National Park Service
U.S. Department of the Interior
Yellowstone National Park
ID, MT, WY

Lamar Buffalo Ranch Sustainable Energy Project

Environmental Assessment

July 2014

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Summary

The National Park Service (NPS) proposes to implement a variety of sustainability improvements at the Lamar Buffalo Ranch. Proposed changes include: replace the existing photovoltaic system, further improve and insulate the building envelopes to reduce energy demand, install a micro hydro system, add a solar thermal heating system in the existing bathhouse, and add energy monitoring displays in the buildings. The NPS also proposes to relocate and update the weather station, move one existing sleeping cabin, and expand the existing bookstore to allow for administrative offices.

The purpose of the proposed action is to improve off-grid environmental stewardship and education at the Lamar Buffalo Ranch by further reducing energy demand and increasing on-site renewable energy production with a long-term goal at the ranch of zero fossil fuel use for daily operations. The need for the proposed action arises from existing equipment failing from age and use and a desire to reduce energy expenses and greenhouse gas emissions. In the early 1990s, Yellowstone National Park established a park wide program intended to increase energy efficiency at its facilities. In 2011 the NPS prepared the *Yellowstone Strategic Plan for Sustainability* which set goals for energy use and greenhouse gas emissions reductions in the park. Two alternatives are analyzed in this Environmental Assessment (EA). Alternative A, the No Action alternative would not replace the photovoltaic array, existing building structures would not be rehabilitated to improve energy efficiency, and a micro hydro system would not be installed. Current conditions would remain as is at the ranch. Alternative B would be implemented in three phases. This alternative proposed to replace the existing photovoltaic array and associated equipment, rehabilitate the interior of the existing cabins to improve energy efficiency, install a micro hydro system and new log structure to house the turbine equipment, add a solar thermal heating system on the existing bathhouse, install energy monitoring units in some of the buildings, relocate the weather station and one existing sleeping cabin, and expand the existing bookstore for administrative offices at the Lamar Buffalo Ranch. The project would be paid for using funds from Grants, with equipment and parts donated by various companies, and donations raised through the Yellowstone Park Foundation, the official fundraising partner of Yellowstone National Park. Alternative B is the NPS's preferred alternative.

This EA has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet objectives of the proposal, 2) evaluates potential issues and impacts to the park's resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics that are included in this document because the impacts may be greater-than-minor include soils, vegetation and wetlands, water quality, wildlife, special status species, historic structures, visual quality, visitor use and experience, and park operations. All other resource topics were dismissed because the project would result in negligible or minor effects to those resources. No major effects are anticipated as a result of this project. Public scoping conducted to assist with the development of this document resulted in a total of 9 individuals submitting correspondence that included 21 comments. Three comments were in support of the project, one comment did not support the project, while the others addressed concerns that were covered in the impact topics.

Public Comment

If you wish to comment on the EA, you may post comments online at http://parkplanning.nps.gov/LamarEA, hand-deliver during normal business hours to the mailroom in the park's Administration Building, or mail comments to: Compliance; Lamar Buffalo Ranch Sustainable

Energy Project EA, P.O. Box 168, Yellowstone National Park, Wyoming 82190. This EA will be on public review for 30 days. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. Although you may request to have your personal identifying information withheld from public review, we cannot guarantee that we will be able to do so. Comments will not be accepted by fax, email, or in any other way than those specified above. Bulk comments in any format (hard copy or electronic) submitted on behalf of others will not be accepted.

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CHAPTER 1: PURPOSE AND NEED

1.1 Introduction

Yellowstone National Park encompasses 2.2 million acres and is located primarily in the northwest corner of Wyoming, with portions extending into southwestern Montana and southeastern Idaho. The park is the core of the Greater Yellowstone Area (GYA), an area of approximately 18-million-acres that includes Grand Teton National Park and John D. Rockefeller Jr. Memorial Parkway to the south, seven national forests, three national wildlife refuges, three American Indian reservations, state lands, towns, and private property. The GYA is the largest and most nearly intact temperate ecosystem in the contiguous United States. Established by an Act of Congress on March 1, 1872, YNP was designated as the first national park in the world, and as a United Nations Biosphere Reserve and a World Heritage Site nearly 100 years later. Through subsequent legislation and administrative guidelines, including the *NPS Management Policies 2006*, Yellowstone's fundamental purpose continues to be the preservation of its cultural and natural resources.

Located in Yellowstone's Lamar Valley, the historic Lamar Buffalo Ranch now operates with the following functions: as ranger residences, barn and horse corrals for NPS operations, and a year round field campus for seminars and education courses conducted through the Yellowstone Association and NPS Environmental Education Program. This small development is not connected to commercial power. Electrical power to operate the ranch is provided from propane fueled generators and, since 1996, photovoltaic (PV) panels. Although the PV array was increased in size in 2005, the development continues to have an energy demand that exceeds what is provided by the existing panels and energy bills for propane are unnecessarily high.

The purpose of this Environmental Assessment (EA) is to examine the environmental impacts associated with proposed changes to improve energy conservation and increase renewable energy production systems at the Lamar Buffalo Ranch. Many of the existing PV array components are at the end of their useful life and buildings are not energy efficient. This project would increase the renewable energy available for use at the ranch and reduce the greenhouse gas emissions of the fossil fuel-powered generators currently in operation. This project is intended to create a model for off-grid environmental stewardship and education in Yellowstone National Park.

This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, Section 106 of the National Historic Preservation Act (NHPA), regulations of the Council on Environmental Quality (CEQ) (40 CFR §1508.9), and NPS Director's Order (DO)-12 (*Conservation Planning, Environmental Impact Analysis, and Decision-Making*).

1.2 Background

The Lamar Buffalo Ranch is located in the northeast portion of the park adjacent to Rose Creek in the Lamar River valley. Summers are characterized as short and cool; persistent snow cover and subfreezing temperatures are common during the winter months. Snowfall averages in excess of 350 cm at elevations of 2100–2600 m (7,000'–8,500'), while snow depths on level sites within the open valleys typically do not exceed 80 cm (Barmore 2003). The ranch facilities are located in one of the most pristine valleys in the park and are accessible year-round by vehicles.

The Lamar Buffalo Ranch was built in the early part of the 20th century in an effort to increase the herd size of the few remaining bison in Yellowstone, preventing the feared extinction of the species. The valley was irrigated for hay pastures, and corrals and fencing were scattered throughout the area. Remnants of irrigation ditches, fencing, and water troughs can still be found. Four remaining buildings

from the original ranch compound are contained within the Lamar Buffalo Ranch Historic District (two residences, bunkhouse, barn, and a portion of the corrals) and are on the National Register of Historic Places.

In 1976, the Yellowstone Association began sponsorship of the Yellowstone Institute, designed to offer participants an in depth educational experience within and about Yellowstone National Park and the surrounding ecosystem. The Yellowstone Association is a National Park Service cooperating association. Cooperating associations are nonprofit organizations chartered by Congress to aid the National Park Service and to provide interpretive literature about the park to visitors. The Yellowstone Association was founded in 1933, and it, like other associations in other parks, operates bookstores located in park visitor centers. Here visitors can purchase books, maps, pamphlets, posters, and other interpretive materials about the park. Profits from these sales are then donated back to the park for interpretive, educational, and research purposes. Over the years, the Yellowstone Association has funded wayside and museum exhibits; established and maintained a research library; provided partial funding for printing of the free park newspaper; provided funding for printing of trail leaflets to aid visitors at the park's geothermal areas; provided training programs for summer naturalists; sponsored scientific conferences, publications, and research programs; restored and maintained historic structures and resources. Each year, about 1,500 Institute students attend in-depth educational programs at the Lamar Buffalo Ranch. An additional 1,200 Institute students visit the Lamar Buffalo Ranch while attending programs based at other locations within the park. The Lamar Buffalo Ranch facility is also used in the spring and fall for the NPS residential environmental education program, Expedition: Yellowstone. The Expedition: Yellowstone program serves about 900 school age children annually.

In the early 1980s, visitor cabins from Fishing Bridge were brought to Lamar to be used for Yellowstone Institute classes. These uninsulated cabins, originally built in the 1920s and 1930 were being phased from use as visitor lodging. Because they had not been maintained for a number of years they were in varying degrees of deterioration. A majority of these cabins were burned, the ones in better condition were moved to new locations, to be used as storage sheds, as well as employee housing and for use by Institute participants at Lamar. In 1993, a cabin replacement project, funded by the Yellowstone Association was initiated to replace the Fishing Bridge cabins with new insulated and heated structures. These cabins are approximately 12’ by 14’ (interior dimensions). The roof extends additional 5-feet over a porch to protect the entrance and provide an outdoor space. The entrance consists of a wooden door and wooden screen door. There are two wooden sliding windows, one on the front of the cabin and one on the back for ventilation and emergency egress. The cabins sit on concrete piers approximately 12-18 inches off the ground. The floors are log joists with 4’ x 4’ cross bracing and 2’ x 6’ tongue-and-groove pine flooring. None of the historic cabins moved to the ranch from Fishing Bridge remain on site at the ranch.

The Lamar Buffalo Ranch Historic District is nationally significant for its role in the history of wildlife management and preservation of wild free roaming buffalo (bison) in the United States. Yellowstone National Park was involved in the effort to preserve and increase the remnant herds of bison in the country following their near-extirpation by commercial hunters in the late 1800s. A small, free-roaming bison herd native to Yellowstone remained in the park because of the protection it had received under the U.S. Army administration. In 1902, Congress appropriated funds to save the bison, and bison from semi-domesticated herds in Montana and Texas were added to Yellowstone’s herd. Initially the semi-domesticated herd was enclosed near Fort Yellowstone at Mammoth Hot Springs. In 1907, 28 bison were moved to a new enclosure in the Lamar Valley, the Lamar Buffalo Ranch, where they were managed using cattle ranching techniques. The valley in front of the ranch buildings was maintained for grazing, and hay was grown there and along several of the Lamar River’s tributaries, such as Slough Creek. An effort was made to keep the size of the herd within set limits, and standard ranching practices were followed to improve the stock. During the winter the animals were fed, with this practice ending in 1952.

Eventually, bison were trucked from the ranch, beginning in 1936, to repopulate ranges in the Hayden and Firehole valleys.

The structures contributing to the historic district include the ranger station, bunkhouse, residence, horse barn, and a portion of the corrals. All of the structures within the historic district boundaries have retained their architectural integrity. Presently the ranger station and residence serve as living quarters and work space for NPS personnel. The bunkhouse is used as a classroom and kitchen by the Yellowstone Institute and by the NPS for its Expedition: Yellowstone program. Other structures at Lamar that are not part of the historic district include the generator building, the Yellowstone Institute bookstore, a portion of the corrals, a bathhouse, and 18 sleeping cabins, one of which serves as the campus manger residence for the Yellowstone Institute. The generator building houses a battery bank for the PV array, control equipment, and two propane-powered generators (12 kW and 15 kW) which run individually and supply much of the electricity for the area. This building is compatible with the adjacent district but is not historically significant. The corral area has been altered from the original corrals, and a portion of it is considered historic and is within the historic district. Eighteen sleeping cabins are located adjacent to the historic district, behind the barn. At the time these cabins were added, the adjacent area was nominated to the National Register as a historic district. That nomination included a determination that the cabins did not detract from the architectural integrity of the historic district. In the early 1980s to lessen the load on the septic system, two exposed aggregate concrete vault toilets were installed. They were placed north of the cabins, across the road and next to Rose creek. The vault toilet structures have since been removed and replaced with a septic system, leach field, and a bathhouse building centrally located within the cluster of sleeping cabins.

The Lamar Buffalo Ranch does not have access to conventional electric power for its energy needs. To provide power to the ranch, the park employs a PV system that was installed in 1996. This original system consisted of a 24V/7 kW PV array with 12 kW generators, a 4800 amp hour battery bank and 8 kW inverters. In 2005, the solar array was doubled for a total of 14 kW and the batteries doubled to 9600 amp hours of storage. The current system is comprised of the PV arrays described above in conjunction with back-up generators, storage batteries and associated power conditioning equipment. The existing PV array consists of four structures within a fenced area. Each structure holds 54 photovoltaic panels for a total of 216 panels in the array. Each mounting structure is 38 feet in length and approximately 10’ tall at the highest point (Figure 1). The current PV array is well screened from public view. The only location it can be seen is from the immediate area of the entrance road into the ranch from the Northeast entrance road. Even from that vantage point, the panels are somewhat screened from view by the log rail fences of the existing corrals. Topography (hills) and buildings of the ranch development keep the array screened from public view from the rest of the Northeast entrance road. Prior to installing the PV panels and propane generators this area was powered by diesel generators, and prior to that a

Figure 1 - Existing Photovoltaic Array

historic pelton wheel that was located beneath the historic bunkhouse. The propane generators used for power backup have been replaced several times due to wear, and in an effort to improve efficiency and noise.

Several steps to improve sustainability have already been implemented at the Lamar Buffalo Ranch. These include: an environmentally friendly path system using a resin binder, switching out incandescent light bulbs to compact fluorescent bulbs in the cabins and bathhouse, radiant heat in the bathhouse, motion sensor lights in the bunkhouse, energy efficient refrigerators and freezers, low-intensity outdoor lights, and exclusive use of "green" cleaning products. Several sleeping cabins have undergone additional insulation installation and building envelope improvements as well.

1.3 Purpose

The purpose and need of the proposed action is to improve off-grid environmental stewardship and education at the Lamar Buffalo Ranch by reducing energy demand and increasing on-site renewable energy with a long-term goal of zero fossil fuels for daily operations. The proposed action should meet the following objectives:

1. Increase renewable energy production and efficiency at the Lamar Buffalo Ranch.
2. Reduce energy consumption and decrease reliance on propane generator and direct propane use.
3. Contribute to goals established by Yellowstone National Park's Strategic Plan for Sustainability including energy reduction, greenhouse gas emissions reduction, waste and water reduction and increasing renewable energy.
4. Improve monitoring and tracking of energy use and demand.
5. Increase opportunities to educate students about sustainable living and energy footprints by providing firsthand exposure to sustainable energy conservation practices.

The ultimate long-term energy goal for the Lamar Buffalo Ranch is to eliminate the use of fossil fuel in its daily operations, leaving propane as solely a backup energy source. A distinct level of energy savings would accompany each of the proposed improvements. Electricity produced through renewable sources would offset propane used currently by generators to create electricity. Upgrades to building envelopes and appliances would reduce the demand for electricity and propane-fueled heat.

In 2012, Yellowstone released its *Strategic Plan for Sustainability* which aligns itself with the *NPS Green Parks Plan* released on Earth Day of the same year and the NPS *Climate Change Response Strategy* released in 2010. In turn these initiatives follow direction from Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*. The Executive Order builds on and expands the energy reduction and environmental requirements of Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management b*y making reductions of greenhouse gas emissions a priority of the federal government, and by requiring agencies to develop sustainability plans focused on cost-effective projects and programs.

1.4 Need

The need for the Proposed Action at the Lamar Buffalo Ranch is to replace the system that is at the end of its useful life and no longer compatible with modern equipment. The existing electric system is no longer operating efficiently. The batteries are not functioning adequately, one bank is now off-line for safety reasons, due to cracking and bulging of some batteries and the other is storing power at no more than 50 percent capacity. The 24 volt system is out of date and is no longer the industry standard. Inverters only allow 8 kW of load to be used at one time. Circuit breakers are often tripped and need to be re-set.

Reduced battery storage capacity of the bank due to age and defects means the generators run much more frequently. The increased generator use increases emissions, reduces the efficiency of the system, leads to increased maintenance needs, and shortens the life of equipment.

Costs of propane needed to provide electricity are increasing each year and are preventing those dollars to be used for upkeep of the ranch facilities. The project would address lack of insulation in many of the buildings to reduce energy demand. The existing array is not as efficient at today's technology, nor is it sized to meet the current energy demand of the ranch facilities while only providing a small fraction of the energy currently used. The proposed project would increase the percentage of renewable energy and decrease the need for fossil fuel based energy, while reducing overall energy demand, maintenance, and costs.

1.5 Relationship to Other Plans and Policies

The Lamar Buffalo Ranch Sustainability EA is consistent with the following plans and policies:

***Yellowstone National Park Master Plan* (1974)**
The Master Plan strived to balance human impacts and preservation of park natural, cultural, and scenic resources by developing objectives for General Management, Resource Management, Visitor Use, and Interpretation. The plan specifically addressed the existing development areas within the park.

"*Existing developments with amenities that go beyond basic food service and lodging have a multiple effect that extends beyond the mere consumption of space and scenery. Sewage requires costly and space-consuming treatment facilities and poses the threat of pollution; garbage and waste require acreage for dumps; water must be impounded or pumped and distributed, which requires clearings that scar the landscape; electricity requires obtrusive poles and wires or disruptive trenches. The character of such developments is not compatible with the tenor of this great wilderness park, and ultimately should be minimized*."

***Yellowstone Institute Cabin Replacement Environmental Assessment* (1993)**
This plan proposed to replace 18 sleeping cabins, build a bathhouse, and relocate the generator building (then located adjacent to Rose Creek) closer to the cabins and corral at the Lamar Buffalo Ranch.

***Yellowstone Long-Range Interpretive Plan* (2000)**
This plan reaffirmed the park is committed to work closely with partners to ensure that the visitors to the region receive the best experiences possible as they learn about the Greater Yellowstone Ecosystem. For over the last 30 years, the Yellowstone Association Institute has supplemented the educational programs offered by the park with in-depth multi-day classes for park visitors.

***National Park Service Management Policies* (2006)**
Section 10.2.2 of the Management Policies directs that the National Park Service must ensure allowed park uses would not cause impairment of, or unacceptable impacts on, park resources and values. A decision to authorize or expand a park concession will be based on a determination that the service

- is consistent with enabling legislation, and
- is complementary to a park's mission and visitor service objectives, and
- is necessary and appropriate for the public use and enjoyment of the park in which it is located, and
- is not, and cannot be, provided from outside the park boundaries, and
- incorporates sustainable principles and practices in planning, design, siting, construction, and maintenance, and
- adopts appropriate energy and water conservation, source reduction, and environmental purchasing standards and goals, and
- will not cause unacceptable impacts.

***Yellowstone Strategic Plan for Sustainability* (2012)**
The Strategic Plan for Sustainability sets forth parkwide goals for operational and infrastructure improvements that reduce impacts on the environment while enhancing visitor experiences and employee living and working conditions. By building upon service-wide direction, the plan focuses on Yellowstone's specific challenges that call for reducing greenhouse gas emissions; energy, water and materials consumption; adapting facilities and conducting operations in an environmentally responsible manner. The plan is to communicate all these efforts with transparency and a compelling message, and to inspire sustainability efforts within and beyond Yellowstone.

1.6 Scoping

According to CEQ regulations 40 CFR 1501.7, scoping is a "process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action." Yellowstone National Park conducted internal scoping with appropriate NPS staff, as described in more detail in the *Consultation and Coordination* chapter. The park also conducted external scoping with the public and interested/affected groups and Native American tribes.

Scoping for the proposed project began on April 9, 2014, with the mailing of a scoping postcard and press release. The postcard and press release provided background information on the project and instructions on how to comment. Public input was coordinated through the NPS Planning, Environment, and Public Comment (PEPC) website. The comment period for the scoping postcard ended on May 9, 2014. During the 30-day scoping period, a total of 9 individuals submitted correspondence that included 21 comments. Comments included concerns regarding environmental impacts, visual quality impacts, impacts to the creek from the proposed energy system, concerns regarding potential future expansion of the facility, and questions about how long the proposed system would last and its feasibility, and concerns related to not impeding the historic feel of the area.

1.7 Impact Topics Retained For Further Analysis

Impact topics for this project were identified on the basis of federal laws, regulations, and orders; *NPS Management Policies 2006*; and NPS knowledge of resources at the park. Impact topics that are carried forward for further analysis in this EA include:

- Soils
- Vegetation & Wetlands
- Water Quality
- Wildlife
- Special Status Species
- Historic Structures
- Visual Quality
- Visitor Use and Experience
- Park Operations

1.8 Impact Topics Dismissed From Further Analysis

As described in the "Environmental Consequences" chapter in this EA, the NPS takes a "hard look" at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. In those cases where impacts are either not

anticipated or are expected to be minor or less, the issues and impact topics are dismissed from detailed analysis. As described in NEPA regulations, NEPA analysis should focus on issues that are truly significant to the action in question, rather than amassing needless detail (Council on Environmental Quality (CEQ) NEPA regulations, 40 CFR 1500.1 (b)). This section identifies the impact topics dismissed from detailed analysis in this EA and provides the rationale for the dismissal. Generally, issues and impact topics are dismissed from detailed analysis for one or more of the following reasons:

- The resource does not exist in the analysis area.
- The resource would not be affected by the proposal, or the likelihood of impacts are not reasonably expected (i.e., no measurable effects)
- Through the application of mitigation measures, there would be minor or less effects (i.e., no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

The NPS uses the concept of "no measurable effects" to determine whether impact topics are dismissed from further evaluation to concentrate its analyses on issues that are truly significant to the action in question, rather than amassing needless detail (CEQ NEPA regulations, 40 CFR 1500.1(b)). For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct, indirect, and cumulative effects is presented.

Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 et seq.) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. The act also establishes a national goal of preventing any future and remedying any existing man-made visibility impairments in Class I areas. Yellowstone National Park is a Class 1 area and extends into five counties in three states, including Park and Teton in Wyoming, Park and Gallatin in Montana, and Fremont in Idaho. None of the five counties have air pollution levels that persistently exceed the national ambient air quality standards and are designated as nonattainment status.

