised and disturbed by the installation.

Undeveloped:

No contribution. A negative impact would result from the placement of a new facility in a previously undisturbed area, and from the noise of helicopter visits to the location.

Natural:

Neutral to very minor contribution. The proposed action is unlikely to have any significant negative impact on natural resource values due to the small size of the installation and the infrequent helicopter visits. A very small contribution may be possible from a greater understanding of the effects of earthquake events on other controlling processes in the natural environment. For example, an understanding of the potential for large magnitude earthquakes on the western part of the Denali Fault would allow the NPS to appreciate large scale natural events that could alter the ecosystems in the area. Landslides, ground surface ruptures, and slope failures could result from prolonged, high intensity shaking. Glaciers may be inundated with rock debris from landslides, as was the case in central and eastern Alaska Range in 2002, which would alter the annual discharge of water into glacial fed rivers and streams and change the long term response of those glaciers to climate. Stream flow and turbidity may be affected in the short term by slope failures or changes in glacier mass balance, and impoundments could create hazardous downstream flooding zones. Slope failures and landslides may alter or eliminate habitat for species that reside in steep mountainous terrain. An understanding of the frequency of large magnitude seismic events of sufficient size to

cause ecosystem level changes would improve the Park's ability to understand and appreciate long-term ecological change.

Outstanding opportunities for solitude or a primitive and unconfined type of recreation:

No contribution. A negative impact would result from the placement of a new facility in a previously undisturbed area, and from the noise of helicopter visits to the location.

Other unique components that reflect the character of this wilderness:

Very minor contribution. The Denali Fault and its related processes is the source for many distinct landform features in the park that are associated with the public's impressions of the area as wilderness. These underlying geologic processes are of interest to the public and information on them is regularly presented to the public by the National Park Service. Scientific research, public education, and interpretation of this important geologic process that is directly associated with the character of the wilderness landscape of the entire park area as well as the mountain massif itself would be enhanced to some degree with data from the installation. The 50% increase in resolution and the ability to monitor an important area of the fault trace that is currently poorly understood suggests that there could be a noticeable scientific enhancement, however the highly specialized nature of the information also reduces the likelihood that there would be any measurable increase that would ultimately provide a net benefit to the public's general understanding of this feature and processes that are associated with this specific wilderness landscape.

F. Describe Effects to the Public Purposes of Wilderness

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

Scientific

Major contribution. The primary benefit of this action is an improved scientific understanding of the Denali Fault for purposes other rather than those directly related to the preservation or enjoyment of the area as wilderness. Without this installation, understanding of seismic activity in the western region of the park would remain limited because the seismometers are not arrayed in sufficient density along this part of the Denali Fault system. The ideal seismic array according to the U.S.G.S. and Advanced National Seismic System for important fault zones is 10-20 kilometers between each seismic station. The current distances between Wickersham Dome, Lake Minchumina, Purkey Pile, and Bearpaw Mountain stations are about 50 to 60 kilometers. The distance between Wickersham Dome and Thorofare seismic stations is a little less than 30 kilometers. The error of an earthquake location is highly dependent on a number of parameters (e.g. distance to nearest station, azimuthal coverage of seismic stations, depth to the hypocenter, and number of sensors). The situation for the western Denali Fault area is affected greatly by a large gap in the azimuthal coverage, which greatly increases the

precision error and also has an adverse effect on the accuracy of the location. Typically the location suffers from trade-offs between the range toward the large gap in the network versus the depth and origin time of the earthquake.

Precision errors from the AEIC catalog a range from a few kilometers to 10's of kilometers for particular events. When trying to assess the hazard from particular faults and fault types, it is difficult due to the uncertainty of the production of seismic events attributable to the various splay faults in the vicinity of the Denali Fault and the complicated region of the Kantishna cluster. The current array of seismic stations is skewing earthquake locations toward the east and north of Wickersham Dome and Thorofare Mountain. The accurate detection of fault creep, the location of micro-earthquakes and large events, and the build up or reduction of stress on various faults in the area would remain low with only the current seismic station array. Associated research and interpretations of the seismology, tectonics, and structural geology of the region would be enhanced with a new data stream. Seismic hazard identification and forecasting may be improved. The new seismometer near the active Denali Fault zone could provide valuable earthquake forecasting and hazard information to help prepare the public for a large or great earthquake in this region of Alaska.

Education

Very minor contribution. New information that could be passed on to the public can certainly be derived from the results of this more detailed monitoring, however the highly specialized nature of the information also reduces the likelihood that there would be any measurable increase that would ultimately provide a net benefit to the public's general understanding of this feature and process that is associated with this specific wilderness landscape.

Step 1 Decision: **Is it necessary to take action?**

Yes: x **No:** **Not Applicable:** ☐

Explain:
The project must satisfy one of the following three criteria that that were previously described in NPS policy in order to be allowed in wilderness.

1. Research and monitoring devices (e. g., video cameras, data loggers, meteorological stations) may be installed and operated in wilderness if (1) the desired information is essential for the administration and preservation of wilderness, and cannot be obtained from a location outside of wilderness without significant loss of precision and applicability; and (2) the proposed device is the minimum requirement necessary to accomplish the research objective safely.