Construction activities in the proposed project area such as hauling materials and operating heavy equipment could result in temporary negligible increases of vehicle exhaust, emissions, and fugitive dust. These potential increases would be temporary and localized and likely dissipate rapidly. If sustainable energy production were to increase via increased PV array size or installation of a micro hydro turbine, then emissions from propane generator use would decrease. Overall, the proposed action could result in a negligible degradation of local air quality in the short-term lasting only long as construction, and a negligible improvement in air quality in the long-term. The Class I air quality designation for the park would not be affected by the project. Because there would be negligible effects on air quality, this topic is dismissed from further analysis in this document.

Climate Change

Although climatologists cannot be certain of the specific long-term consequences, it is clear that the planet is experiencing global climate changes that affect ocean currents, sea levels, polar sea ice, and global weather patterns. Although this is likely affecting precipitation patterns and amounts in Yellowstone, it would be speculative to predict localized changes in temperature, precipitation, or other weather facets, in part because many of the variables are not fully understood. The actions proposed in this EA would not greatly affect or contribute to climate change. Therefore, the possible effects of climate change are dismissed from further analysis.

Archeological Resources

The National Historic Preservation Act, as amended in 1992 (16 USC 470 et seq.), the National Environmental Policy Act, NPS Director's Order 28, Cultural Resource Management Guideline (NPS

1997), Management Policies (NPS 2006), and NPS Director's Order 12, *Conservation Planning, Environmental Impact Analysis and Decision-making* (NPS 2011), all require the consideration of impacts on cultural resources listed in, or eligible for listing in, the National Register of Historic Places (National Register).

Intensive archeological surveys consistent with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation have been conducted within the Area of Potential Effect (APE) (Sanders et al. 1996; Smith 1993). These studies recorded no archeological sites eligible for or listed on the NRHP. Monitoring is recommended during construction. If archeological resources are discovered or unanticipated effects on historic properties are found after the Section 106 process has completed, NPS will make reasonable efforts to avoid, minimize or mitigate adverse effects to such properties. As no archeological sites have been discovered by past surveys within the project area, archeological resources have been dismissed from further analysis.

Cultural Landscapes

The NPS defines cultural landscapes as geographical areas associated with historic events, activities, or people that reflect that park's history, development patterns, and the relationship between people and the park. Cultural landscapes at the park include Fort Yellowstone, the Old Faithful area, North Entrance, Stephen's Creek, Artist's Point, Apollinaris Spring, Roosevelt Lodge, and the Tower Ranger Station. None of the actions under consideration in this EA are expected to affect the characteristics of these areas that contribute to their designation as cultural landscapes. Therefore, potential impacts on cultural landscapes from the alternatives in this EA are not analyzed in further detail.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. The proposed activities would not take place in areas where minorities and low-income populations and communities could realize disproportionate health or environmental effects. Therefore, this topic has been dismissed from further analysis.

Ethnographic Resources

The NPS Director's Order 28, *Cultural Resource Management*, defines ethnographic resources as any site, structure, object, landscape or natural feature assigned traditional, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. Discussions with the 26 Native American tribes associated with the park to identify park resources significant to tribes have been ongoing for years. Although no specific area has been identified, many tribes have identified the general importance of thermal water and geyser features, and the various minerals found in the thermal areas, as important resources to be preserved and protected. A variety of common plants found throughout the park have been identified as having been used for food, medicinal and other purposes, many of which are still used today. All of the plants identified are common and are plentiful in many locations within and outside the park. Because ethnographic resources potentially affected by this project are less than minor, this topic has been dismissed from further analysis.

Floodplains

Executive Order 11988 (Floodplain Management), requires all federal agencies to avoid construction within the 100-year floodplain unless there is no other practicable alternative. The *NPS Management Policies 2006* and Director's Order 77-2, *Floodplain Management*, strive to preserve floodplain values and minimize hazardous floodplain conditions. According to Director's Order 77-2, certain construction within a 100-year floodplain requires preparation of a statement of findings. There will be no net loss of

floodplains and only negligible impacts from an outflow chase as described in Alternative B - Chapter Two. Implementing any of the actions proposed in this EA would have no greater than negligible impacts on floodplain values or contribute to hazardous floodplain conditions. Therefore, this topic has been dismissed from further analysis.

Soundscape Management
In accordance with *NPS Management Policies 2006* and Director's Order-47 *Sound Preservation and Noise Management*, an important component of NPS's mission is the preservation of natural soundscapes associated with national park units (NPS 2006). Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscapes is the aggregate of all the natural sounds that occur in park units, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

The proposed action would occur in what is considered the developed area of Lamar Buffalo Ranch. Existing sounds in this area are most often generated from vehicle traffic, people, wildlife, wind, and propane generators. During construction of the proposed action, human-caused sounds would likely increase due to construction activities, equipment, vehicle traffic, and construction crews. Sounds generated from construction would be temporary, lasting only as long as the construction activity, and would have negligible impacts. Any increases in renewable energy production would have the benefit of reducing generator run times, a long-term minor beneficial impact to the local soundscape. As no impacts on this topic are greater than minor, this topic is dismissed from further analysis.

Prime and Unique Farmlands
In August 1980, the Council on Environmental Quality directed federal agencies to assess the effect of their actions on farmland soils classified as prime or unique by the U.S. Department of Agriculture's Natural Resources Conservation Service. Prime or unique farmland is defined as soil that produces general crops such as common foods, forage, fiber, and soil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. Yellowstone National Park has no prime or unique farmlands; therefore this impact topic was dismissed.

Indian Trust Resources
Secretarial Order 3175 requires that any anticipated impacts to Indian Trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. The park's lands and resources related to this project are not held in trust by the Secretary of the Interior. Because there are no Indian Trust resources, this topic is dismissed from further analysis.

Lightscape Management
NPS Management Policies 2006 emphasize the protection of natural lightscapes not only for the enjoyment and experience of visitors, but also for the protection of ecological integrity. Mitigation strategies are articulated, including restricting the use of artificial lighting only when necessary, utilizing minimum impact techniques and shielding lights to prevent unwanted light scatter. The proposed action would not have any impact on lightscape management; therefore this impact topic was dismissed from further analysis.

CHAPTER 2: ALTERNATIVES

This chapter presents two alternatives for the project that includes energy conservation, renewable energy production, water/ waste reduction, and energy monitoring/education at the Lamar Buffalo Ranch. The alternatives were developed to fit the purpose and need for the project as discussed in Chapter 1. Alternative A, the No Action alternative, presents a continuation of current operations. No sustainable energy infrastructure improvements or energy monitoring equipment would be installed and provides a baseline for comparing the consequences of implementing the action alternative—Alternative B, the Sustainability Improvements alternative addresses sustainable energy infrastructure and facilities improvements at the ranch that would conserve energy, reduce fossil fuels, and provide a model for off-grid environmental stewardship and education. Alternatives that were dismissed from further consideration are described later in this chapter.

2.1.1 Alternative A – No Action

The No-Action Alternative describes the conditions that would continue to exist if no action was taken. Under Alternative A, sustainable energy infrastructure and facilities improvements to conserve energy and reduce fossil fuels would not be undertaken. There would be no renovation of the existing buildings or replacement and expansion of the existing photovoltaic (solar energy) panels, storage batteries or related control equipment. Time and cost commitments would increase for repair and regular maintenance of the existing system as it continues to age. Additional generator power would be needed as existing storage batteries become less efficient at storing electrical power and eventually fail as is the case of one of the existing battery banks (Figure 2). Frequent visits by staff of the NPS electrical shop in Mammoth and from resident staff at Lamar would be necessary to diagnose and repair failures in the system. The high cost of providing power would continue and likely increase from high propane use. Operations at Lamar would continue to contribute more greenhouse gas emissions as the use of propane increases, taking Yellowstone further from its reduction goals.

Figure 2 - Cracked batteries of existing battery bank that has been taken off-line

The existing weather station located between the Buffalo Keeper's cabin and the Soda Butte Cabin within the historic district would remain. The lack of some weather sensors on the existing station would mean some data would continue to not be gathered. Gaps in weather data would occur due to the current equipment not being automated. The NPS rangers and Yellowstone Institute campus manager would continue to use their residences for administrative functions.

2.1.2 Alternative B – Sustainability Improvements

Alternative B would upgrade sustainable energy infrastructure and implement facility improvements at the Lamar Buffalo Ranch to conserve energy and water. This alternative would be implemented in three separate phases with a long-term goal of eliminating the use of fossil fuel use in daily operations. A

synopsis of each of the three phases is described below with a figure to illustrate the proposed changes. Specifics of the proposed project are described in greater detail after the synopsis of each phase.

The first phase of this project would be scheduled to begin late summer/fall 2014. This phase would reduce use of propane powered generators by replacing and expanding the existing photovoltaic (PV) array from 14 kilowatts (kW) to approximately 45 kW, replacing failed and failing battery banks (for storing electrical power), replacing electrical control equipment, and installing a new 5 kW micro hydro system. In addition a new weather station would be installed and fenced. This phase of construction is anticipated to require two months to complete (Figure 3).

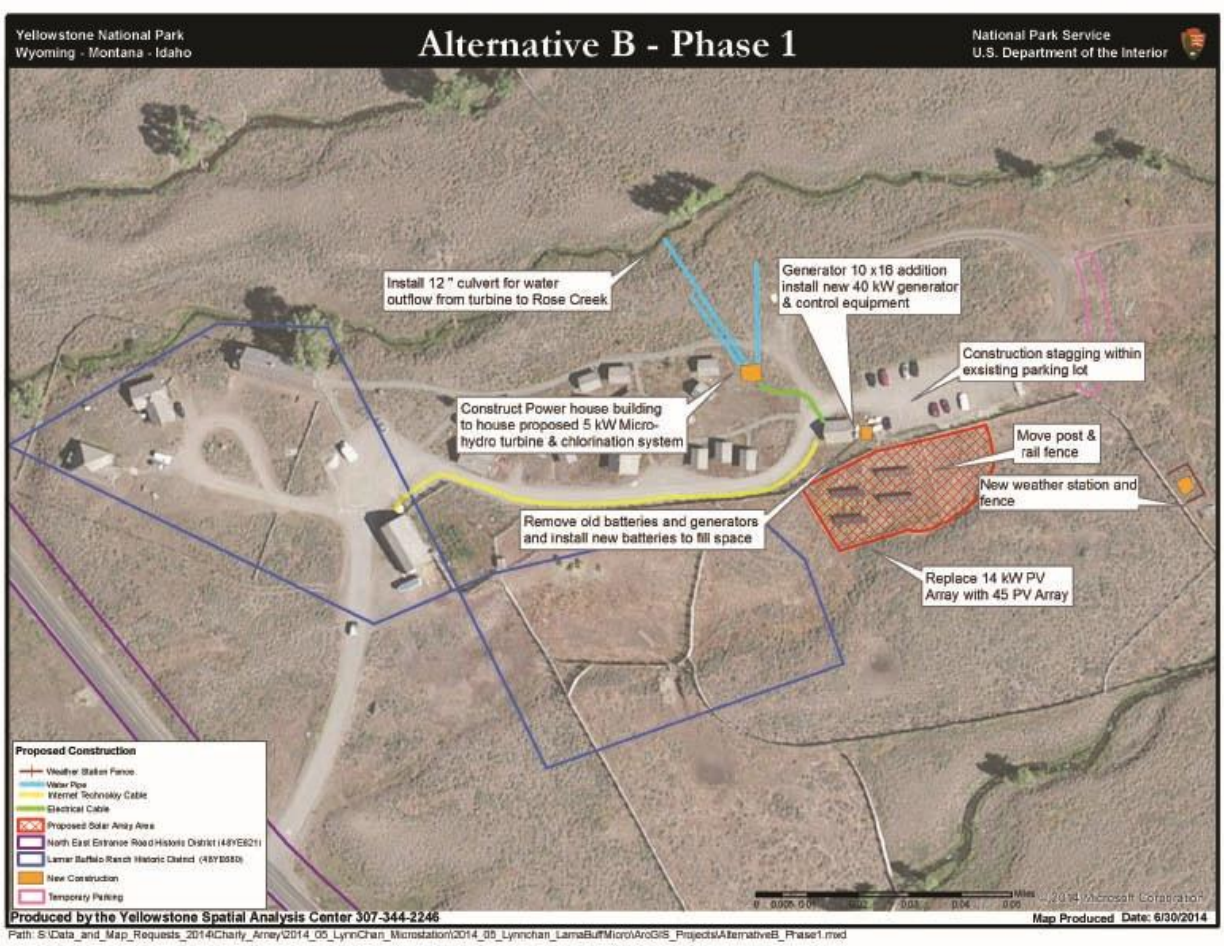

Figure 3 – Phase 1, Alternative B

Phase 2 would be scheduled to occur in 2016 and would upgrade the energy efficiency of the building envelopes (walls, windows, floors, and ceilings) by reducing air exchange and adding insulation. Solar thermal panels would be installed on the south side of the existing bath house to provide hot water that can be used directly for domestic water purposes, and/or for supplemental radiant heat (Figure 4).

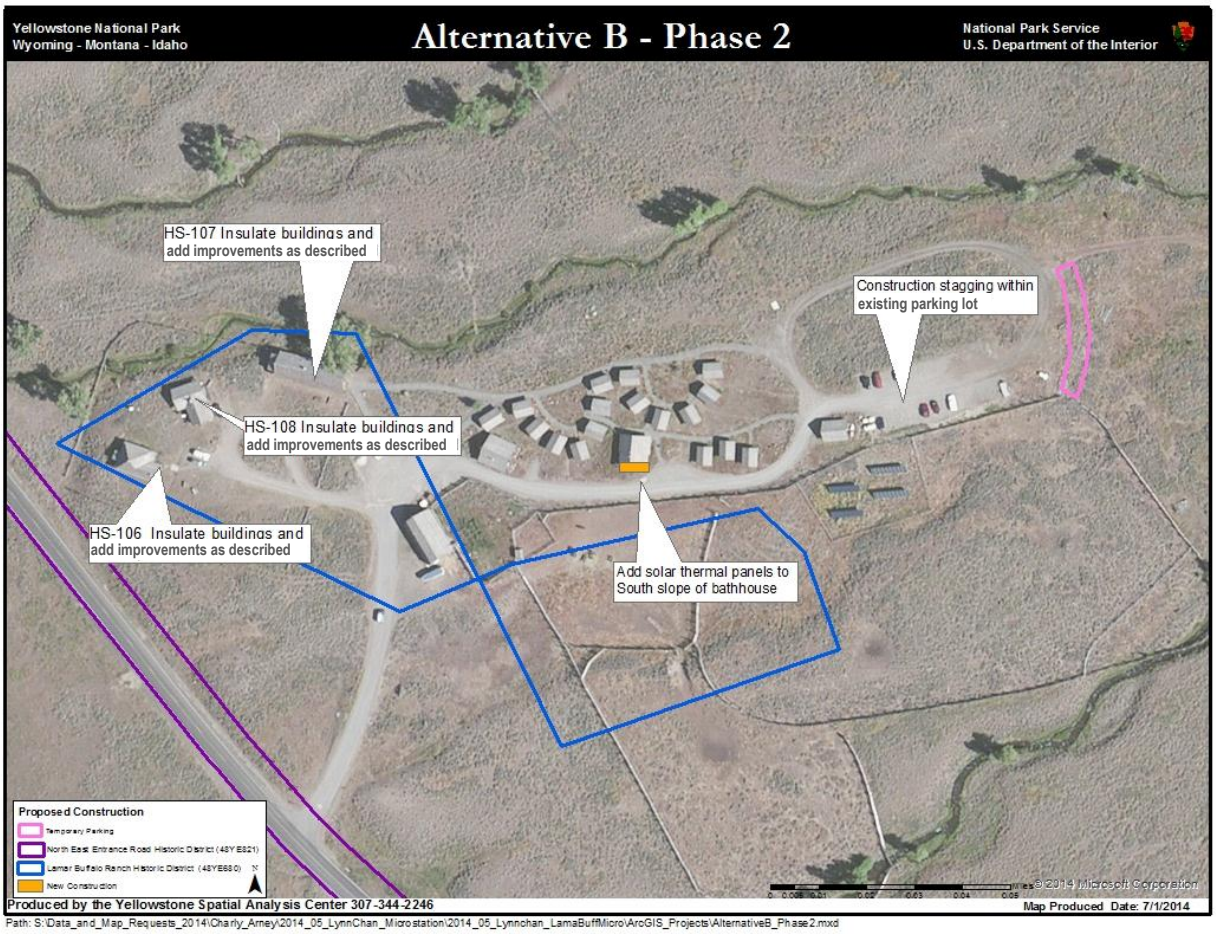

Figure 4 – Phase 2– Alternative B

Phase 3 would be scheduled to occur in 2020 and would replace propane-fueled heaters and appliances, with further expansion of the PV array to approximately 100 kW. Energy monitoring equipment would be installed to track and manage energy use and loads, while providing information for education purposes. Existing buildings, both historic and non-historic, would receive renovations with an emphasis on improving the building envelope for energy conservation and green building practices. An addition would be constructed onto the existing Yellowstone Institute bookstore to allow for administrative office space for area rangers and the Yellowstone Institute campus manager (Figure 5).

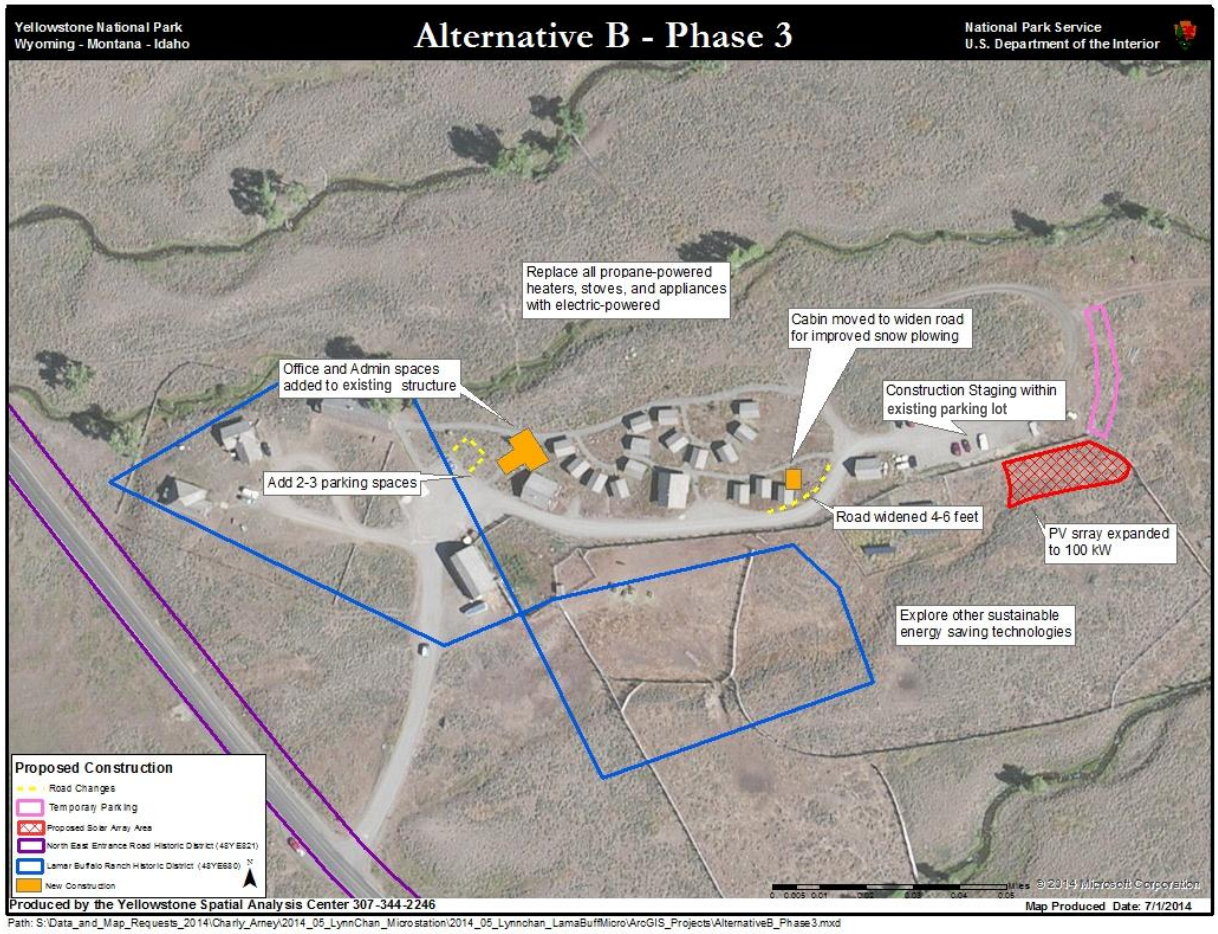

Figure 5 – Phase 3– Alternative B

Further detail of the components included in Alternative B follows:

Update Existing Components of the Electric Power Supply

Alternative B proposes to upgrade components of the electric power generation system. Components of this system would include: upgrading and expanding the solar photovoltaic array; replacing the propane fueled generators with a single larger backup generator; installing a micro hydro system; and installing new energy system monitoring and tracking equipment. These components are described in more detail in the following paragraphs.

Photovoltaic (PV) Array
The new array would entail two separate phases of expansion. The first phase would provide approximately 45 kilowatts (kW) of power and be located in the same area as the existing 14 kW array situated in the southeast portion of the development. The third phase would expand the array to approximately 100 kW. The new array would replace the panels and mounting structures which were installed in 1996 and 2005. The old photovoltaic panels are a mix of 75- and 150-watt 12 volt panels wired for a 24 volt system. The new panels would be 250 watt panels operating at 600 volts. Phase one would consist of approximately 5 rows of PV panels. Two rows would be approximately 143 feet in length, two at 107 feet, and the remaining one at 35 feet. Distance between each panel post would be approximately 15 feet. Height of supporting concrete posts used to hold the framework for the array would vary from ground level to approximately 4 feet above the ground. These 12-inch diameter concrete posts would be cast in place in drilled holes 3-4 feet deep. The existing PV array covers approximately 0.15 acres. The replacement array would cover about 0.3 acres for the phase 1 expansion and an additional 0.4 acres for the phase 3 expansion (total 0.7 acres). Approximately 100 feet of trenching, at 24-inches deep, would be needed to bury electrical cable to carry power from the PV array to the battery bank in the generator building. The old panels would be removed and used for smaller scale needs throughout the park. A non-historic section of post-and-rail fence would be moved approximately 50 feet to the east to accommodate phase one PV panel layout.

Battery Bank
The existing battery bank consists of 72 (1600 amp hour) lead-acid aborbed glass mat (AGM) batteries that were installed in 1996 and 2005. The batteries are configured into two banks, one of which is offline as many of the batteries have bubbles and cracks that have formed in their plastic housings. The old batteries would be recycled. The new batteries would be refurbished hybrid vehicle batteries that would be sized to store approximately two days' worth of extra power. Approximately 208 battery packs for the new energy system would be provided via corporate donations. Life expectancy of the new batteries would be much greater than the old AGM ones currently in use at the ranch. The new battery banks would be placed within the current log generator shed that currently houses the storage batteries, control equipment, and two backup generators. Generators and related charge control equipment would be moved to an added room to the east of the existing generator shed in order to make room for an expanded battery bank (see following paragraph).

Generator Shed Addition
In order to house the new equipment, an addition of approximately 15 feet would be constructed on the back (east side) of the generator shed. Design of the new addition would be compatible with the existing structures and historic character of the area. A new 40 kW generator would be installed to provide back-up power in the event the alternative energy system was offline or needed maintenance. This new generator would be housed within the new shed addition along with all new electric system control equipment.

Backup Generator
There are currently three generators used as back up, and more recently as primary power for the electric system. Two are located within an existing log building used to house the battery banks and control equipment. The first generator is a 12 kW, the second is a 15 kW. A third generator, a 20 kW sits outside the building within a weather proof box. None of the three existing generators are synchronized and must be operated independently. A new 40 kW generator is proposed to replace the three. It is anticipated that the new generator would only operate during scheduled maintenance activities on the renewable power system and as an emergency power back up. The increased PV array size and new batteries should lead to this generator not being needed for primary power in the area.

In addition, the existing 1,000 gallon propane tank would be moved 15-20 feet to the east of its existing location. Relocation of the tank would be required in order to allow space to construct an addition on the generator shed.

Cable and Associated Trenching
Approximately 1,000 feet of trenching would be required to install underground networking, electric cables, water pipes, and a tail race (water outflow pipe for micro hydro turbine). Placement of the networking and electric cables would occur within or directly adjacent to existing roads and pedestrian pathways within the ranch. The water pipe and tail race would be located between Rose Creek and the existing sleeping cabins in an area vegetated primarily with sagebrush. In areas where topsoil is present *Mitigation Measures* for vegetation would be followed.

Micro Hydro Turbine and Building
The micro hydro system would involve the installation of a horizontal shaft, dual nozzle Pelton-type turbine, with 5.0 kW, 240/120 VAC (alternating current volts), single phase, 60 Hz generator. This system would assist in charging the batteries especially at night when solar charging is not possible. A new log structure approximately 14 x 20 feet would be constructed to house the turbine equipment. The micro hydro building would be located at the top end of the development east of the uppermost sleeping cabins and designed similar to the existing cabins. This building would be located outside the historic district and in a location that complements the layout and configuration of the existing cabin grouping. The building would house the turbine equipment as well as the chlorination system for the domestic water service which is now housed in a vault within the historic district. The turbine generator would be tied into the electrical infrastructure with cable trenched to the generator shed running direct AC power converted to DC for battery charging. When the battery banks are charged, the power from the turbine would be diverted by an automated switch to ballast loads such as electric water heating elements. The turbine would have several safety devices. An internal jet deflector system ensures the turbine would continue to pass flow following a shut down and an internal bypass allows water to circumvent the paddles to limit wear on the turbine if it is not in use. An electric load control governor would allow the generator to charge the battery bank through an inverter to DC (direct current) power as well as provide direct AC power to augment electric loads if there is residual power available. All water used in the generation of power would be returned to the middle fork of Rose Creek. This fork in the creek in recent history ended in the meadow prior to reaching the Lamar River; in summer of 2014 this fork has joined the west fork of the creek just west of the Northeast Entrance Road.

Spring flow calculations to assess the feasibility of micro hydro included measurements for water flow and pressure were taken consistently throughout the year. It was determined that a reliable water source exists from the spring, with a head of approximately 180 feet, average flow rate of 596 gallons per minute (gpm) and minimum observed flow rate of 412 gpm. Maximum design flow for the turbine would be 320 gpm to generate approximately 4.5 kW continuously. Not only could this amount of power keep battery banks charged requiring less need for back-up propane generators when solar is not sufficient, but a direct AC (alternating current) contribution could off-set direct propane loads such as for hot water heat. This would result in less propane used, fewer tank fills, reduction in transportation costs, and reduction in greenhouse gas emissions. The tail race would be a 12-inch pipe (buried culvert) that would return water to the middle fork of Rose Creek. The pipe would require excavation to place approximately 150 feet of pipe approximately three-feet deep. A six-inch water inflow pipe and a six-inch water outflow pipe would be installed to connect the micro hydro turbine to the existing six-inch domestic water pipe located directly north of the Buffalo Ranch development. The water pipes would each be approximately 100 feet in length and buried approximately six feet deep. The outlet would include a rip-rap treatment of eight-inch natural stone 16” deep to prevent stream bank erosion and would be blended with the natural surroundings. Any required wetland permits would be acquired prior to construction.

Stream flow data, stream temperature, and fish species composition would be monitored on Rose Creek multiple times throughout the year. The data collected by NPS staff would be used to guide operations of the micro hydro turbine. Flow to the turbine would be reduced or stopped during critical periods for fish spawning or very low flow times of year. During these times, the turbine would produce less power than its 4.5 kW rating.

New Building Space for Domestic Water Chlorination Function
The chlorination function for the domestic water system at the ranch is currently located within an underground vault in the historic district. This function would be relocated to the micro hydro building. The existing vault would likely remain as all water distribution lines are accessed at this point. Trenching for approximately 200 feet of new water pipe to tie into the existing pipe west of the pedestrian walkway would be required.

Solar Hot Water
Of all facilities at the ranch, the bathhouse uses the most hot water providing showers for students, a laundry facility for the Yellowstone Institute, and radiant floor heat. Solar thermal heating panels would be installed on the south end of the building on the roof of a new shed structure that would be located below the existing gable roof line to reduce its visual impact.

Improved Building Envelope
All buildings, including historic buildings, would undergo renovations that would focus on energy conservation. Renovations would ensure buildings have well insulated walls, ceilings and floors and air infiltration is minimized. Historic buildings would have an architectural and engineering survey completed and recommendations for structural and stabilization improvement to the foundation and logs would be followed. Original windows on historic buildings would remain in place with energy efficient, double pane wood storm windows added. Interior floor plans would remain the same or similar. The outside of the log buildings would be re-chinked and caulked to reduce air infiltration, seal penetrations, holes, and cracks and to exclude rodents. All work on historic buildings would follow the Secretary of the Interior's Standards for Historic Preservation and historic appearance and integrity would be maintained. Best practices for energy conservation would meet or exceed standards and final energy performance would meet the Guiding Principles for High Performance and Sustainable Buildings.

Existing light fixtures would be updated to Light Emitting Diode (LED) fixtures where possible. Skirting around the perimeter of the non-historic buildings to improve the thermal performance of the floor, reduce heat loss, and improve the comfort level by providing a warm floor underfoot would be completed as funding permits. The material for the skirting would be chosen to blend with the existing cabin exterior and would penetrate the ground surface by approximately 18-24 inches to deter ground squirrels, badgers, and other ground dwelling animals from entering the crawl spaces.

Future Alternative Energy Improvements and Testing
Yellowstone National Park plans to continue to work toward a long-term goal of zero emissions for daily operations at the Lamar Buffalo Ranch. Future renewable energy applications would include a further expansion of the PV arrays on the same slope where panels cannot be seen from the Northeast Entrance Road or from the historic district. The PV array output would be increased to 100 kW for phase three of this alternative.

Wind power would be considered in the future if a technology is proven to adequately address concerns regarding noise, visibility, and potential bird strikes with rotors or drums. A wind gauge installed as part of the automated weather station or at the peak of a non-historic cabin would provide information over the next few years regarding the potential for wind power verses possible effects. At present the park does not have good information on average and seasonal wind speeds in the area of the ranch to properly assess the

viability of wind as an energy source in this location. Heating systems such as ground source heat may also be considered if installation of the technology would only have minor effects or less on park resources.

Water Chlorination
The existing water chlorination function for the domestic water supply of the ranch occurs from equipment located within an underground vault within the historic district. The water chlorination function would be moved to a room in the micro hydro turbine building that is discussed above.

Addition to Existing Bookstore for Administrative Offices
A maximum 320 square foot addition to the existing Yellowstone Institute bookstore would be constructed to serve as office space for NPS rangers and the Yellowstone Institute campus manager; an existing function that is currently performed within the employee's residences at the ranch. The existing bookstore is located within a 12' x 14' cabin adjacent to the historic district but not within its boundary. The building addition would be of the same architectural design as the other cabins in the area.

Relocate a Sleeping Cabin
The most southeastern sleeping cabin on the upper end of the development, would be moved approximately 10-20 feet to the north of its existing location. This would be done to allow for widening of the road at this location to improve clearance for snow plowing operations in the winter months and allow larger vehicles more room to pass through this constricted point. The cabin is not historic, or located within the historic district. A short distance of trenching would be required to extend electric service to the relocated cabin.

Walkway Formalization
An informal pedestrian pathway, approximately 85 feet along the south side of the bunkhouse between the front and rear entrances, would be formalized and constructed to match the design of the existing walkways at the ranch. Formalizing the pathway would involve grading, leveling the cross slope, installing an aggregate mix, and adding log edging along the sides of the walkway to direct foot traffic and minimize impacts to adjacent soils and vegetation.

Weather Station Changes
The existing weather station is located between the Buffalo Keeper's cabin and the Soda Butte Cabin within the historic district. Weather data from this location has been collected for a number of years but is not a complete record with many gaps. A new self-contained piece of equipment would be located at the eastern most edge of the existing corrals and outside of the historic district (Figure 6). The location would not be visible from the Northeast Entrance Road or from the historic district as topography, existing fences, and buildings would screen its view. Approximately 60 linear feet of post and rail fence would be constructed to help protect the equipment from wildlife that may gain access within the corral area. The weather station would be mounted on a tripod that is approximately 10ft tall. The unit would be powered by its own solar panel; therefore no trenching would be required. Excavation would be required at each of the three tripod legs to a depth of about 18 inches, and 3 feet for each of the fence posts. Data collected would include: wind, temperature, precipitation, relative humidity, solar radiation, and soil moisture. The estimated number of visits to the station would be one or two per year. The existing weather equipment would be removed from the historic district after about one year in order to determine any differences in data due to a change in location.

Figure 6 - Proposed Weather Station Location and Equipment Example

Construction Staging/Temporary Parking

The existing upper parking lot would be used as a temporary staging/stockpile area during construction. The area would be used for placement of a temporary construction office trailer, port-a-potty, construction and assembly operations, material stockpiling, and equipment storage. Access to the staging area would be via the main entrance road to the ranch. The area directly adjacent to the upper portion of the upper parking lot (northeast of the generator shed) is presently used as a stockpile site for old fencing material, parking of trailers, and other materials used in maintenance activities at the ranch. The vegetation in this area has been disturbed and is not in a natural condition. The area would be used temporarily to park vehicles displaced from the main parking area and would be re-vegetated after construction.

Energy Monitoring and Education

Energy monitoring sensors and displays would be installed in all the main buildings (Buffalo Keeper's Quarters, bunkhouse, bookstore, and the Soda Butte Ranger Station and Campus Manger's cabin). The monitors would provide educational information explaining real time system operations, different energy use behaviors, and provide information for improving the system. Monitoring equipment would track energy consumption data for the entire ranch, and individual buildings. Users could access data for the types and amounts of energy used, total greenhouse gas emissions, yearly comparisons broken down by month on a real-time basis in a visual representation. Monitoring equipment would support decision-making at all levels from employees to students taking action to pursue their own initiatives to reduce energy consumption.

Energy monitoring would enable improved energy management and tracking of energy use while on site, and/or from a remote location via the park's website, allowing technical experts to maximize efficiencies and identify problems.

Energy Savings
Total propane use at Lamar from August of 2012 to July of 2013 totaled 14,846 gallons. This amount included 10,776 gallons used by direct propane appliances (including heaters) and 4,070 gallons used by generators to produce electricity to supplement that provided by the existing solar panels. Upgrades to the renewable energy system in Phase I would provide 95% of the electricity at Lamar and reduce propane use by generators at the site to approximately 370 gallons per year, saving 3,700 gallons of propane annually. This is a 25% reduction in total propane use at the site. Energy saving measures implemented in Phase 2 would result in a 50% reduction in direct propane use, which would equate to 5,388 fewer gallons of propane used annually. In Phase 3 propane would only be used as a backup power source and would theoretically eliminate the remaining 5,758 gallons of propane use. The cumulative reductions of all phases of the project will reduce the park's propane use by approximately 15,000 gallons annually.

2.2 Mitigation Measures

The following mitigation measures were developed to minimize the degree and/or severity of adverse effects and would be implemented during execution of the chosen action alternative, as needed:

General Construction

To minimize the amount of ground disturbance, staging and stockpiling areas would be located in the parking area, or in previously disturbed sites, away from core visitor use and residential areas to the greatest extent possible. All staging and stockpiling areas would be returned to pre-construction conditions following construction.

Construction zones would be identified and fenced with construction tape, snow fencing, or some similar material prior to any construction activity. Fencing would define the construction zone and confine activity to the minimum area required for construction. All protection measures would be clearly stated in the construction specifications and workers would be instructed to avoid conducting activities beyond the construction zone as defined by the construction zone fencing.

Fugitive dust generated by construction would be controlled by spraying water on the construction site if necessary. Any water used for dust control would be taken from hydrants in park administrative areas, or a local source approved by the park.

To minimize possible petrochemical leaks from construction equipment, the contractor would regularly monitor and check construction equipment to identify and repair any leaks.

Soils

Topsoil conservation measures would be employed prior to construction in accordance with Yellowstone's Vegetation Management Guidelines. Topsoil would be stripped and replaced wherever possible to enhance revegetation following the construction phase.

Disturbed soils are more susceptible to erosion and until revegetation takes place, standard erosion control measures such as silt fences and/or sandbags would be used to minimize any potential soil erosion.

Vegetation

Disturbance to existing vegetation at the site would be avoided to the greatest extent possible.

Revegetation and recontouring of disturbed areas would take place following construction and would be designed to minimize the visual intrusion of any proposed structures on the landscape.

The construction site would be monitored and non-native species control methods implemented if necessary to minimize the introduction of noxious weeds.

Equipment used would be cleaned using NPS protocols for reducing the spread of any non-native plant species.

Wildlife

All outdoor food storage would adhere to park policies already in place to ensure no unattended food sources are available to wildlife.

All contractors and employees would be educated about working in grizzly bear country and briefed on proper food storage and safety measures.

Monitoring of Rose Creek would occur to determine any changes in stream flow due to operation of the proposed micro hydro turbine. If stream flow reductions are observed that cause concern to native species of the creek, water flow to the turbine would be decreased or halted.

Soundscapes and Air Quality

To reduce noise and emissions, construction equipment would not be permitted to idle for more than 10 minutes while not in use according to the Superintendent's Compendium, based on CFR 36 § - 5.13 Nuisances.

The proposed cabin to house the micro hydro turbine would be insulated to reduce noise during times the turbine is operating.

Historic Resources

Designs for new buildings within the boundaries of the landmark and historic districts, or in close proximity to the districts, would be well executed and sensitive to the cultural and natural environment. The NPS would identify the district's character-defining features in its design planning process, and use a project-specific design recognizing the unique visual and cultural features that qualified the district for listing in the National Register of Historic Places.

New construction would be consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties, and the Secretary of the Interior's *Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings* would be contingent upon completion of Section 106 responsibilities including consultation with the Wyoming SHPO.

Should construction unearth previously undiscovered cultural resources, work would be stopped in the area of the discovery and the park would consult with the Wyoming SHPO and the Advisory Council on Historic Preservation, as necessary, according to §36 CFR 800.13, Post Review Discoveries. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) and NPS Director's Order 28 would be followed.

The NPS would ensure that all contractors and subcontractors are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological sites or historic properties. Contractors and subcontractors would also be instructed on procedures to follow incase previously unknown archeological resources are uncovered during construction.

Should operations uncover or find any paleontological remains, operations would immediately be suspended and the park geologist notified. Any paleontological remains found within the project area are the property of the NPS and would be removed only by NPS staff or designated representatives.

Visual Quality

Siting of the proposed PV array expansion would be done in such a way as to keep new panels within the swale and behind existing fences that currently screen the array from the historic district and in such a manner that would not cause adverse impacts to the historic district, and not be visually obtrusive to the rustic nature of this area.

Visitor Use and Experience

All construction activities would be conducted during daylight hours, to avoid loud and disruptive work at night.

2.3 Alternatives Considered and Dismissed

The following alternatives were considered for project implementation, but ultimately dismissed from further analysis. The reasoning for dismissal is provided in the following alternatives description.

Bury electrical power along the roadway from Tower Junction to Lamar Buffalo Ranch - The Lamar Buffalo Ranch is located approximately 10 miles from Tower Junction, the closest point of commercial power in the area. Installation of a new underground line from this point to the ranch is estimated to cost $180,000 to $210,000 per mile, or a total of 1,800,000 to $2,100,000 dollars. Above ground lines were not considered due to the visual impacts of these types of electric transmission. Due to the high cost of installing underground electric service, and the fact that nearly all components and labor proposed in Alternative B would be covered by donations from corporations and private donors, this alternative was considered, but dismissed.

Install the project as proposed in Alternative B, but without the micro hydro component – This alternative was considered to eliminate concerns with potential reduced flows of the three branches of Rose Creek below the spring box. In this alternative water to operate the micro hydro turbine would not be diverted from the area below the existing spring box through an existing 6-inch pipe at the rate of 320 gpm. The water flow in Rose Creek would be maintained at natural levels. The only water diverted would be that consumed for domestic water use at the ranch, and to provide water for stock (horses) when using the corrals at the ranch. As a micro hydro turbine would produce power 24 hours per day, and the PV array would only give on average 6 hours of power production per day, more PV panels and batteries would be needed. In order to offset the power that would have been produced from the micro hydro turbine, approximately 80 additional 250 watt PV panels would need to be added to the array. Additional batteries would also be required to store the power generated from these panels. This would have the effect of lengthening each of the proposed 5 rows by 50-60 feet in length. Trenching of electric cable from the micro hydro to the battery bank would not be required. A new building to house a relocated water chlorination function would still be needed, unless a decision is made to leave the function in its existing location within the vault within the historic district. Given the fact that the micro hydro turbine can operate 24 hours a day, and can offset the base energy needs without additional PV or battery storage, this alternative was dismissed.

Table 2-1 How Each Alternative Meets Project Objectives

Objectives	Alternative A (No Action)	Alternative B (Sustainability Improvements)
Increase renewable energy production and efficiency at the Lamar Buffalo Ranch.	No increase of renewable energy output or efficiency improvements would occur from this alternative	The PV array size would increase from its existing 14 kW to 45 kW in Phase I, and then increase again in Phase III to 100 kW. This alternative would also increase power production with the installation of a 4.5 kW micro hydro system.
Reduce energy consumption and decrease reliance on propane generator use.	Reliance on energy from propane-powered generators would likely increase as battery storage efficiency continues to decline with battery age. No additional measures to reduce energy consumption are proposed for this alternative.	This alternative would reduce the reliance on the propane-powered generators by increasing the PV array size, replacing and increasing the size of the battery bank, and installing a micro hydro system. Measures to reduce energy consumption would occur by insulating the building envelopes during Phase II.
Contribute to goals established by Yellowstone National Park's Strategic Plan for Sustainability including energy reduction, greenhouse gas emissions reduction, waste and water reduction and increasing renewable energy.	This alternative has already contributed to meeting these goals with the installation of the current PV array that was installed in 1996 and upgraded in 2005. Generator run times are increasing as battery storage efficiency decreases. No further renewable energy upgrades are proposed in this alternative.	This alternative would further contribute to meeting these goals by reducing emissions from propane-powered generator use, through increasing the power production capabilities of the PV array size, installation of a micro hydro turbine, and implementation of energy conserving steps (insulation, installing new energy efficient fixtures and power components).
Improve monitoring and tracking of energy use and demand.	No energy monitoring or energy use tracking equipment would be installed as part of this alternative.	This alternative would install equipment that would track the energy consumption, energy production, of various components of the system at the Lamar Buffalo Ranch.
Increase opportunities to educate students about sustainable living and energy footprints by providing firsthand exposure to sustainable energy conservation practices.	Currently, some opportunities exist to educate students on sustainable energy practices by using the existing PV system installed at the ranch.	Information gained energy tracking and monitoring would be used to fine tune the system for efficiency, and to be used to help educate guests and park visitors.