The information provided by the project is not essential for the administration and preservation of wilderness. It seems difficult to establish any kind of direct application of the proposed incremental increase in our understanding of seismic activity to the administration or preservation of wilderness. The information is of interest scientifically, but it has no direct application to the preservation of an enduring resource of wilderness for future generations. For example, it would be much easier to justify a weather station than this installation because it could be argued that the weather data is a major and direct component of natural systems. It is possible to see how good information would help distinguish natural effects on the resources of the wilderness from those that might be anthropogenic in nature, and therefore require management intervention to preserve wilderness resource conditions. Incrementally better information on seismic events seems more difficult to connect in this way. The natural processes of the wilderness and the values of solitude or primitive and unconfined type of recreation will not be threatened if this action is not taken.

2. It increases scientific knowledge, even when this serves no immediate wilderness management purpose, provided it does not compromise wilderness resources or character.

   If the information really does not serve any immediate wilderness management purpose or is not essential for the understanding of the wilderness area, policy still allows it to occur if it does not compromise wilderness resources or character. The project information increases scientific knowledge about the Denali Fault and associated features in the Denali Wilderness, but this information does not serve any immediate wilderness management purpose. The project, however, would compromise wilderness character because: 1) a permanent or long term installation is one of the major prohibitions in the Wilderness Act, and 2) the use of motorized equipment (helicopter) in wilderness to install and maintain the seismometer is another prohibition.

3. The desired information is essential for the understanding health, management or administration of wilderness and the project cannot be reasonably modified to eliminate or reduce the nonconforming wilderness use(s).

The only possible justification for the action is that it is needed for the understanding of the wilderness area. Understanding in this context would be broadly interpreted to mean an increase in understanding of a prominent aspect of the wilderness area. According to NPS-77, Natural Resources Management Guideline, the NPS should seek to identify significant geologic features and processes. Section 202 of ANILCA states that Denali NP & P additions are to be managed "…to protect and interpret the entire mountain massif and the additional scenic mountain peaks and formations". The Denali Fault is certainly an important feature of the Denali landscape and a contributing factor to the development of its mountain scenery. It is reasonable to suggest that a basic understanding of this prominent feature and landform process does enhance the public's appreciation of the wilderness landscape that is specific to the park. Also, as a side

benefit, it has been possible to provide larger societal benefits related to public health and safety in the process of gathering the general information that informs the public about this landscape feature. For these reasons, the Geophysical Institute was allowed to install a new radio relay unit to support their seismic network in the past on Double Mountain. However, in that specific case, the Geophysical Institute said that this installation in wilderness was essential for the retention of their existing seismic monitoring system in Denali in the new digital format that they believed was critical for both scientific quality and public safety. The Castle Rocks site is somewhat different in that it will provide only an incremental addition to this basic system. It is focused on a relatively small region of the overall fault that has seismic activity of interest to the Geophysical Institute. New information that could be passed on to the public can certainly be derived from the results of this more detailed monitoring, but the highly specialized nature of the information also reduces the likelihood that there would be any measurable increase that would ultimately provide a net benefit to the public's general understanding of this feature and process that is associated with this specific wilderness landscape.

While there are certainly impacts on wilderness character, primarily from the establishment of an installation in an area that is notably free from signs of modern technology, they are generally minor. Given the fundamental role that the Denali Fault plays in the landscape, the associated visitor experience, the long-term ecological processes of the area, and the contribution the information can make to public health and safety, the proposed action can on balance meet the minimum requirement for the administration of the area as wilderness. However, in its current configuration, this project is at best neutral in terms of a cost and benefit. For example, if this type of installation were proposed for any other location where the negative impacts were even slightly greater, such as within the designated wilderness or in an area of greater public use, it is questionable whether the relatively small benefit of increased understanding by the general public of the Denali Fault that can realistically gained from such detailed monitoring could outweigh even a small increase in any additional negative impacts.

This minimum requirement finding is made with the understanding that no other external equipment or other types of transmission equipment will be placed at this site beyond the items described in the environmental assessment without additional review. The proposed transmission equipment has been authorized at this location partly because of its extremely low profile nature. Any additional equipment could negate this assumption that was a critical element in the impact verses benefit decision to authorize the proposed action.

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

Step 2: Determine the minimum tool.

Description of Alternative Actions

For each alternative, describe what methods and techniques will be used, when the action will take place, where the action will take place, what mitigation measures are necessary, and the general effects to wilderness character.

A discussion of alternatives and the environmental consequences is provided in the attached Environmental Assessment for the project.

Step 2 Decision: What is the Minimum Tool?

The selected alternative is:

Alternative B, site A is selected

D**escribe the rationale for selecting this alternative**:

The selected alternative provides the best mitigation for the impacts to visual and soundscapes resources through the site specific placement of the monitoring unit and the restricted use of helicopters to the minimum number of trips necessary for maintenance. Reducing these impacts also reduces impacts to related wilderness resource values.

Describe any monitoring and reporting requirements:

A determination should be made on the type of raptor, if any, using the area, and appropriate monitoring should be done prior to helicopter landings at the location.

The number of landings at the site should be monitored to confirm that the minimum necessary trips are being used.

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

X	mechanical transport	**x**	landing of aircraft
X	motorized equipment	☐	temporary road
☐	motor vehicles	**X**	structure or installation
☐	motorboats		

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

Approvals	Signature	Name	Position	Date
Prepared by:	s/Joe Van Horn		Wilderness Program Manager, DENA	08/17/2005
Recommended:				
Approved by:				