Table 2-2 Environmental Impact Summary by Alternative

Impact Topic	Alternative A (No Action)	Alternative B
Soils	Long-term, negligible, adverse impacts to soils.	Short- and long-term, negligible, adverse impacts to soils.
Vegetation and Wetlands	Long-term, negligible, adverse impacts to vegetation and wetlands.	Short- and long-term, negligible to minor, adverse impacts to vegetation and wetlands.
Water Quality	Short- and long-term, negligible, beneficial impacts to water quality.	Short- and long-term, minor, adverse impacts to water quality.
Wildlife	Short-term, negligible, adverse impacts to wildlife.	Short- and long-term, negligible to moderate, adverse impacts to wildlife.
Special Status Species	Short-term, negligible, adverse impacts to special status species.	Short-term, negligible to minor adverse impacts to special status species.
Historic Structures	Long-term, negligible, adverse impacts to historic structures.	Short- and long-term, minor, adverse impacts to historic structures.
Visual Quality	Long-term, minor, adverse impacts to visual quality.	Long-term, minor, adverse impacts to visual quality.
Visitor Experience	Long-term, minor, adverse impacts to visitor experience.	Long-term, minor, beneficial impacts to visitor experience.
Park Operations	Long-term, minor, adverse impacts to park operations.	Long-term, moderate, beneficial impacts to park operations.

2.4 Environmentally Preferable Alternative

According to the Department of the Interior regulations implementing NEPA (43 CFR 46.30), the environmentally preferable alternative is the alternative "…that causes the least damage to the biological and physical environment and best protects, preserves, and enhances historical, cultural, and natural resources. The environmentally preferable alternative is identified upon consideration and weighing by the Responsible Official of long-term environmental impacts against short-term impacts in evaluating what is the best protection of these resources. In some situations, such as when different alternatives impact different resources to different degrees, there may be more than one environmentally preferable alternative."

It has been determined that Alternative B, Sustainability Improvements, would be the environmentally preferable alternative. Alternative B would provide much more power to run the ranch from sustainable power sources while drastically reducing the run times required from propane-powered generators. Sound from these generators would be reduced considerably (they are only expected to be run during maintenance activities when the sustainable energy sources would need to be completely offline). The

education components of this alternative would be implemented to work towards improved understanding of energy conservation and alternative power sources that could be applied outside of YNP.

Alternative A would continue to use the existing PV system and would rely on the propane powered generators to provide approximately 80 percent of the current electrical needs of the ranch. The efficiency of the current battery bank would continue to decline to the point of failure in just a few years. This would increase the demand on the generators to provide 100 percent of power after this point. Noise duration and propane emissions would slowly increase over time. Because of the impacts associated with Alternative A, it is not the environmentally preferred alternative.

CHAPTER 3: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (existing setting or baseline conditions) and analyzes the potential environmental consequences (impacts or effects) that would occur as a result of implementing the proposed project. Direct, indirect, and cumulative effects are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- **Type** describes the classification of the impact as either beneficial or adverse, direct or indirect:
  - *Beneficial*: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - *Adverse*: A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - *Direct*: An effect that is caused by an action and occurs in the same time and place.
  - *Indirect*: An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **Context** describes the area or location in which the impact would occur. Effects may be site-specific, local, regional, or even broader.
- **Duration** describes the length of time an effect would occur, either short- and/or long-term:
  - *Short-term* impacts generally last only during construction, and the resources resume their pre-construction condition following construction.
  - *Long-term* impacts last beyond the construction period, and the resources may not resume their pre-construction conditions for a longer period of time following construction.
- **Intensity** describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this EA.

Cumulative Impact Scenario

The CEQ regulations which implement NEPA require assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7).

Cumulative impacts were determined by combining the impacts of the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at YNP and, if applicable, the surrounding region. The geographic scope for this analysis includes actions both, within and outside of Yellowstone's boundaries. The temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis, listed from past to future:

- **Park-wide Road Improvement Plan (1992)** – This plan provides direction to preserve and extend the service life of principal park roads, enhance their safety, and continue access to Yellowstone National Park and its features.

- **Yellowstone Institute Cabin Replacement (1993)** – This plan proposed to replace the existing cabins with insulated cabins for students and staff, build a bathhouse, and relocate the generator building behind the cabins and out of view.

- **Wireless Communications Services Plan (2008)** – This plan provides a framework for establishing wireless communication services park-wide.

- **Native Fish Management Plan (2010)** – This plan conserves native fish from threats of non-native species, disease, climate induced environmental change, and provides guidance and an adaptive framework for managing fisheries and aquatic resources.

- **Tower-Roosevelt Comprehensive Plan (2010)** – This plan alters or improves visitor services, facilities (buildings, roads, and paved parking areas), and utilities while preserving the distinct and significant rustic western camp character and resources in the Tower-Roosevelt area. This plan does not increase the footprint of the developed area.

- **Lake Comprehensive Plan (2012)** – This plan alters or improves visitor services, facilities, buildings, roads, paved parking areas, and utilities while focusing on protecting the developed area by managing growth and development.

- **Invasive Vegetation Management Plan (2013)** – This plan provides guidance to prevent, eradicate, and control the spread of non-native plants through the use of manual and herbicide methods.

- **Electric Transmission/Distribution System Communication and Automation Plan (2014)** – YNP in conjunction with NorthWestern Energy (NWE), one of the electricity providers for the park will improve the reliability, safety, and overall service quality of electrical power distribution to the NPS, concessioners, and visitors. The project also includes a communication system for use by NWE.

- **Bechler Administrative Area Improvement Plan (2014)**- This plan improves visitor experience and park operations by addressing day use and overnight parking, circulation, employee housing, and utilities.

- **Long Range Interpretive Plan (ongoing)** – The Long Range Interpretive Plan would provide visitor experience goals, primary interpretive themes, and program recommendations.

- **Wildland Fire Management Plan (2013)** – Many developed areas in Yellowstone have been evaluated and treated for hazard fuel reduction projects, and all of the developed areas must be monitored. Tree canopy density needs to be modified to stop crown fires, which may initially take several years to accomplish through treatment. A quality fuel reduction project will make allowances for wind-throw, and over the course of a few years of conservative treatment, the final canopy spacing will be achieved. Accumulated dead and down fuels will be removed using chainsaws, chippers and possibly some small, minimal footprint types of machinery. Fuel that is not chipped and removed may be piled and burned when it is safe and appropriate to do so.

- **Commercial Stock Outfitter Concession Contracts (in progress)** – Actions proposed in this EA would provide opportunities for visitors to experience the backcountry of Yellowstone National using guided saddle and pack tours while protecting the natural and cultural resources of the park. The EA evaluated three alternatives; alternative A – no action; alternative B – would issue 10-year commercial saddle and pack contracts at the current number (44) with similar terms and conditions of current contracts as specified in the Operating Plan; alternative C would also issue up to 44 concessions contracts in addition to providing increased monitoring and management flexibility to respond to resource impacts.

- **Trail Maintenance Projects (ongoing)** – YNP rehabilitates or relocates 10-15 sections of trail per year. This action results in short-term adverse impacts to soils, vegetation, visitor use, and wildlife, while resulting in long-term benefits to soils, vegetation and visitor use.

- **NEON (future)** - The National Ecological Observatory Network (NEON) is a continental-scale monitoring platform for discovering and understanding impacts of climate change, land use change, and invasive species on ecology. NEON would gather long-term data on ecological responses of the biosphere to changes in land use and climate, and on feedbacks with the geosphere, hydrosphere, and atmosphere. It would consist of distributed sensor networks and experiments, linked by advanced cyber infrastructure to record and archive ecological data for at least 30 years. The Yellowstone Northern Range site is being considered by NEON, Inc. and the NPS as one of 20 Core Wildland Sites throughout the country. Core NEON sites would require permanent scientific monitoring equipment. A full proposal would detail what types and where such infrastructure is needed. Any infrastructure proposals would follow the guidelines determined through this plan and additional compliance might be required.

3.1 Soils

Affected Environment

The Lamar Buffalo Ranch sits at the base of an alluvial fan. To the northeast of the ranch the surface geology is made up of landslide deposits. According to *Soils of Yellowstone National Park* (Rodman et al. 1996) the project area is in soil unit 2222. Soil in this unit formed on alluvial fans, with slopes less than 15 percent, and under non-forested habitat types. The main surficial deposit is fan alluvium derived from andesite, rhyolite, or sedimentary rocks. The main soil order is mollisols with thick epipedons with medium to moderate course textures that are well drained. Typical profile ranges from a fine-loamy to a skeletal, mixed, superactive Pachic and Typic Cryoboroll.

Soils in the developed area of the Lamar Buffalo Ranch have been impacted in the past as structures have been constructed and/or moved. Foot traffic and vehicle parking are mostly designated to specific well defined routes. Over the years this definition of circulation routes has allowed natural vegetation to establish and soil conditions improve. There is no storm water system. All roads have a gravel surface that allow for natural percolation of moisture into soils, minimizing surface water runoff and preventing erosion.

Methodology and Intensity Level Definitions
Methodology used for assessing impacts to soils was derived from available information and park staff. For purposes of analyzing potential impacts to soil resources, the intensity of impacts is defined as follows:

Impact Intensity	Impact Description
Negligible	Soils would not be affected by compaction, trampling, erosion, removal, etc., or the effects to soils would be below or at the lower levels of detection. Any effects to soils would be slight with no measurable or perceptible changes.
Minor	Effects to soils due to compaction, trampling, erosion, removal, etc., would be detectable, small, and localized. Changes would not be expected to be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Effects to soils due to compaction, trampling, erosion, removal, etc., would be readily apparent and result in a long-term change to the soils character, including erosion patterns in a localized area. Mitigation measures, if needed to offset adverse effects, could be extensive but would likely be successful.
Major	Effects on soils due to compaction, trampling, erosion, removal, etc., would be readily apparent, substantially change the character of the soils and erosion patterns over a large area, and likely would be permanent. Extensive mitigation measures would be needed to offset any adverse effects and their success could not be guaranteed.

3.1.1 Impacts of Alternative A (No Action)

The no action alternative would represent a continuation of current conditions at the Lamar Buffalo Ranch. No new construction, trenching or ground disturbance would occur. Long-term, adverse, negligible impacts from students and staff walking off paths and causing soil compaction and erosion would continue.

Cumulative Effects: Cumulative impacts on soils are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in YNP. Use would continue at the ranch. Consequently the total area of compacted soil would remain essentially the same. Ongoing administrative activities such as road reconstruction and maintenance, backcountry operations, facilities maintenance and construction, and hazard fuels reduction projects would continue to have adverse effects on soil resources in the park. Road maintenance activities would require disturbance and removal of soil by heavy equipment. Trail maintenance would continue. The impacts of Alternative A in conjunction with the past, present, and reasonably foreseeable future actions would be minor, short- and long-term adverse.

3.1.2 Impacts of Alternative B

This site contains soils that have been previously disturbed and compacted. The footprint of all aspects of the proposed project would be located within previously disturbed areas. Implementation of Alternative B would affect soils by construction operations including: grading, trenching, excavation, construction including building and piping for the micro hydro, installation of the PV array, weather station, formalizing the path to the bunkhouse, additions to the generator shed, bathhouse, and Yellowstone Institute bookstore, staging, moving one of the sleeping cabins, and widening the road for snow plowing operations and other large vehicles. These impacts would result in approximately 11,300 square feet (0.26 acres) of direct temporary impacts and approximately 2,400 square feet (0.06 acre) of permanent impacts. Short-term disturbance would occur from trenching and temporary parking.

Mitigation measures such as topsoil salvage and replacement would be used to reduce impacts on soils and allow for revegetation. Monitoring for noxious weeds would be done and treatments would be implemented if needed. Because most of the project area has been previously disturbed by development activities (e.g., maintenance and construction) or by incidental use, the effects of the proposed activities would constitute a negligible, short-and long-term, adverse effect on soils.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor, short- and long-term adverse impacts to soils.

3.2 Vegetation & Wetlands

Affected Environment

Yellowstone National Park contains diverse vegetation as a result of the extreme topographic relief, differing soils, varied slope and aspect, and range of microclimates (Despain, 1990). Yellowstone's vegetation is composed primarily of typical Rocky Mountain species. The five generalized vegetation types in the park are: montane forests, sagebrush-steppe, alpine meadows, wetlands/riparian and hydrothermal communities. Vegetation in the Lamar area consists mostly of sagebrush-steep with varied non-native grasses and forbs and some cottonwoods along Rose Creek. No special status plant species occur within the proposed project area.

As part of the past historic management efforts to increase numbers of bison in the park, exotic grasses were introduced for growing feed, pastures were irrigated from Rose Creek, and fences were constructed across the Lamar Valley and around the ranch buildings. These facilities were used for manipulating animal movements, undertaking a variety of ranching and animal husbandry practices, and for supporting elk culling operations from 1923 to 1968, during which 26, 400 elk were removed from the park (NPS 1997). Due to these extensive practices that took place in the area during the first half of this century, native vegetation has been impacted.

Yellowstone National Park Resource Management crews have performed spot treatments of non-native plant species in and around the Buffalo ranch over the years. These include low priority species such as houndstongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), yellow sweetclover (*Melilotus officinalis*), blue mustard (*Chorispora tenella*), and field pennycress (*Thlaspi arvense*). These primarily have been found around the corrals, cabins, and along the roads near the ranch. Reoccurring patches of spotted knapweed (*Centaurea maculosa*), a high priority species, occurs within a couple of miles of the ranch and occasionally along the road near the developed area.

On May 22, 2014, NPS staff conducted a survey for wetlands within the project area. The survey identified a few small wetlands, limited to the immediate bank along Rose Creek and was dominated by sedges. Plants observed in the wetlands were blister sedge (*Carex vesicaria),* water sedge (*Carex aquatilis*), field horsetail (*Equisetum arvense),* (alsike clover) *Trifolium hybridum,* (wild chives) *Allium schoenoprasum* and (willow) *Salix spp*. (Anderson, email communication 2014).

Methodology and Intensity Level Definitions

Methodology used for impact analyses for vegetation and wetlands was based on surveys and previous projects conducted within the area. These analyses were conducted in the context of the project area. The intensity of impacts on vegetation and wetlands are defined as follows:

Impact Intensity	Impact Description
Negligible	Some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. Operations would not alter wetland functions and values. The effects would be on a small scale, no special status species would be affected, and wetland impacts would be less than 0.1 acre.
Minor	The alternative would affect some individual native plants and would also affect a relatively minor portion of that species' population. Impacts could result in a change to wetland functions and values, but the change would be of little consequence. Mitigation to offset adverse effects, including special measures to avoid affecting species of special concern, could be required and would be effective.
Moderate	The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population and over a relatively large area. Impacts could result in a change to wetland functions and values; the change would be measurable and consequential. Mitigation to offset adverse effects could be extensive, but would likely be successful. Some species of special concern could also be affected.
Major	The alternative would have a considerable effect on native plant populations, including species of special concern, and affect a relatively

large area in and out of the park. Impacts would result in a noticeable change to wetland functions and values; the change would result in a severely adverse or substantially beneficial impact. Mitigation measures to offset the adverse effects would be required, extensive, and success of the mitigation measures would not be guaranteed.

3.2.1 Impacts of Alternative A (No Action)

The no action alternative represents a continuation of current activities at the Lamar Buffalo Ranch. No new construction or ground disturbance activities would occur, and vegetation and wetlands would remain unchanged. Vegetation disturbances from existing buildings, parking, and from staff and visitors walking off path and trampling vegetation, routine maintenance activities and the possibility of non-native plant introductions would remain and continue. Overall, the impacts to vegetation and wetlands would be long-term, negligible, and adverse.

Cumulative Effects: The impacts on vegetation and wetlands are based on the incremental impact of the action when compared to other past, present, and reasonably foreseeable future actions in YNP. Ongoing administrative activities such as road reconstruction and maintenance, backcountry operations, facilities maintenance, and hazard fuels reduction projects would continue to have adverse effects on vegetation and wetlands in the park. Road maintenance activities would require disturbance and removal of soils and vegetation by heavy equipment operation. Backcountry operations include horse and foot patrols and trail maintenance. Trail maintenance causes localized disturbance of soil and vegetation, and overnight use of campsites and cabins lead to some vegetation trampling and development of social trails. Most facilities maintenance activities occur in developed areas where minimal impacts to vegetation occur. However, adverse impacts to vegetation may become necessary because some plant material may be cleared and removed for general operation practices. Additionally, Yellowstone's hazard fuels reduction projects require the removal of excess fuel (trees) from developed areas. Impacts to vegetation and wetlands is reduced by ensuring trails are maintained, including the use of barriers to prevent development of social trails and by monitoring construction and maintenance activities. Park visitation is expected to continue increasing each year as a result of population growth in nearby communities and elsewhere. The growth and visitation would increase recreational use, such as angling, camping, and hiking. These activities commonly trample vegetation and impact wetlands resulting in minor, short- and long-term adverse impacts to vegetation.

3.2.2 Impacts of Alternative B

The footprint of the proposed project would occur within a developed area, much of which has been previously disturbed. Implementation of Alternative B would affect vegetation wherever grading, trenching, excavation, or construction occurs including: building and pipe installation for the micro hydro, installation of the PV array, weather station, formalizing the path to the bunkhouse, additions to the generator shed, bathhouse, and Yellowstone Institute bookstore, staging, relocation of one sleeping cabin, and widening the road for snow plowing operations and other large vehicles. Impacts would occur from trenching and use of heavy equipment that would result in 1,000 feet of trenching; 650 feet would be under existing road and pathways and 350 feet would be in sagebrush between Rose Creek and the cabins. Although these locations occur in previously impacted areas the additional disturbance creates conditions conducive to establishment and spread of non-native vegetation. Implementation of mitigation measures would occur as described in the *Mitigation Measures* section. After implementation of the project is complete and if needed, disturbed areas would be graded to match the pre-construction conditions and seeded with native vegetation. Additional roads would not be installed to access the PV array.

The proposed project would divert water at a spring which flows into Rose Creek. This diversion could alter the base and peak flows, sediment transport processes, and physical condition of the creek corridor.

Wetland vegetation along the corridor is not expected to change due to the proposed stream flow alterations. The tail race for the micro hydro would be a 12-inch pipe (buried culvert) that would return water to the middle fork of Rose Creek. The pipe would require excavation to place approximately 100 feet of pipe approximately 4- to 6-feet deep. The outlet would include a rip-rap treatment of 8" natural stone 16" deep to prevent stream bank erosion. Any required wetlands permits would be obtained prior to construction.

Stream flow measurements conducted in early May 2014 indicated the proposed micro hydro system would remove approximately 10% of the in-stream flow at that time from Rose Creek. It is not known what that percentage would be as natural flows decrease throughout the spring and summer season; nor what the percentage would be during winter months, when flows naturally are at their lowest. In order to understand more about the flow measurements, additional data would be collected. Data collected from stream flow monitoring would be used to determine appropriate periods for operations of the proposed micro hydro turbine. Impacts to wetlands along Rose Creek are not expected to occur from the micro hydro system and therefore considered negligible. Under Alternative B negligible to minor, short- and long-term, adverse impacts to vegetation would occur.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in negligible to minor, short- and long-term adverse impacts to vegetation and wetlands.

3.4 Water Quality

Affected Environment

Rose Creek is a tributary that splits in the area of the Lamar Buffalo Ranch. The stream is approximately 5 miles in length and comprised of two primary tributaries, including the North Fork and the East Fork, whose confluence is approximately ½ mile upstream from the Lamar Ranger Station. Rose Creek crosses the Northeast Entrance road approximately 0.3 mile upstream of its confluence with the Lamar River. In the past, the stream has been modified and is now highly braided as it flows adjacent to the Lamar Ranger Station. These unnatural, braided stream channels appear to be the result of human activity associated with the historic Buffalo Ranch that was once operated in this area.

Methodology and Intensity Level Definitions
Information regarding potential impacts to water quality was obtained from interdisciplinary team members and other park staff. The area of analysis includes Rose Creek. The following impact thresholds were established in order to describe the relative changes in water quality under the alternatives.

Impact Intensity	Impact Description
Negligible	Impacts (chemical, physical, or biological effects) would not be detectable, would be well below water quality standards or criteria, and would be within historical or desired water quality conditions.
Minor	Impacts (chemical, physical, or biological effects) would be detectable but would be well below water quality standards or criteria and within historical or desired water quality conditions.

Moderate	Impacts (chemical, physical, or biological effects) would be detectable but would be at or below water quality standards or criteria; however, historical baseline or desired water quality conditions would be temporally altered.
Major	Impacts (chemical, physical, or biological effects) would be detectable and would be frequently altered from the historical baseline or desired water quality conditions; and/or chemical, physical, or biological water quality standards or criteria would temporarily be slightly and singularly exceeded.

3.3.1 Impacts of Alternative A (No Action)

Under the no action alternative, sustainability and energy system improvements would not be implemented. The physical, chemical, and biological characteristics of Rose Creek would remain unchanged. Alternative A would continue to have negligible, short- and long-term, adverse impacts to water quality due to the proximity of the existing development.

Cumulative Effects: Cumulative impacts on water resources/water quality are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Construction and facilities maintenance can adversely affect water quality by disturbing soils and hardening surfaces (e.g. paving) near stream corridors and promoting erosion and increased runoff, which can contribute to increased turbidity levels in adjacent surface waters. Implementation of the Native Fish Conservation Plan has resulted in minor adverse impacts due to increases of in-water activities parkwide. Past and ongoing recreational use such as fishing, camping, and hiking would continue, resulting in adverse localized, temporary impacts to water quality. Hiking and camping activities can disturb soils which can promote erosion leading to increased sedimentation in adjacent water bodies. Trail maintenance and construction would continue and cause short-term erosion of soil into nearby waters. Past fires over the analysis area have increased surface erosion rates and input of fine sediment to stream channels. In general, the moister streamside riparian areas do not burn as hot as uplands and thus sediment transport to surface water is reduced. Alternative A, coupled with past, present, and foreseeable future actions would result in minor, short- and long-term adverse effects to water quality.

3.3.2 Impacts of Alternative B

The micro hydro system is the only component likely to affect water quality. The solar PV array and other components of the proposed project would not impact water quality. Use of the micro hydro system at full power would divert approximately 320 gpm of water from a spring that feeds Rose Creek to an existing enclosed underground pipe for a distance of approximately 2900'. In order to determine the operating parameters and an acceptable amount of water flow to be diverted for power generation at various seasons and stream flows, the NPS would establish a monitoring plan for this location to better understand the impacts of the operation of the micro hydro turbine on water quality factors. Data collected on water quality parameters would include water temperature and flow rate. Information would be used to establish baseline information for water quality characteristics within this watershed.

Implementation of monitoring to identify water quality impacts would guide the operations plan for the micro hydro system. Results of monitoring Rose Creek streamflow, temperature, and other factors listed above would be used to guide the operation of the micro hydro system. Operation of the micro hydro system would be based on monitoring results. Water quality monitoring would ensure impacts would be no greater than minor, adverse, short-and long-term.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor, short- and long-term adverse impacts to water quality.

3.4 Wildlife

Affected Environment

The Lamar Buffalo Ranch area is within the Lamar Valley and is often referred to as the "Serengeti of Yellowstone", which encompasses the lower portions of the Yellowstone, Lamar, Gardner, Slough, and Soda Butte drainages. The most common mammals living in and around the Lamar Buffalo Ranch area include bison (*Bison bison*), elk (*Cervus canadensis*), gray wolf (*Canis lupus*), moose (*Odocoieus hemionus*), bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), black bear (*Ursus americanus*), American badger (*Taxidea taxus*) and coyotes (Canis latrans). There are also small mammals Uinta ground squirrel (*Urocitellus armatus*), pocket gopher (*Thomomys clusius*), jackrabbit (*Lepus townsendii*), little brown bat (*Myotis lucifugus*) and a wide variety of birds.

Currently many of the ranch buildings have nesting swallows and are home to a colony of little brown bats that dwell above porches, along building eaves and in attic spaces. The attic rafters in the bunkhouse serve as a maternity roost where young are raised during late spring to late summer. Beneath these areas accumulation of guano has created a maintenance and health concern.

Mammals
The Lamar Buffalo Ranch has a long history of wildlife management and has served as an area of reintroduction for two species - bison and gray wolves. In 1902, Congress appropriated funds to purchase three bull bison from the Goodnight herd in Texas and 18 cow bison from the Allard herd in Montana, attempting to revitalize the wild mountain bison herd. The domesticated bison herd was moved in 1906 from upper Mammoth to the Lamar Valley. In 1907, the wild herd consisted of 25 bison. The population of the wild bison herd fluctuated in numbers until 1931 when the population dropped to ten. Until after 1938, when most domesticated bison were released to intermingle with the surviving wild herd, Lamar was the site for strengthening the population to reduce the chances of extinction due to poaching.

In 1995, the gray wolf was reintroduced to the natural Yellowstone habitat after being extirpated by in 1926. An area just north of the Lamar Buffalo Ranch served as the release area and wolves were fenced in acclimation pens for a 'soft' release from 1995-1997. This type of release ensured the animals, originally from Canada, would not travel north to their formal home ranges. The fenced area was used to contain the wolves so they became familiar with the new environment.

Birds
Though the Lamar Buffalo Ranch developed area has not been surveyed specifically, the following is a list of birds that are commonly found in the area. None of the species are sensitive (Baril, email communication 2014). Red-tailed Hawk (*Buteo jamaicensis*), Northern Flicker (*Colaptes auratus*), American Kestrel (*Falco sparverius*), Black-billed Magpie (*Pica hudsonia*), Common Raven (*Corvus corax*), Tree Swallow (*Tachycineta bicolor*), Violet-green Swallow (*Tachycineta thalassina*), Cliff Swallow (*Petrochelidon pyrrhonota*), Mountain Chickadee (*Poecile gambeli*), Mountain Bluebird (*Sialia currucoides*), Townsend's Solitaire (*Myadestes townsendi*), Sage Thrasher (*Orescoptes montanus*), European Starling (*Sturnus vulgarus*), and Brewer's Sparrow (*Spizella breweri*).

Fish
Rose Creek is an important Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) spawning tributary in the lower Lamar River drainage. Complete spawning surveys have not been conducted in the valley; however, based on geomorphological conditions, such as stream gradient, accessibility, and length of tributaries to the Lamar River, Rose Creek provides abundant spawning habitat for that area.

Native cutthroat trout are thought to be among the most ecologically important fish of the Greater Yellowstone Ecosystem and are highly regarded by anglers. Longnose dace (*Rhinichthys cataractae*) also inhabit the Lamar River drainage. Several factors, nonnative species and disease among them, are threatening the persistence of native fish. Nonnative species in the park include brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), lake chub *(Couesius plumbeus)*, lake trout (*Salvelinus namaycush*), and rainbow trout (*Oncorhynchus mykiss)*. YNP's goal is to restore the ecological role of native species, including fluvial Arctic grayling (*Thymallus arcticus*), westslope cutthroat trout (*Onchorhynchus clarkii lewisi*), and Yellowstone cutthroat trout, while ensuring sustainable native fish angling and viewing opportunities for visitors.

Despite changes in species composition and distribution, large-scale habitat degradation has not occurred. Water diversions, water pollution, and other such impacts on aquatic ecosystems have rarely occurred in Yellowstone. Consequently, fish and other aquatic inhabitants continue to provide important food for grizzly and black bears, river otters, mink, ospreys, bald eagles, pelicans, and many other birds and other species.

Aquatic nuisance species disrupt ecological processes because they are not indigenous to the ecosystem. Invasive organisms can cause species extinction, with the highest extinction rates occurring in freshwater environments. Aquatic nonnative species that are having a significant detrimental effect on the park's aquatic ecology include lake trout in Yellowstone Lake; brook, brown, and rainbow trout in the park's streams and rivers; and the parasite that causes whirling disease. Though there are other aquatic nonnative species in the park, their effects are less dramatic.

Methodology and Intensity Level Definitions
Impact analyses of fish and wildlife were based on recent studies and previous projects conducted within the park. The intensity of impacts to wildlife is defined as follows:

Impact Intensity	Impact Description
Negligible	Neither wildlife nor fish would be affected, changes would be either non-detectable or, if detected, would have effects that would be considered slight and short-term.
Minor	Temporary displacement of a few localized individuals or groups of animals or fish; mortality of individuals that would not impact population trends; mitigation measures, if needed to offset adverse effects, would be simple and successful.
Moderate	Effects to wildlife would be readily detectable, long-term and localized, with consequences affecting the population level(s) of specie(s). Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major	Effects to wildlife would be obvious, long-term, and would have substantial consequences to wildlife populations in the region; mortality of a number of individuals that subsequently jeopardizes the viability of the resident population; extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

3.4.1 Impacts of Alternative A (No Action)

Numerous wildlife species inhabit the Lamar Buffalo Ranch area, and the wildlife present varies on a seasonal basis. Those that are most common to the immediate area are those tolerant of, if not habituated to, human presence and activity. Wildlife that currently use the area would remain unchanged under Alternative A.

Swallows and bats would remain in their current locations. The bunkhouse attic would continue to serve as a maternity roost for the little brown bat and remain an important building for bat productivity. Guano from these two species would continue to pose a maintenance and health concern. Other than routine maintenance, repair and upkeep activities that would continue under the no action alternative, no additional disturbance would occur. While wildlife such as bison, small mammals, and some birds occur within the project area with regularity, many species avoid the area because of the human activity. Within the project area, native Yellowstone cutthroat trout, Longnose dace, amphibians, and aquatic organisms occur in Rose Creek. In early summer, Yellowstone cutthroat trout travel from the Lamar River to shallower stretches of the creek to spawn. Effects from the adoption of Alternative A would be negligible, short-term, adverse impacts.

Cumulative Effects: Cumulative impacts on wildlife are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in YNP. Construction projects in YNP would continue to occur. Ongoing administrative activities such as hazing, wildlife monitoring, road construction, and facilities maintenance would continue to affect some wildlife resources. Hazing efforts are carried out by park personnel to discourage wildlife (e.g. bears, wolves, and coyotes) from using developed areas and to move bison back into the park during winter months. While Lamar Buffalo Ranch does not have a history of hazing animals, the potential exists for some wildlife to be permanently removed from the population if they become habituated to human food and pose a threat to human safety. Wildlife monitoring practices are used to document various demographics of wildlife populations in the park and may cause adverse impacts ranging from generalized disturbance to sedation and handling of the animals. Noise from road construction and facilities maintenance could disturb wildlife in localized areas. Impacts from these disturbances could range from no impact to movement away from the immediate area. Park visitation is expected to increase each year as a result of population growth in nearby communities and elsewhere. Past and ongoing recreational uses such as boating, angling, camping, and hiking would continue park-wide. Fishing occurs park-wide during the summer months and could contribute to generalized disturbance of all wildlife species that occur near streams and lakes. Camping and hiking occur throughout the park and could lead to generalized disturbance which could affect feeding and resting behavior. Camping activities risk habituation of bears and other carnivores to human foods which could lead to some individual animals being euthanized. Both ongoing administration activities and increased visitor use could lead to impacts to wildlife populations throughout the park that are short- and long-term, negligible to minor, and adverse.

3.4.2 Impacts of Alternative B

Although the long-standing, minimal development of the Lamar Buffalo Ranch has resulted in localized degradation of wildlife habitat, a diversity of wildlife species inhabit the area. An increase in human presence from construction crews while the proposed sustainability improvements are underway would

temporarily displace some species; although the wildlife present within the immediate vicinity of the proposed activities are habituated to human activity. Adverse effects on these animals as a result of the activities proposed under Alternative B are generally expected to be negligible because of the human presence that already occurs there. The species that use this area would be temporarily displaced by construction activity and equipment, but they would be expected to return following completion of the project.

The NPS expects no increase in wildlife mortalities in this area because all construction activities would be short-term (temporary) and confined to the immediate project area. As with all YNP construction projects, the NPS would direct the contractor to manage food and garbage so that they are not available to grizzly or black bears. Contractor staff would have to attend a bear/food management orientation safety session and abide by the normal bear management guidelines.

Some migratory birds would be permanently displaced outside of the nesting period (mid-May – August 1st) by the addition of bird exclusion devices (netting, spikes, etc) installed on many of the structures. Due to health concerns, this safety precaution is necessary in order to provide a healthy environment for both staff and participants staying at the Lamar Buffalo Ranch. Additionally, ground squirrels and other small mammals may be excluded from their current homes by the installation of skirting and better insulation that's proposed to be installed under many of the structures.

Insulation to the bunkhouse attic floor is not expected to affect bats, but modifications to the rafters that support the ceiling in the bunkhouse could. However, this project would not include modifications to the rafters but would include closing access to the rehabilitated buildings. To ensure impacts to the existing colony are mitigated, renovations on the buildings would occur when bats are typically not found in buildings (November to April). In the event that bats are able to access the rehabilitated buildings, mitigation measures would be in place to allow for appropriate maintenance practices (use of drop cloths and making sure the rafters are accessible for humans to clean up droppings) and safe clean-up procedures. Long-term, moderate adverse impacts to the bat colony may occur following the work proposed to improve the building envelope.

As Rose Creek is an important fish spawning tributary of the Lamar River drainage, the micro hydro system would not be used continuously at full power year round. Rather, the amount of flow diverted to the turbine would be less during critical spawning and rearing/emigration periods. Thus the turbine could be shut down completely with no diversion of the creek during critical time periods for fish, or reduced flow to the turbine would be implemented during low flow periods to ensure adequate surface flow of the three forks of Rose Creek to reduce impacts on resident fish populations.

Alternative B would install a micro hydro system powered by water from an existing domestic water line. This water line transports water from an existing spring box located adjacent to Rose Creek and upstream of the development. Flow measurements conducted in early May 2014 indicate the proposed micro hydro system would remove approximately 10% of the instream flow from Rose Creek during that heavy flow period. It is not known what that percentage would be as stream flows decrease throughout the spring and summer season; nor what the percentage would be during winter months, when flows naturally are at their lowest though percentages are expected to rise. The 320 gallons per minute of water the micro hydro turbine would use equates to approximately 0.71 cubic feet/second (cfs). The location of the water draw area is above the area where Rose Creek branches into three forks. The 0.71 cfs would be divided among these three branches and total combined reduction of flow would equal 0.71 cfs when the micro hydro system is functioning at full power. If operated at full power continuously, the micro hydro system would have potential to cause moderate, long-term, adverse impacts to fish, amphibian, and aquatic species that inhabit Rose Creek. To keep impacts to no greater than minor, the micro hydro system would be operated based on the results of monitoring efforts on Rose Creek. If data suggests a threshold or trigger point is

reached, the amount of water used may be adjusted or the micro hydro system shut down during critical periods. To establish baseline data and establish thresholds, monitoring of fish habitat would be conducted by NPS personnel during winter months, stream flow data would be collected every two weeks or as conditions warrant, spawning success evaluated in spring and early summer. Under Alternative B, negligible to minor, short- term and long-term adverse impacts to park wildlife would be expected to occur as long as mitigation measures are implemented dictating potential limits of micro hydro turbine operation during critical time periods.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor to moderate, short- and long-term adverse impacts to wildlife.

3.5 Special Status Species

Affected Environment

The species listed below are either federally listed as endangered, threatened, or candidate species or are listed by the park as a species of management concern. Only species that exist or have the potential to exist in the project area are listed. The evaluation of effects included direct, indirect, interrelated, interdependent, and cumulative impacts as defined by the Endangered Species Act (ESA). Consultation with the U.S. Fish and Wildlife Service (USFWS) will occur for this plan. Mitigation proposed by the park for impacts on threatened or endangered species could include avoidance, minimization, and conservation measures as agreed upon by the USFWS.

Bald Eagle (*Haliaeetus leucocephalus*): The USFWS removed the bald eagle from the list of endangered and threatened wildlife on August 8, 2007. Current data indicate populations of bald eagles have recovered in the lower 48 states, with an estimated minimum of 9,789 breeding pairs now compared to 417 active nests in 1963 (USFWS 2006). Since 1984, the number of nesting pairs in YNP has increased substantially, with 31-34 nest attempts per year since 2001. Thus the park may have reached saturation in the number of nesting pairs that can be supported (Baril et al. 2009). Nesting and fledgling bald eagles in Yellowstone increased incrementally from 1987 to 2005 (McEneaney 2006). Resident and migrating bald eagles are now found throughout the park, with nesting sites located primarily along the margins of lakes and shorelines of larger rivers. The bald eagle management plan for the Greater Yellowstone Ecosystem achieved the goals set for establishing a stable bald eagle population in the park, with a total of 26 eaglets fledged from 34 active nests during 2007 (McEneaney 2006). This is the most fledged eaglets ever recorded Yellowstone and the increasing population trend indicates habitat is not presently limiting the growth of the population.

North American pronghorn (*Antilocapra americana*): Yellowstone's pronghorn population was one of only a few not exterminated or decimated by early in the 20th century and, as a result, was the source for re-establishing or supplementing populations throughout much of its range (Lee et al. 1994). These pronghorn express much of the genetic variation that was formerly widespread in the species, but is no longer present elsewhere (Reat et al. 1999). This population also sustains one of only two long-distance pronghorn migrations that persist in the greater Yellowstone region (White et al. 2007). There are serious concerns about its viability because low abundance (~300) and apparent isolation have increased its susceptibility to random, naturally occurring catastrophes (NPS 2010; National Research Council 2002).

Bison (*Bison bison*): Plains bison at Yellowstone have been petitioned for listing as an endangered species twice in the past 15 years and both times the U.S. Fish and Wildlife Service has declined to list

the species. The Yellowstone bison population has been identified as a distinct population by USFWS definition. The population is comprised of plains bison that historically occupied about 20,000 square kilometers (km2) in the headwaters of the Yellowstone and Madison rivers of the western United States. While nearly extirpated in the early 20th century, Yellowstone National Park provides sanctuary to the only wild and free-ranging bison population to continuously occupy historic range. Intensive husbandry, protection, and relocation were used to bring back the population, and in summer 2011 there were about 3,700 bison in the park (1300 on the central range that includes the Lake development area). Yellowstone bison are managed as a single population having two distinct breeding areas with individuals that move across an extensive landscape (220,000 acres). These bison are subject to natural selection factors such as competition for food and mates, predation, and survival under substantial environmental variability. Thus, they have retained the adaptive capabilities of plains bison. Yellowstone bison contribute a unique genetic lineage to plains bison that is not represented elsewhere within populations managed by the Department of Interior. They have high genetic diversity compared to other populations of plains bison, and are one of a few bison populations with no evidence or suggestion of potential cattle ancestry.

The central herd occupies the central plateau of Yellowstone National Park, extending from the Pelican and Hayden valleys in the east to the lower elevation and thermally influenced Madison headwaters area in the west. Central herd bison congregate in the Hayden Valley for breeding. Most bison move between the Madison, Firehole, Hayden, and Pelican valleys during the rest of the year. Some of these bison are likely to migrate north to the Gardiner Basin during the winter months and return to the Hayden Valley to breed. Emigration has been observed with more bison emigrating north from the central range than vice versa. The northern herd occupies the area commonly referred to as the northern range, extending from the high elevations along the east boundary from Cooke City south to the Needle (a small number of males summer in the upper Lamar Valley to Saddle Mountain) westward to include the Mirror Plateau, Specimen Ridge and Upper Slough Creek all the way to the lower reaches of the Gardiner Basin at Yankee Jim Canyon. This sub-population breeds at the eastward end of their range and slowly moves down in elevation as the fall and winter months pass. By late winter and early spring the majority of the northern range group is located west of Tower and follows the chronology of spring green up conditions back to the high country for the July/August breeding period.

Bison tend to be observed in open grassland or shrub steppe habitats but due to the juxtaposition of these habitats in Yellowstone there are many travel corridors along rivers and over high elevation passes that provide connections to all of the major watersheds throughout the park. The bison population is more commonly found in the northern 2/3 of the park but small numbers (mostly males) move in to the Thoroughfare and portions of the Caldera between Lewis Lake and West Thumb. As late as the 1970's there was a remnant group of bison that used the Pitchstone Plateau and portions of the Bechler Valley. That area has not been routinely monitored but use of meadows in this portion of the park would not be unexpected. A recent evaluation of potential habitat identifies the southern 1/3 of Yellowstone as suitable but not extensively occupied at this time.

Gray Wolf (*Canis lupus*): Gray wolves were native to the Greater Yellowstone Area when the park was established in 1872. Historically hunted for their hides and as predators, they were eliminated from the ecosystem by the 1930s. The USFWS released an EIS on wolf reintroduction in May 1994. In 1995 and 1996, 31 gray wolves from Canada were released in the park. A total of 14 wolves were released in the winter of 1994-1995; 17 additional wolves were released in 1996 (Phillips and Smith 1996). On May 5, 2011, the USFWS removed gray wolves in a portion of the Northern Rocky Mountain Distinct Population Segment (DPS) encompassing Idaho, Montana, and parts of Oregon, Washington, and Utah from the Federal List of Endangered and Threatened Wildlife. Gray wolves in Wyoming remain on the List of Endangered and Threatened Wildlife and continue to be subject to the provisions of our experimental population regulations codified at 50 CFR 17.84(i) and (n). Wolves reintroduced into YNP and central Idaho were classified ―nonessential experimental according to section 10(j) of the ESA of 1973, as

amended (16 U.S.C. 1531). In national parks and wildlife refuges, nonessential experimental populations are treated as threatened species, and all provisions of Section 7 of the ESA apply (50 CFR 17.83(b)). The gray wolf was removed from the federal list of endangered and threatened wildlife and from Wyoming's wolf population's status as an experimental population effective September 30, 2012. The USFWS, NPS, and the states will monitor wolf populations in the Northern Rocky Mountain DPS and gather population data for at least five years. At the end of 2013, at least 95 wolves in 10 packs and one group (8 breeding pairs) occupied YNP. The wolf population has declined by about 50% since 2007 mostly because of a smaller elk population, the main food of northern range wolves. At the end of 2013, there were approximately 440 adult wolves in the GYA. At least one member of most packs is radio-collared, allowing NPS and USFWS personnel to monitor the movements of most packs.

Yellowstone Cutthoat Trout (*Oncorhyrynchus clarkia bouvieri*): A range-wide status review estimated that the conservation population (>90% genetic purity) of YCT occupy over 6,300 km within their native range in Idaho, Montana, Nevada, Utah and Wyoming. Yellowstone Lake, at over 84,000 surface acres, is home to the largest population of YCT in existence (Varley and Schullery 1998) and is an important food source for many animal species in the park. In Yellowstone Lake, recent threats such as lake trout introduction, drought, and whirling disease have severely diminished the ecological role of this fish.

Threatened and Endangered Species: *The species listed below are either federally listed as endangered or threatened. Candidate species are included above.*

Canada Lynx (*Lynx canadensis*); Status Threatened: The USFWS listed the Canada lynx as a threatened species in 2000. Lynx are considered rare in the Greater Yellowstone Area and are believed to use boreal or montane forests. Evidence of lynx in Yellowstone National Park comes from about 216 winter tracking surveys (conducted during winters of 2001-2004 and covering 1,043 total miles); from 118 lynx hair-snare transects deployed park-wide during the summers of 2001-2004, and from historic sightings. Park-wide, only four lynx sightings have been reported by visitors in the last 10 years. Surveys have documented one possible, two probable, and two definite cases of lynx presence, including a female accompanied by a kitten. Population numbers are unknown. Lynx prefer upper elevation coniferous forests in cool, moist vegetation types, particularly those that support abundant snowshoe hares, the primary food source for lynx. The best evidence of lynx presence is along the east shore of Yellowstone Lake. Critical habitat for lynx has also been designated for YNP and overlaps with Lynx Analyses Units through the park created in 2009.

The Fish and Wildlife Service designated critical habitat for lynx on February 27, 2009 (USFWS 2009). Five lynx critical habitat units were selected in the United States that provide adequate habitat elements for lynx. Unit #5 falls within the Greater Yellowstone Area (GYA) and is slightly over 6 million acres. Approximately 927,000 acres fall within Yellowstone National Park.

Wolverine (*Gulo gulo*); Status - Proposed for Threatened under ESA: The wolverine is a wide-ranging mustelid that naturally exists at low densities throughout much of northern and western North America (Beauvais and Johnson 2004). Wolverines are highly adapted to extreme cold and life in environments that have snow on the ground all or most of the year (Aubry et al. 2007). In the contiguous United States, these habitats are highly mountainous and occur at elevations above 8,000 feet (Copeland et al. 2007).

Overexploitation through hunting and trapping, as well as predator poisoning programs, likely caused wolverine populations to contract along the southern portion of their historical range in North America since the early 1900s (Banci 1994). However, recent surveys indicate wolverines are widely distributed in remote, montane regions of Idaho, Montana, Washington, and parts of Wyoming (68 FR 60113).

Wolverines have been detected in the Greater Yellowstone Ecosystem including the eastern, northern, and southern portions of the park (Beauvais and Johnson 2004; Copeland et al. 2007). Wolverines have protected status in Washington, Oregon, California, Colorado, Idaho, and Wyoming (Banci 1994). In Montana, wolverines are classed as furbearers and trapper harvests are managed through a quota system that limits the number of animals that can be taken. On February 4th, 2013, the USFWS proposed for the wolverine to be listed as threatened, moving it from candidate species category in the contiguous United States. However, as of May 2014, memoranda from USFWS Mountain-Prairie Regional Directors do not support issuing a final rule adding the wolverine to the list of threatened species for reasons including a concern about the degree to which climate change impacts on wolverine populations can be reliably predicted. A final decision on species status is expected later in 2014.

Grizzly Bear (*Ursus arctos horribilis*); Status - Threatened: A recovery plan for grizzly bear populations in the lower forty-eight contiguous United States was implemented because grizzly bears were listed in 1975 under the Endangered Species Act (USFWS 1982). The plan was developed to provide direction for the conservation of grizzly bears and their habitat to federal agencies responsible for managing land within the recovery zone. That same year, YNP completed an Environmental Impact Statement (EIS) for a grizzly bear management program specifically designed to recover the subpopulation of grizzly bears inhabiting the park (NPS 1983). Management of grizzly bears in YNP has been successful in enabling grizzly bear recovery and reducing bear-human conflicts (e.g., property damage, incidents of bears obtaining human food, bear-inflicted human injuries) and human-caused bear mortalities in the park (Gunther 1994, Gunther and Hoekstra 1998, Gunther et al. 2000, Gunther et al. 2004). The U.S. Fish and Wildlife Service removed grizzly bears in the Greater Yellowstone Ecosystem from the Federal List of Threatened and Endangered Wildlife on April 30, 2007. In 2009, a U.S. District Court returned the grizzly to the federal threatened species list, saying the Conservation Strategy was not enforceable and insufficiently considered the impact of climate change on grizzly food sources. The USFWS and the Department of Justice appealed. In 2012, a ruling was made to keep the grizzly bear on the federal threatened species list. The grizzly bear population in the GYA was estimated to range between 549 and 672 in 2012.

Methodology and Intensity Level Definitions

Impacts to USFWS Threatened and Endangered Species and Yellowstone Species of Management Concern are analyzed in this impact topic based on the knowledge of park resource specialists, current literature, and consultation with USFWS. The intensity of impacts to special status species are defined as follows:

Impact Intensity	Impact Description
Negligible	Adverse or beneficial impacts to individuals or population of threatened and endangered species or species of concern or to the species habitat that is not measurable or perceptible and would be unlikely to occur.
Minor	Adverse or beneficial impacts to individuals or population of threatened and endangered species or species of concern or to the species habitat that are measurable, small, and localized may occur. Short- or long-term disturbances to individuals or population and/or a small amount of habitat could be permanently modified or removed. Impacts would not measurably affect the migration patterns, or other demographic characteristic of the population (i.e., age/sex structure, recruitment rates, survival rates, movement rates, population sizes, population rates of change).

Moderate	Adverse or beneficial impacts to individuals or population of threatened and endangered species or species of concern or to the species habitat that are measurable, localized, and of consequence would affect a moderate portion of the species/range in the Park. Short- or long-term disturbances could measurably affect the migration patterns or other demographic characteristics of a population (i.e., age/sex structure, recruitment rates, survival rates, movement rates, population sizes, population rates of change). Impacts would not significantly increase the susceptibility of populations(s) in or near the Park to environmental or demographic uncertainties (e.g., severe winters, droughts, disease epidemics, and skewed age or sex ratios).
Major	Adverse or beneficial impacts to individuals or population of threatened and endangered species or species of concern or to the species habitats that are measurable, large, long-term, and cause a widespread change across the region. The susceptibility of populations(s) throughout the region to environmental or demographic uncertainty would significantly increase.

3.5.1 Impacts of Alternative A (No Action)

Eight special-status species were determined to have potential to occur within the Lamar Buffalo Ranch area. Special status wildlife species are generally not expected to inhabit within the Lamar Buffalo Ranch area due to the level of habitat disturbance,human use, and NPS management aimed at preventing use of developed areas by some species (e.g. bears and wolves). Since infrastructure would remain the same under Alternative A, only negligible, short-term, adverse impacts are expected.

The bald eagle, pronghorn, gray wolf, and wolverine are not known to regularly inhabit the project area but have the potential to exist in the project area. Special status species that inhabit the Lamar Buffalo Ranch area are as follows and any effects to these species would be negligible, short-term, and adverse.

Yellowstone Cutthoat Trout: Yellowstone Cutthroat Trout is a Yellowstone species of concern. A description of its presence and impacts from the proposed project are described in the *Wildlife* section of this EA.

Grizzly Bear: Because of the regular presence of humans in the Lamar Buffalo Ranch area, grizzlies generally avoid the project area; however they do occasionally pass through. The area is managed for regular human use or occupation. Management of carcasses in administrative areas, such as Lamar, requires their removal to reduce conflicts with bears. These carcasses are relocated to other areas of the park where they can be safely utilized by bears and other scavengers without disturbance. The probability of grizzly bear loss due to vehicular traffic is not likely to increase with the no action alternative. Traffic on roads to the Northeast Entrance is expected to stay neutral, with no increase or decrease expected. While there may be short-term displacement of bears form areas adjacent to the administrative area due to ongoing maintenance and management actions, there would be no long-term impacts. Implementation of Alternative A **"may affect, but is not likely to adversely affect"** the grizzly bear.

Canada Lynx: The Lamar Buffalo Ranch area does not occur in a Lynx Analysis Unit and few, if any lynx occur in the area. Since the ongoing maintenance is in an area of continued human use, movements of lynx near the project site are not anticipated. While there is always the potential that there could be some direct or indirect impacts to lynx, these impacts are expected to be short-term and negligible. Alternative A would have **"no effect"** on the Canada lynx and therefore this alternative would have **"no effect"** on Canada lynx critical habitat.

Cumulative Effects: Cumulative impacts on special status species are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in the Lamar Buffalo Ranch area. For ESA-listed species, cumulative effects are those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area. Continuing construction projects in the developed areas of the park would occur, but all moderate or major impacts on park special status species must be mitigated. Ongoing administrative activities such as road reconstruction and maintenance, backcountry operations, hazing activities, and facilities maintenance would continue to have adverse effects on special status species in the park. These would cause temporary displacement of special status species from generalized disturbance; feeding and resting behavior of wildlife species may be interrupted and some special status plant species may be adversely impacted from equipment working in construction areas. Effects from these activities would be direct, short-term, and negligible because of the limited duration of the activity. Most facilities maintenance would take place in developed areas where minimal impacts to special status species would occur. However, adverse impacts to some species may occur because they are disturbed by noise and people associated with maintenance activities. Park visitation is expected to increase each year as a result of population growth in nearby communities and elsewhere. Past and ongoing recreational use such as fishing, camping, and hiking would continue park-wide. These activities could lead to negligible to minor adverse impacts because special status species can become disturbed from human activity. Outside of the park, recent hunting regulations for gray wolves would have an adverse effect on the population, but compliance with the individual state's wolf management plan would ensure genetic viability and survival of the species.

Cumulative effects to special status species from such actions would be negligible and adverse. While some individuals and groups would be displaced, overall wildlife populations would not be jeopardized. Alternative A would contribute to negligible, adverse cumulative impacts on special status species. Combined with known past, current and future projects and actions, there would be negligible adverse cumulative impacts on special status species.

3.5.2 Impacts of Alternative B

As stated, eight special-status species were determined to have potential to occur within the Lamar Buffalo Ranch area; however, they are generally not expected to occur within the administrative area due to the level of habitat disturbance and consistent human use year round. Due to this lack of occurrence in the project areas, minor adverse effects to special status wildlife species are expected due to a very small loss of habitat disturbance or displacement from increased human presence during the construction period.

The bald eagle, pronghorn, gray wolf, and wolverine are not known to regularly inhabit the project area but have the potential to exist in the project area. Special status species that inhabit the Lamar Buffalo Ranch area are as follows and any effects to these species would be negligible and short-term.

Grizzly Bear: Because of the regular presence of humans in the Lamar Buffalo Ranch area, grizzlies generally avoid the project area; however they do occasionally pass through. The area is managed for regular human use or occupation. Management of carcasses in administrative areas, such as Lamar, requires their removal to reduce conflicts with bears. These carcasses are relocated to other areas of the park where they can be safely utilized by bears and other scavengers without disturbance. The probability of grizzly bear loss due to vehicular traffic is not likely to increase with the no action alternative. Traffic on roads to the Northeast Entrance is expected to stay neutral, with no increase or decrease expected. While there may be short-term displacement of bears form areas adjacent to the administrative area due to construction activities but there would be no long-term impacts. All contractor employees would be

required to abide by the park's proper food and garbage storage policies. Food storage and disposal procedures at the construction sites would be enforced to minimize the potential for bears to obtain food. By limiting construction activities to within the Lamar Buffalo Ranch developed area, there would be no loss of grizzly bear habitat. The probability for grizzly bear loss due to vehicular traffic is not likely to increase with this alternative. Traffic on the roads in the Lamar Buffalo Ranch developed area is expected to slightly increase with different phases of this project but speed limits of 15 miles per hour occur here. While there may be short-term displacement of bears from areas adjacent to the ranch developed area due to construction activities, there would be no long-term impacts. Implementation of Alternative B **"may affect, but is not likely to adversely affect"** the grizzly bear.

Canada Lynx: The Lamar Buffalo Ranch area does not occur in a Lynx Analysis Unit and few, if any lynx occur in the area. Since the construction area of the PV solar array, micro hydro system, and other components of the project is in an area of continued human use, movements of lynx near the project site are not anticipated. While there is always the potential that there could be some direct or indirect impacts to lynx, these impacts are expected to be short-term and negligible. Alternative A would have **"no effect"** on the Canada lynx and therefore this alternative would have **"no effect"** on Canada lynx critical habitat.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor, short- and long-term adverse impacts to special status species.

3.6 Historic Structures

Affected Environment

The affected environment for this proposed project would comprise the Area of Potential Effect (APE) per the National Historic Preservation Act definition:, "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." [36 CFR Part 800.16(d)]. The APE for this project includes the Lamar Buffalo Ranch Historic District (48YE680) for potential direct and indirect effects, and adjacent portions of the Northeast Entrance Road Historic District (48YE821) for indirect visual effects.

Lamar Buffalo Ranch Historic District (48YE680)
The Lamar Buffalo Ranch Historic District, located just east of Rose Creek in the Lamar Valley in the northeast quadrangle of the park, is a portion of the multiple resource nomination for the Historic Resources of Yellowstone National Park. The historic district was listed on the National Register of Historic Places on December 7, 1982, being recognized as nationally significant for its role in the history of wildlife management and preservation of bison and for the importance in the history of park rangers in Yellowstone. The period of significance for the Lamar Buffalo Ranch Historic District is 1907-1952, when a semi-domesticated herd of bison were managed using cattle ranching techniques at the Lamar Buffalo Ranch, mostly through the work of a chief buffalo keeper, one assistant, one to two herders, and an irrigator. They maintained the valley in front of the ranch buildings for grazing and grew hay there along several of the Lamar River's tributaries, such as Slough Creek. After the visitor season, park rangers would help with the ranch work; cutting hay, running bison in from other areas to the enclosures at the ranch, slaughtering excess animals, castrating, and inoculating calves. During this time, they would stay at the bunkhouse. The movement from ranching bison to preserving them in a natural state was a

gradual one that began around 1930. In 1952, the NPS terminated the operation of managing a semi-domesticated herd at Lamar. The Lamar Buffalo Ranch's operation exhibits the concern for preserving the bison and illustrates the evolution of ideas concerning appropriate wildlife management during almost half of Yellowstone's history (NPS, 1982).

Resources that convey the significance of the Lamar Buffalo Ranch Historic District consist of five contributing structures: Horse Barn (HS-109), Soda Butte Residence (HS-108), Buffalo Keepers Quarters (HS-106), Bunkhouse (HS-107), and Corral (HS-999). All structures retain integrity although the corrals have been altered. The historic district sits on a slight hill at the base of an alluvial fan among mostly sagebrush and nonnative grasses with cottonwood trees growing along Rose Creek. The viewshed from the historic buildings spans the enormous valley. Adjacent to the district are a cluster of cabins utilized by the Yellowstone Institute for field classes, which were constructed around 1993-1999. These new cabins replaced cabins that had been brought in for the same purpose from Fishing Bridge Historic District during the winter of 1981. The 1982 National Register Nomination Form for Lamar Buffalo Ranch stated, "The 18 rustic cabins adjacent to the historic district were moved in to provide housing for the Yellowstone Institute participants. Their presence does not detract from the architectural integrity of the Historic District (NPS, 1982)." Now non-extant, these former Fishing Bridge cabins were removed from Lamar after 1993. The new cabins are visible from all portions of the historic district; however, they were constructed using design and materials that do not detract from the architectural integrity of the district. In 1994-96, photovoltaic (PV) panels were installed (as a replacement for the noisy diesel-powered generators) to the east of the contributing portion of the corrals and in 2005, the PV array was doubled.

Presently the historic structures at Lamar Buffalo Ranch Historic District serve as a ranger station, residence, and work space for NPS personnel. The bunkhouse is used as a classroom and kitchen by the Yellowstone Institute and by the National Park Service for educational programs. Contributing structures include:

1. Lamar Buffalo Ranch Corral (HS-0999): The corral was originally constructed in 1906-1907 when the bison herd was moved from upper Mammoth to the Lamar Valley. The contributing portion of the corral is adjacent to and southeast of the horse barn (HS-109) approximately 200-feet x 240-feet and currently constructed with several horizontal poles laid between sets of vertical posts. Its continued use as a livestock pen has required realignment and replacing all the fencing material several times over the years.

2. Lamar Buffalo Ranch Ranger Station / Lamar Buffalo Ranch Buffalo Keeper's House (HS-0106): This heavy timber log construction historic residence for the buffalo keeper was built in 1915. Today it serves as a ranger's residence. It is a single story L-plan structure of horizontal logs with enclosed trough type false cornering and concrete chinking. The cedar shingle 4-sided hipped roof covers the living area; a gable extension covers the kitchen and storage area. The structure sits on a concrete foundation. It has had later additions with the most prominent being the framed-in-porch on the façade and the shed porch on the rear. In 1964, doors were installed on the porch so it functions more as a threshold between the exterior and interior. The original floor plan remains intact although most of the interior finishing materials have been replaced. All interior wall and ceiling surfaces are covered with painted sheetrock. The oak flooring remains intact and the painted band of wood cupboards in the kitchen present a historic appearance. The windows in the house were originally 6-light single pane casement sash. Not original to the structure, the windows are currently 4-light casement sash. Exterior screens and operable storm windows were added during the mid-1980s and in around 2004, those storm windows were repaired. Between 1997 and 2001, the exterior window frame colors and log paints were analyzed to determine the original colors for all historic buildings in Lamar. It was concluded that the original wood paint color was a dark brown and the window frames were a dark green.

In 2009, the Wyoming State Historic Preservation Office concurred with a proposed energy saving rehabilitation of three historic structures at the Lamar Buffalo Ranch, including this building (SHPO file #1209BHB007). The 2009 proposal was to replace the non-historic windows with modern sash and frame replicas of the six-light original windows with double-pane glass and no storm windows; the original door was to be replaced with a solid-core, double pane glass, but dated to indicate modern materials; insulation was to be added inside the interior walls, foundation, and ceilings. In 2011, the Wyoming State Historic Preservation Office concurred with the park's updated proposal to use a "full divided light" six-light casement style window rather than the true previously proposed "true divided light" six-light casement style window (SHPO File # 1011BAB001). This project has not yet been implemented.

3. Lamar Buffalo Ranch Bunkhouse (HS-0107): This saddle notched log structure was originally constructed in 1929-30. It has a wood shingle gable roof and is on a cobble stone foundation. The west end of the structure has a shed porch on raised cobblestone foundation with log columns on railings. Historically, a pelton wheel provided power to the ranch and was located in a vault beneath the bunkhouse. A black and white photo from 1956 clearly shows the original windows to be 6-light casement. A second photograph from 1975 illustrates one-over-one double hung single pane sash with triple, double, and single openings. Although a specific date for this change was not documented, the building's current windows are not the style or type that was originally designed or constructed. The interior, which was modified post-1963, retains no integrity and does not contribute to the building's significance. This building now provides classrooms, dining, and bath facilities for the Yellowstone Institute. In 2000, Historical Research Associates of Missoula, Montana, completed a survey and evaluation of the exterior and interior of this building and concluded the interior retains no integrity and does not contribute to the building's significance.

   In 2009, the Wyoming State Historic Preservation Office concurred with the proposed energy saving rehabilitation of three historic structures at the Lamar Buffalo Ranch, including this building (SHPO file #1209BHB007). For this building, the 2009 proposal was to replace the modern windows with double hung replicas of the original windows; the doors replaced with replicas of the original doors; and the interior walls and ceiling insulation upgraded. In 2011, the Wyoming State Historic Preservation Office concurred with the park's updated proposal to use a "full divided light" six-light casement style window rather than the true previously proposed "true divided light" six-light casement style window (SHPO File # 1011BAB001). The replacement windows proposed for the Bunkhouse was intended to return to the historic outside-opening, six-light casement windows, the same size as the original windows rather than the smaller one-over-one light double-hung modern windows. This project has not yet been implemented.

4. Lamar Buffalo Ranch Residence / Lamar Buffalo Ranch Assistant Buffalo Keeper's House/Soda Butte Ranger Station (HS-0108): The building was originally a ranger station located in Soda Butte, east of the Lamar Buffalo Ranch. The building was likely moved to Lamar Buffalo Ranch in 1938 to house the buffalo keeper's assistant. The horizontal log walled residence with a gable roof and exposed log ends has a stone-faced concrete foundation. The L-plan building is single story with four rooms and one bath. In 1939, a 9'x18' - L-extension to the building was constructed for a bedroom, bathroom, and a mudroom. This building is the only historic structure in the district that has retained the original windows. Modern interior finishes include sheetrock walls and ceilings, Formica countertops, and vinyl floorings, but the floor plan and the interior wood doors and door and window trim are contributing interior features. The building is currently used as a ranger residence.

In 2009, the Wyoming State Historic Preservation Office concurred with the proposed energy saving rehabilitation of three historic structures at the Lamar Buffalo Ranch, including this building (SHPO file #1209BHB007). The 2009 proposal was to retain the existing historic windows, but replace the modern storm windows with low profile, high transparency, double-paned manufactured storm windows; fit the existing doors with weather stripping and sweeps; and add insulation to the floor and ceilings and insulated wrap to exposed pipes. This project has not yet been implemented.

5. Lamar Buffalo Ranch Horse Barn (HS-0109): Constructed in 1927, the barn was and is currently used as storage and a temporary seasonal workshop. The building is of log construction, 1-1/2 stories and on a concrete capped stone-faced foundation. The logs are double saddle-notched. A log-framed gambrel roof is covered with cedar shingles and has a log pole ridge cap. Five 15-light awning windows symmetrically line each side elevation.

Northeast Entrance Road Historic District (48YE821)

The adjacent Northeast Entrance Road Historic District was determined eligible May 17, 1995 at the state level under Criterion A as an early road to the mining districts and Criterion C for its bridge design, is associated with the historic context - Construction of the Road System in Yellowstone, 1872-1966. The period of significance is 1871 – 1941. The boundary of this historic district extends 50-feet to either side of the center line.

Guiding Regulations and Policies

Federal land managing agencies are required to consider the effects of their proposed actions on properties listed in, or eligible for inclusion in, the National Register of Historic Places, and allow the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment as per the National Historic Preservation Act, as amended and its implementing regulations found at 36 CFR Part 800. Agencies are required to consult with Federal, state, local, and tribal governments/organizations, identify historic properties, assess adverse effects to historic properties, and negate, minimize, or mitigate adverse effects to historic properties while engaged in any federal or federally assisted undertaking (36 CFR Part 800). Section 106 (§106) consultation (as described in the NHPA of 1966, as amended) with the State Historic Preservation Office (SHPO) will occur for a proposed project. The ACHP is invited to participate if a proposed project is considered a major undertaking.

Federal law and NPS management policies require full consideration of historical and architectural values whenever a project may affect historic properties. Additionally, the NPS "must to the maximum extent possible, undertake such planning and action as may be necessary to minimize harm to any National Historic Landmark that may be directly and adversely affected by an undertaking" (36 CFR 800.10). Under the Advisory Council's regulations, a determination of either adverse effect or no adverse effect must be made for affected historic properties that are eligible for or listed on the National Register of Historic Places. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that would qualify it for inclusion in the National Register (e.g., diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the Preferred Alternative that would occur later in time, be farther removed in distance, or be cumulative (36 CFR Part 800.5, Assessment of Adverse Effects). A determination of no adverse effect means there would be an effect, but the effect would not diminish the characteristics of the cultural resource that qualify it for inclusion in the National Register of Historic Places. The CEQ regulations and the National Park Service's Conservation Planning, Environmental Impact Analysis and Decision-Making (Director's Order 12, NPS 1992) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact (e.g., reducing the

intensity of an impact from major to moderate or minor). Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by §106 is similarly reduced. Although adverse effects under §106 may be mitigated, the effect remains adverse.

It is important to note the definition for adverse impacts per the National Environmental Protection Act (NEPA) is not strictly correlated with the definition of adverse effects in the National Historic Preservation Act. Therefore, it is possible to have adverse impacts for the purposes of NEPA review that do not rise to the level of adverse effect per 36 CFR Part 800.

Methodology and Intensity Level Definitions

In accordance with the Advisory Council on Historic Preservation's regulations implementing §106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to historic properties including cultural landscapes for this project were identified and evaluated by (1) determining the area of potential effect (APE); (2) identifying cultural resources present in the area of potential effect that were either listed in or eligible to be listed in the National Register of Historic Places; (3) applying the criteria of adverse effect to affected cultural resources either listed in or eligible to be listed in the National Register; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

A historic site, structure, or building is eligible for the National Register of Historic Places if it meets one or more of the following criteria A through D:

a. It is associated with events that have made a significant contribution to the broad patterns of our history;
b. It is associated with the lives of persons significant in our past;
c. It embodies the distinctive characteristics of a type, period, or method of construction; or represents the work of a master; or possesses high artistic value; or represents a significant and distinguishable entity whose components may lack individual distinction;
d. It has yielded, or may be likely to yield, information important in prehistory or history.

A historic building or structure must also possess integrity of location, design, setting, materials, workmanship, feeling, and association.

Methodology used for assessing impacts to historic structures was derived from available information and park staff. For purposes of analyzing potential impacts to historic structures, the intensity of impacts is defined as follows:

Impact Intensity	Impact Description
Negligible	Impact(s) is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for §106 would be *no adverse effect*.
Minor	Impact results in little, if any, loss of integrity. The determination of effect for §106 would be *no adverse effect*.
Moderate	Impact results in loss of integrity. The determination of effect for §106 would be *adverse effect*. A memorandum of agreement (MOA) is executed among the National Park Service and applicable state historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts reduce the intensity of impact under NEPA from major to moderate.

Major	Impact results in loss of integrity. The determination of effect for §106 would be *adverse effect*. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the National Park Service and applicable state historic preservation officer and/or Advisory Council are unable to negotiate and execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

3.6.1 Impacts of Alternative A (No Action)

Under Alternative A, no historic properties would be affected.

Cumulative Effects: Cumulative effects on historic resources are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in the Greater Yellowstone Area. Impacts to historic properties may occur from construction projects, addition of new structures and other elements to historic districts, and maintenance and repairs to structures and roads. All of these activities are conducted under the same general guidelines for identifying and protecting cultural resources, so long-term adverse impacts are avoided to the greatest extent practicable. Previous construction projects at Lamar Buffalo Ranch Historic District include alteration of windows and interiors of the historic structures HS-0106, HS-0107, and HS-0108, although the windows for HS-108 are original. In 1981, 18 rustic tourist cabins were relocated from Fishing Bridge Historic District to just east of the Horse Barn (HS-0109) outside the Lamar Buffalo Ranch Historic District to provide housing for the Yellowstone Institute participants. The1982 National Register Nomination Form states, "Their presence does not detract from the architectural integrity of the historic district." After 1993, these 18 cabins were removed and replaced with new insulated rustic-style cabins for students and staff, along with a new bathhouse and the generator building was relocated to behind the cabins and out of view as part of the Yellowstone Institute Cabin Replacement EA (1993). The main access road through the ranch was relocated south and immediately adjacent to the corral fence as part of this project. In 1996, photovoltaic (PV) panels were installed to the east of the contributing portion of the corrals and in 2005, the array was doubled. Currently the array is out of view from a majority of the historic district since it faces away from the district on the south-facing slope of a gully at a lower elevation than the historic district. Any portions that may be visible are screened by the substantial corral fencing. The existing array, however, is visible from inside the contributing portion of the corrals where animals are kept. Prior to installing the PV panels and propane generators this area was powered by diesel generators, and prior to that a historic pelton wheel that was located beneath the historic bunkhouse. The continued use of the corral as a livestock pen has required realignment and replacing all the fencing material over the years. The impacts from past, present, and reasonably foreseeable action have had a minor, short- and long-term, direct/indirect adverse impact on historic properties.

Alternative A would not impact historic properties and therefore would not incrementally add to an overall cumulative effect to cultural resources.

Alternative A, in conjunction with these past, present, and reasonably foreseeable projects would result in negligible long-term adverse impacts to historic resources. This would be considered a *no historic properties affected* determination under §106.

3.6.2 Impacts of Alternative B

Alternative B would upgrade sustainable energy infrastructure and implement facility improvements at the ranch to conserve energy and water. Components of this alternative include

Proposed Photovoltaic (PV) Array Expansion and Weather Station Relocation

The existing PV array is on the north bank of a wide swale outside of both historic districts and covers approximately 0.15 acres. It is effectively screened by topography and corral fencing. The replacement array would cover approximately 0.7 acres, expanding the facility to the east by 0.4 acres, away from the historic districts, and requiring the relocation and expansion of the non-historic fencing around the array. The expansion would take place over two phases. A small (portable) weather station would be relocated to the eastern most edge of the existing corrals, adjacent to the proposed expansion of the PV array.

On May 12, 2014, Yellowstone Center for Resources staff checked the visibility of the existing PV array from the entire Lamar Buffalo Ranch Historic District and along the stretch of the Northeast Entrance Road Historic District from approximately 1 mile to the northwest and 1 mile southeast of the Lamar Buffalo Ranch.

Along this section of the Northeast Entrance Road Historic District (48YE821), the existing PV array was only visible at the intersection of the Lamar Buffalo Ranch access road. This is mostly due to terrain. The existing solar array was placed against the north bank of a swale that effectively hides the facility and its proposed expansion from view from the two adjacent historic districts. Only at the point where the swale intersects with the road intersection can one glimpse the panel up the swale. A photo was taken at this location (See Figure 7 - Photopoint 2). A photo-simulation of the expanded PV array was developed to demonstrate the proposed PV array would be barely visible in the distance from Photopoint 2 (Figure 15). Visibility of the PV array may be heightened during seasons where the late afternoon sun angle would be lower in the sky and may reflect back toward this photopoint location. However, even with this potential for sun reflection, the duration of visibility of this facility would be only a moment while a vehicle was traveling past or through this intersection. The proposed portable weather station would not be visible from the road. For this reason, the impact of the proposed PV array expansion and small weather station on this historic district would be minor, indirect, adverse, and short-term; the PV array would *not adversely affect* the setting of the Northeast Entrance Road Historic District.

From the Lamar Buffalo Ranch Historic District (48YE680), the existing PV array and location for the proposed small weather station was only visible from inside the contributing portion of the corrals where animals are kept. The substantial timber corral fence obstructed all views; therefore, a photo was not taken from inside the corrals. The impact of the proposed PV array expansion and small weather station on this historic district would be negligible, adverse, and indirect; the PV array would not adversely affect the setting of the Lamar Buffalo Ranch Historic District.

Proposed Generator Shed

In order to house the new equipment, an addition of approximately 10 feet would be constructed on the back of the generator shed outside the historic district. The addition is proposed for the east side of an existing structure and would not be visible from any point within the Lamar Buffalo Ranch Historic District or the Northeast Entrance Road Historic District. No historic properties would be affected by this element of the project.

Proposed Solar Thermal Awning on Bathhouse

Solar thermal heating panels would be installed on the south end of the Institute bathhouse, outside the historic district. The addition is proposed for the south side of an existing non-historic structure outside the historic district and would be visible from the Lamar Buffalo Ranch Horse Barn (HS-0109) and the Lamar Buffalo Ranch Corrals (HS-0999). A photo (Figure 19) was taken at this location (See Figure 7 - Photopoint 6). A photo-simulation (figure 20) of the solar thermal heating panel was developed to illustrate how this facility would appear from this photopoint. The proposed panel would be a new feature placed on an existing structure within a cluster of many structures outside the district and would have a

minor, indirect, and long-term adverse impact on historic structures; the proposed solar panel would *not adversely affect* the setting of the Lamar Buffalo Ranch Historic District.

Proposed Micro hydro Powerhouse

The new micro hydro turbine, housed in a new 14' x 20' log structure outside the historic district, would be blocked from view by existing cabins so that it would not be visible from any point within the Lamar Buffalo Ranch Historic District or the Northeast Entrance Road Historic District. *No historic properties would be affected* by this element of the project.

Proposed Office Addition on Bookstore

A building addition to the existing Yellowstone Institute bookstore would be constructed to support an office function and would be of a similar style, materials, and cluster-arrangement as other buildings within the complex and be difficult to discern. Based on photos and photo-simulations (Figure 17 & 18), the proposed building addition would not be visible from the Northeast Entrance Road Historic District and would blend into existing cabins when viewed from the Lamar Buffalo Ranch Historic District. Therefore, the proposed addition would have no effect on the views and setting of the adjacent Northeast Entrance Road Historic District. The addition would have a minor, indirect, and long-term adverse impact on historic structures; the proposed project would have a *No Adverse Effect* on the views and setting of the adjacent Lamar Buffalo Ranch Historic District.

Relocate Sleeping Cabin

This project would be outside of and not be visible from any point within the Lamar Buffalo Ranch Historic District or the Northeast Entrance Road Historic District. *No historic properties would be affected* by this addition.

Proposed Building Rehabilitations

The Lamar Buffalo Ranch Ranger Station (HS-0106), the Lamar Buffalo Ranch Bunkhouse (HS- 0107), and the Lamar Buffalo Ranch Residence (HS-0108) would undergo a rehabilitation that would focus on energy conservation. An existing walkway would be formalized along the south side of the bunkhouse (HS-107).

Portions of the building interiors for the Lamar Buffalo Ranch Ranger Station (HS-0106) and Lamar Buffalo Ranch Residence (HS-0108) are contributing. The interior floor plans of the Lamar Buffalo Ranch Ranger Station (HS-0106) and Lamar Buffalo Ranch Residence (HS-0108) remain intact. The oak flooring and painted band of wood cupboards in HS-0106 present a historic appearance, although most of the interior finishes have been replaced. The interior wood doors and window trim for HS-0108 are contributing interior features; however walls, ceilings, floors, and countertops have been replaced with modern finishes. The interior of the Lamar Buffalo Ranch Bunkhouse (HS-0107) retains no integrity and does not contribute to the building's significance. Blown in closed-cell foam would be used for an insulating material where appropriate and best practices would include an interior panel to separate it from historic fabric. No closed cell-foam would adhere to and/or trap moisture against historic fabric. For all three historic structures, interior floor plans would remain the same or similar, however interior finishes and sheathing would be removed and replaced with the exception of the interior doors in HS-0108.

The exterior of these buildings would be unchanged although the windows would be returned to their previous appearance. For the Lamar Buffalo Ranch Residence, (HS-0108) the windows are original and would not be altered, though the modern storm windows would be replaced. The outside of the log buildings would be re-chinked and calked to reduce air infiltration, seal penetrations, holes, and cracks and to exclude rodents. These historic buildings would also receive structural and condition improvements where needed such as foundation and log repairs.

All work on historic buildings would follow the Secretary of the Interior's Standards for Historic Building Preservation and Rehabilitation and the Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings. The rehabilitations would involve re-insulating ceilings, walls, floors, and foundations and adding or replacing windows and would be the same as the rehabilitation that received consultation and concurrence in 2009/2011 that *no historic properties would be adversely affected* from the Wyoming State Historic Preservation Office in both 2009 (SHPO file #1209BHB007) and in 2011(SHPO File # 1011BAB001). The proposed building rehabilitations would have a minor, long-term, and direct adverse impact on these historic structures. Consistent with the determination of affect received in 2009 and 2011, these rehabilitations would not adversely affect these three historic structures that contribute to the Lamar Buffalo Ranch Historic District (48YE680). Formalizing the existing pedestrian pathway on the south side of the bunkhouse would have a minor, long-term, and direct adverse impact on this historic structure would have No Adverse Effect to the Lamar Buffalo Ranch Bunkhouse (HS- 0107) or the Lamar Buffalo Ranch Historic District (48YE680).

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects are the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor, short- and long-term direct and indirect adverse impacts, resulting in a *no adverse effect* under §106.

3.8 Visual Quality

Affected Environment

The location of the Lamar Buffalo Ranch in the Lamar Valley, and the siting of the historic ranch buildings within the valley sit on a slight hill at the base of Druid Peak. Consequently, as one enters the valley, the view of the site is an overall view of the ranch relative to the valley. The viewshed from the ranch gives one a sense of the enormous valley and the small scale of development from the ranch structures. The relationship of the historic buildings and corrals within the site as well as the rustic log materials from which they are constructed, make the historic district an important visual feature of the valley which does not detract from the natural landscape features.

Structures contributing to the Lamar Buffalo Ranch Historic District include the Buffalo Keeper's cabin, bunkhouse, Soda Butte cabin, and horse barn. All of the structures within the historic district boundaries have retained their architectural integrity. Presently the buildings serve as a ranger station and residences. The bunkhouse is used as a classroom and kitchen by the Yellowstone Institute and by the National Park Service for its "Expedition: Yellowstone" program. Other structures at Lamar that are not part of the historic district include the generator building, bathhouse, 18 sleeping cabins, and a portion of the corrals. Eighteen rustic (sleeping) cabins are located adjacent to the historic district, behind the horse barn. These cabins were constructed in the 1990s and are not considered historic.
Many of the following photo-simulations in this section were derived from photos taken from the photo points shown on the following photopoints map (figure 7).

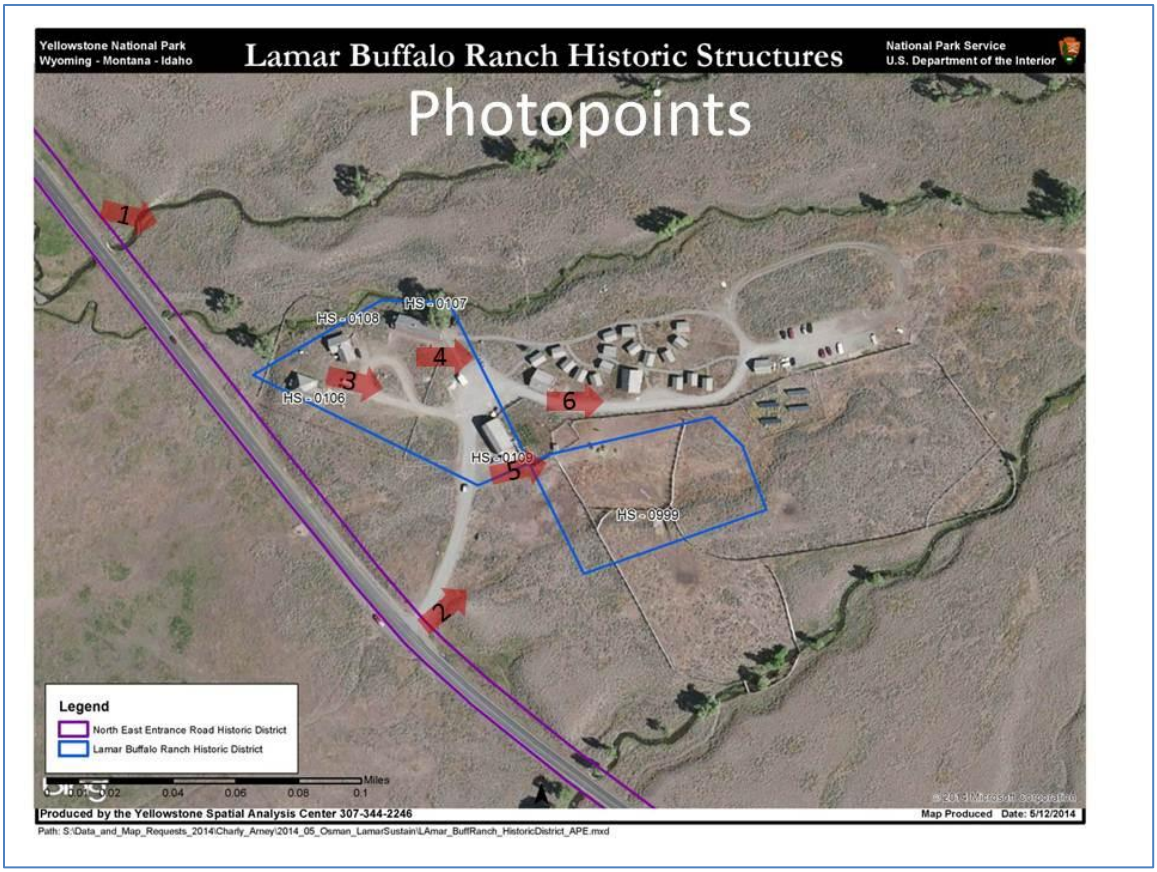

Figure 7 - Photopoints Map

The location of the existing photovoltaic solar array at the Buffalo Ranch is situated on the south facing slope of a gully (Figure 8). The panels have negligible impact on the scenery as they are screened from most views toward the ranch and from within the ranch.

Methodology and Intensity Level Definitions

Analyses of the potential intensity of impacts to scenic resources were derived from available information regarding desired views in the action areas and park staff records and past observations of the effects to those desired views (visual quality) from development, visitor use, and area operations, including construction activities. For purposes of analyzing potential impacts to historic structures, the thresholds of change for the intensity of an impact are defined as follows:

Impact Intensity	Impact Description
Negligible	Changes to the visual quality of the landscape, including nighttime quality, would be barely detectable or changes would be short-term, small and localized.
Minor	Changes to the visual quality of the landscape, including nighttime quality would be short-term or long-term small and localized to an area in the park. The change is noticeable but does not negatively affect the character of the site or its relationship to or dominance in the surrounding natural setting.

Moderate	Changes to the visual quality of the landscape (including nighttime quality) would be long term and obvious in many areas of the park. There could be an effect of an area to other areas. Effects would noticeably change the impression of the immediate site and the character of the overall setting.
Major	Changes to the visual quality of the landscape) including nighttime quality, would be significant and occur park wide. Changes would be long term) considerable, and widespread, with negative changes considered obtrusive at the park wide level. Obvious differences would change the character and overall impression of the area, its association with and dominance within the surrounding natural setting.

3.8.1 Impacts of Alternative A (No Action)

Alternative A does not propose any change that would affect current views of, or from within the Lamar Buffalo Ranch. Existing weather equipment within the historic district would remain. The PV array would not increase in size and now new buildings or additions would be constructed.

Overall, Alternative A would have long-term, minor, adverse impact to visual resources due to the continued existence of the photovoltaic array, and weather monitoring equipment.

Cumulative Effects: Cumulative impacts on visual resources are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in Yellowstone National Park. The original array was installed in 1996, and expanded in 2005. The present sleeping cabins were constructed in the mid-1990s. These changes have had minor impacts on views mostly from within the ranch looking out. Views of the ranch from the Northeast Entrance Road would be considered negligible. Construction projects in the park would continue to occur and have impacts related to visibility would likely be considered negligible due to distances from the ranch of envisioned future projects. When added to other past, present, and reasonably foreseeable future actions in the park, Alternative A would result in long-term, minor adverse impacts.

3.8.2 Impacts of Alternative B

Alternative B would continue the use of, and expand the size of the PV array used to provide electric power for the ranch. To accommodate the expanded array size, it would grow toward the northeast and remain within an existing swale that tends to hide the panels from outside and within the ranch site. Existing 2-post, 9-rail fences surrounding the corrals, and existing buildings and topography create a very good screen to hide the panels from visitors to the park, and users of the ranch development. The expanded PV array would have minor long-term impacts to visual resources of the area. Changes to existing non-historic buildings would negligible impacts from an addition to the east side of the existing generator building, and the addition of solar thermal panels to the south side of the bathhouse building. Additional minor impacts would occur from the construction of a new cabin to house the micro hydro turbine and water chlorination function. Temporary but negligible impacts would occur from excavation required to install electric transmission and IT cable and move the existing buried propane tank. The installation of a small self-contained weather station at the site at the far east of the corrals and site would have negligible long-term impacts on visual resources of the area, while at the same time improving the views within the historic district by the removal of the existing equipment. Figures depicting these changes may be seen in the visual simulations in figures 8-20 below.

Figure 8 - Existing PV Array (from above the array looking west toward the Northeast Entrance Road)

Figure 9- Proposed PV Array, Phase I

Figure 10 - Existing Generator Building

Figure 11 - Proposed Generator Building Addition

Figure 12 - Existing View From Bunkhouse

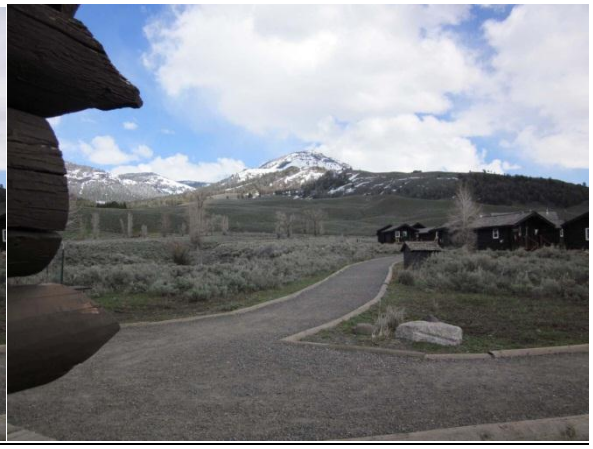

Figure 13 - Proposed Micro Hydro Building

Figure 14 - Existing PV Array (from entrance road)

Figure 15 – Proposed PV Array (all phases)

Figure 16 - Existing Weather Equipment, White Box (center of photo) to be removed

Figure 17 – Existing Bookstore

Figure 18 – Relocated Bookstore & Proposed Addition

Figure 19 - Existing Bath House

Figure 20 – Proposed Solar Thermal Panels

Cumulative Effects: Cumulative impacts on visual resources are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in Yellowstone National Park. The expansion of the PV array and the office addition proposed for the bookstore would have the most impact on the visual resources of the area. These changes would have minor impacts on views mostly from within the ranch looking out. Impacts of proposed construction from views of the ranch from the Northeast Entrance Road would be considered negligible and adverse. Construction projects in the park would continue to occur and have impacts related to visibility would likely be considered negligible due to distances from the ranch of envisioned future projects. When added to other past, present, and reasonably foreseeable future actions in the park, Alternative B would result in long-term, minor adverse impacts.

3.9 Visitor Use and Experience

Affected Environment

The Lamar Buffalo Ranch is located along the Northeast Entrance Road. This segment of park road is open year round and serves as the only winter route to Silver Gate and Cooke City, Montana, as the Beartooth and Chief Joseph Highways are closed during the winter. Since the reintroduction of wolves in 1995, this segment of road and especially the area around the Lamar Buffalo Ranch has grown in popularity among photographers and wildlife watchers, and those visiting the park in the winter. The Lamar Valley offers amazing views of open meadows, meandering river systems, and often provides safe wildlife watching opportunities a short distance from the road.

In 1993, the Lamar Buffalo Ranch formally became a "home base" for the Yellowstone Association Institute (YAI). The 1993 Lamar Buffalo Ranch EA established the area as the location for the YAI with the goal to accommodate visitors who wish to learn more about the natural history of Yellowstone. Today the Yellowstone Association continues to offer a range of educational field seminars, with lodging optionally provided at one of the 18 rustic cabins within the developed area. Participants use the bathhouse for showers and the historic bunkhouse for dining and indoor instruction. Institute field seminars cover a range of topics including photography, wilderness first aid, wildlife watching, and geology. Number of participants in YAI seminars varies year to year, however the average number of participants staying at Lamar is around 900. Seminars are offered from late May through early September, and December to March.

The ranch is not open to the general public and is signed as a "Service Area Only" as there are no guest services or a public interpretive contact station. A small bookstore is located in one of the cabins; however, it is only open to YAI participants during limited operating hours scheduled by instructors.

The rustic accommodations at Lamar add to the educational experience and participants are encouraged to conserve energy, recycle, and individually contribute by making sustainable choices in this "off the grid" development. Education and behavior change is a component of each course's curriculum and an interpretive display at the Bathhouse explains the current solar system and what participants can do to "lighten" the load.

Methodology and Intensity Level Definitions
Methodology used for assessing impacts to visitor use experience is based on how changes at the Lamar Buffalo Ranch would affect the visitor, particularly visitors' enjoyment to this rustic historic location. Thresholds for this impact assessment are as follows:

Impact Intensity	Impact Description
Negligible	Management actions would result in impacts that would be barely detectable, or would occasionally affect the experience of few visitors in the applicable setting.
Minor	Management actions would result in impacts that would be slight but detectable; could be perceived as negative by visitors or would inhibit visitor experience. Impacts would negatively affect the experience of some visitors in the applicable setting.
Moderate	Management actions would result in impacts that would be readily apparent and perceived as somewhat negative. Impacts would negatively affect the experience of many visitors in the applicable setting.
Major	Management actions would result in impacts that would be highly negative, affecting the experience of a majority of visitors in the applicable setting.

3.9.1 Impacts of Alternative A (No Action)

Under Alternative A, the no action, YAI would continue to utilize the Lamar Buffalo Ranch as the location of their field seminars and as the existing solar array ages, the electrical power demand would increasingly be provided more by propane generators. The educational components of the field seminars would no longer include sustainability components and interpretation of the electrical system. Due to the increasing dependence on propane, the overall effect of Alternative A would be minor, long-term and adverse.

Cumulative Effects: Cumulative impacts on visitor use and experience are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in Yellowstone National Park. Visitation to Yellowstone increased throughout the early 1990s. In 2010, Park visitation was 3.6 million. Construction projects in the park would continue to occur and have impacts related to construction noise, dust, and restricted use, but each project's effects on visitor use and experience would be independently and collectively evaluated. When added to other past, present, and reasonably foreseeable future actions in the park, Alternative A would result in short -term, negligible adverse impacts.

3.9.2 Impacts of Alternative B

Visitors of the ranch are the individuals most likely to be impacted from implementation of this project. Implementation of Alternative B would cause short term, minor, adverse impacts from construction vehicles, equipment, and interior energy renovations. Intermittent noise would be limited to the construction phases of the preferred alternative. Construction noise would be temporary in duration and expected to be negligible to minor, short term, and adverse. No noise is anticipated from operation of the solar array. To minimize impacts from noise, the micro hydro system building would be well insulated and situated at the furthest end of the cabins. Interruptions to existing electricity service would be limited and coordinated to minimize impacts to visitors of the ranch.

For the purpose of construction staging, the existing parking area would be temporarily roped off to ensure visitor safety. Parking would be to the east of the adjacent parking area in an area of previous disturbance. Once construction is complete, full access to the existing parking area would be restored; no long-term adverse impacts would occur. The proposed formalized pedestrian pathway to the back of the bunkhouse as part of this project would allow the back classroom for environmental education programs to be accessed without disrupting the front classroom and minimize the mud on shoes and tracking of mud into the classroom during wet conditions, thereby, improving visitor use and experience and adding a minor long-term beneficial impact to visitor use and experience

After construction however, implementation of Alternative B would result in long-term beneficial impacts to the visitors at Lamar Buffalo Ranch. This alternative would provide an example of sustainable energy in the park. In addition to environmental benefits, the solar and micro hydro system would result in minor, long-term, beneficial impacts by showcasing and proving education information about renewable energy.

Overall, implementation of Alternative B would have a minor, long-term beneficial effect to visitor use and experience.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor, short- and long-term beneficial and adverse impacts to visitor use and experience.

3.10 Park Operations

Affected Environment

Park operations consist of both NPS and Yellowstone Association, a NPS cooperating association at the Lamar Buffalo Ranch. The Lamar Buffalo Ranch is part of the Division of Resource Management and Visitor Protection that operates three ranger stations in the Tower District. The ranger stations are located at Tower Junction, the Lamar Buffalo Ranch, and Northeast Entrance. The Lamar Ranger Station provides emergency visitor service only. Two of the historic structures (Buffalo Keeper's Quarters and Soda Butte Residence) are used as ranger residences and administrative offices. The Lamar Buffalo Ranch has no visitor center, public restroom, museum, or formal interpretative contact station. Park Service personnel stationed at Lamar are few in number and are often away from the ranch during duty hours.

National Park Service Operations
The NPS provides support operations for visitor protection and emergency services from the Lamar Ranger Station. Two NPS law enforcement rangers are housed at the ranch where their living quarters serve as their office spaces. In addition to visitor protection and emergency services they respond to wildlife traffic jams which are numerous in this area of the park.

Maintenance Operations/Facility Management: NPS operations for the Lamar Buffalo Ranch are carried out by the park's Maintenance Division. Operations include maintenance of the PV system including storage batteries, propane generator, and related control equipment, water and sewage systems, building maintenance, and garbage and recycling collection. During the winter, snow removal is done when the road from Mammoth to the Northeast Entrance is plowed. Plowing and road maintenance services are provided by the NPS.

The area does not have commercial power and has partially relied on solar power for its electrical energy since 1996 when the first PV panels were installed. The first installation consisted of a 24V/7 kW PV array with 12 kW generators, a 4800 amp hour battery bank and 8 kW inverters. In 2005, the solar array was doubled for a total of 14 kW and the batteries doubled to 9600 amp hours (AH) of storage. The inverters were not updated at this time as the improved units were only available in 48 kW which was not compatible. The propane generators used for backup have been replaced several times in an attempt to improve efficiency and noise. Propane use at Lamar from August of 2012 to July of 2013 totaled 14,846 gallons. This includes 10,776 gallons used by direct propane appliances (including heaters) and 4,070 gallons used by generators to produce electricity to supplement that provided by the solar panels.

In 1985, Expedition: Yellowstone, a curriculum-based residential program for students' grades 4 through 8 was established. The mission of this program is to teach students about the natural and cultural resources of Yellowstone National Park, investigate current issues affecting the Greater Yellowstone Ecosystem, and to promote stewardship and preservation of ecosystems worldwide. Emphasis is on learning through direct experience in the outdoors. This program operates September through mid-December and mid-February through May. The number of Expedition: Yellowstone participants vary from year to year but are generally in the range of 1,500. Students primarily come from schools in communities in the states of Wyoming, Montana, and Idaho. However they have also come from nearly all 50 states over the course of the program's existence. The program has two campuses. The Lamar Buffalo Ranch is used during the spring and fall. The Youth Conservation Corps facilities in Mammoth Hot Springs are used during winter months.

Yellowstone Association Operations
The Lamar Buffalo Ranch offers the Yellowstone Association many of the things needed to have a high quality, in-park educational program. The ranch offers a retreat-like atmosphere highly conducive to learning about Yellowstone and the ecosystem. Courses taught at the ranch are kept small and generally last three to five days and cover a variety of topics. Courses are offered at the ranch from late May through early September and December to March. The number of students each year is approximately 900. The small scale, family-like atmosphere of the programs, including the communal cooking arrangements and bathhouse reinforces the desire to keep things personal and approachable, without an "institutional" feeling. Students share space in log cabins that include three single beds, a propane heater and reading lights. The cabins do not have electrical outlets or plumbing.

In the 1990's a campus manager's cabin was created from two smaller cabins and has been used as the manager's living quarters, an office, and a storage area. In addition, the bunkhouse was renovated, creating two classrooms, a large kitchen and eating area, and two bathrooms with showers. Yellowstone Association staff lives at the ranch only during the periods of time when courses are being conducted.

Methodology and Intensity Level Definitions
Impacts to park operations focuses on (1) employee and visitor health and safety, (2) ability to protect and preserve resources, (3) staff size, whether staffing needs to be increased or decreased, (4) existing and needed facilities, (5) communication (i.e., telephones, radio, computers, etc.), and (6) appropriate utilities (sewer, electric, water). Park staff knowledge was used to evaluate the impacts of each alternative and is based on the current description of park operations presented in the Affected Environment section of this document. For purposes of analyzing potential impacts to park operations, the intensity of an impact is defined as follows:

Impact Intensity	Impact Description
Negligible	Park operations would not be affected or the effect would be at or below the lower levels of detection, and would not have an appreciable effect on park operations.
Minor	The effect would be detectable, but would be of a magnitude that would not have an appreciable adverse or beneficial effect on park operations. If mitigation were needed to offset adverse effects, it would be relatively simple and successful.
Moderate	The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
Major	The effects would be readily apparent and would result in a substantial adverse or beneficial change in park operations in a manner noticeable to staff and the public, and be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, could be expensive, and their success could not be guaranteed.

3.10.1 Impacts of Alternative A (No Action)

Under Alternative A, installation of a new solar PV array and micro hydro system to improve energy efficiency and sustainability would not occur. Buildings would not be insulated and remain unchanged. The ranch would continue to rely on the existing PV array and propane generators for electrical needs. Maintenance would continue to be required for the PV arrays. Deficiencies in the current PV system would continue to take many hours of time from the rangers on site as well as an electrician from park headquarters located in Mammoth.

Under the no action alternative, new office administrative space would not be constructed. NPS staff and the Yellowstone Institute campus manager would continue to operate from their residences and remain in separate buildings posing minor inconvenience in terms of communication. The existing weather equipment would remain in the historic district and weather would be collected when staff has time. Gaps in weather data would remain. These operational issues would continue to have a long-term, minor, adverse effect on park operations.

Cumulative Effects: Cumulative impacts on park operations are based on the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions in Yellowstone National Park. A major source of impacts to operations and facilities is the continued use of the park by visitors and staff. Park infrastructure is in continual need of repair/replacement, mainly due to age and

use. Past, ongoing, and future construction projects that will have an adverse impact on park staff include road construction projects (e.g., Norris to Golden Gate, Dunraven to Tower, etc.), building rehabilitation (e.g., Albright Visitor Center, Lake Hotel, etc.), utility replacement/upgrades (e.g., Lake Area Water line, Old Faithful Sewer main, etc.), and general maintenance associated with managing a large park. Activities considered in this analysis include park operations by interpretation, maintenance, administration, visitor protection, and resource management personnel. Impacts to park operations, including all associated needs for employing staff to conduct these actions (i.e., administrative, housing, vehicles, etc.), would continue in the current condition. Typical park operations include fire management actions, e.g., prescribed and wild fires, human use, emergency services, and construction projects. Beneficial impacts have also resulted from these activities, including improved access and quality of housing and other facilities. When added to other past, present, and reasonably foreseeable future actions in the park, Alternative A would have direct, short -term, negligible to minor adverse impacts.

3.10.2 Impacts of Alternative B

Under Alternative B, there would be a change to current park operations and infrastructure at the Lamar Buffalo Ranch. Maintenance would be required for the new PV arrays and the micro hydro system but much of the maintenance would be able to be done remotely. A number of energy-saving conservation measures would be incorporated. These measures would reduce the impact of maintaining the cabins for both NPS and YA personnel. Overall, maintenance costs and propane costs would be reduced. The combined solar and micro hydro technologies would provide a reliable source of energy that would ensure that the park does not have to anticipate the negative results and expense of power failures and much use of propane generators. A system involving both solar PV panels and a micro hydro turbine would have the complementary nature of solar and water resources —when one of these resources is not plentiful, the other is often available. The goals established by Yellowstone National Park's Strategic Plan for Sustainability and stewardship through using environmentally conscious practices and educating students at the ranch would likely be met. Upgrades to the renewable energy system in Phase I would mean that the renewable energy system would provide 95% of the electricity at Lamar, this would reduce propane used by generators at the site to approximately 370 gallons per year, saving 3,700 gallons of propane annually. The cumulative reductions of all three phases of the project would reduce the park's propane use by 14,846 gallons annually.

Addition of an office space would allow consolidation of NPS staff and the Yellowstone Institute campus manager to operate at one central location. This consolidation would substantially improve the efficiency of the park operations at the ranch. The weather equipment would be removed from the historic district and weather would be collected automatically and require only one or two site visits per year. Data collected would include: temperature, precipitation, relative humidity, solar radiation, and soil moisture. This data would be transferred to the internet using a GOES satellite link.

Implementation of the project would have long-term, moderate, beneficial impacts on park operations.

Cumulative Effects: The impacts from past, present and reasonably foreseeable projects would be the same as described in the cumulative effects section for Alternative A. Alternative B, in conjunction with these past, present, and reasonably foreseeable projects would result in minor, long-term beneficial impacts to park operations.

CHAPTER 4: Consultation and Coordination

4.1 Scoping and Agency Consultation

Scoping is a process to determine the breadth of environmental issues and alternatives to be addressed in an EA. The park conducted both internal scoping with appropriate NPS staff and external scoping with the public and interested groups and agencies.

Internal Scoping
Initial internal scoping meetings to facilitate the preparation of this environmental Assessment were held with the interdisciplinary team and various resource specialists were held in Yellowstone National Park in March 2014. Discussions included the clarification the project scope and features of the proposed project, characterization of the action alternative, determination of the relevant impact topics, and identification of issues for each.

External Scoping
The following actions were taken to inform the public about the intent to prepare an EA for this project. The external scoping was conducted for the period from April 9 to May 9, 2014.

- Approximately 167 scoping notice postcards were mailed on April 9, 2014 to the park's NEPA planning/compliance mailing list. These included local, state, and federal agencies; organizations, and individuals.

- A parks news release was issued inviting the public to comment.

- The scoping notice was made available electronically on the NPS Planning, Environment, and Public Comment (PEPC) website: http://parkplanning.nps.gov/LamarEA

- A news release was issued inviting the public to comment.

Nine pieces of correspondence were submitted during the public scoping period. These are summarized as follows.

Impacts from Proposed Energy System
- The EA should address the environmental impacts associated with the micro hydro system and expansion of the solar array.

Usage of the Lamar Buffalo Ranch
- What is the current seasonal usage of this facility (in terms of park employees, Yellowstone Association Employees, Visitors (Day or overnight), or other personnel). What is the projected future usage?

Socioeconomics
- An economic analysis and feasibility study should be conducted as part of the EA and for consideration as one of the proposed alternatives. We are not convinced the YNP sustainable energy project would be cost-effective.

Energy
- If there is to be an increase in power available overall or will the new system have a lower output than the existing gas generator solar combo? If the new system is meant to have higher output,

why is that power required, what new capacities are being added to the functions of the ranch that demand greater power?

Upgrades at the Lamar Buffalo Ranch

- Will any other improvements be required to accommodate this increase (septic or water)? What are the impacts of these changes in use and what justifies them?

4.2 Consultation

Agency Consultation

A copy of this EA will be forwarded to the USFWS, to allow for consultation in accordance with the Endangered Species Act. Consultation for this project will occur during the public review period of this EA. Section 7 determination of effect for this project on Threatened and Endangered Species are "may affect but not likely to adversely affect" to Canada lynx, "no effect" to lynx critical habitat and "may affect but not likely to adversely affect" grizzly bears (USFWS 2014).

In accordance with §106 of the National Historic Preservation Act, NPS will provide the Wyoming State Historic Preservation Officers an opportunity to comment on the effects of this project during the public review period of this EA. This document's analysis found there would be "no adverse effect" on historic properties, landmarks, or districts for the action proposed under the preferred alternative.

Native American Consultation

A scoping letter describing the proposed action was mailed to tribal members of Yellowstone's 26 associated tribes in April 2014, to solicit concerns and comments for the proposed project. The park did not receive any responses from the tribes.

4.3 Environmental Assessment Review

The EA is subject to a 30-day public comment period. To inform the public of the availability of the EA, NPS will publish a news release and distribute a letter to various agencies, tribes, and individuals from the mailing list. The document will be available for review on the PEPC website at http://parkplanning.nps.gov/LamarEA. Copies of the EA will be provided to interested individuals, upon request.

During the 30-day public review period, the public is encouraged to submit their written comments to NPS, as described in the instructions at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed, prior to the release of a decision document. The National Park Service will issue responses to substantive comments received during the public comment period, and will make appropriate changes to the EA, as needed.

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