National Park Service
U.S. Department of the Interior

Denali National Park and Preserve
Alaska

Rock Creek Bridge Replacement

Environmental Assessment
March 2012

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Note to Reviewers

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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
ADFG	Alaska Department of Fish and Game
ANILCA	Alaska National Interest Lands Conservation Act
AASHTO	American Association of State Highway and Transportation Officials
BMP	Best Management Practice
CAA	Clean Air Act
CBA	Choosing by Advantage
CCC	Civilian Conservation Corps
CFR	Code of Federal Regulations
DCP	Development Concept Plan
DENA	Denali National Park and Preserve
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FHWA	Federal Highways
GMP	General Management Plan
LRFD	Load Resistance Factor Design
MBTA	Migratory Bird Treaty Act
MSE	Mechanically Stabilized Earth
NEPA	National Environmental Policy Act
NPS	National Park Service
RV	Recreational Vehicle
USC	United States Code
USFWS	United States Fish and Wildlife Service
VA	Value Analysis
WFLHD	Western Federal Lands Highway Division

1.0 PURPOSE AND NEED

1.1 PURPOSE OF AND NEED FOR ACTION

The National Park Service (NPS), in cooperation with Federal Highways (FHWA) Western Federal Lands Highway Division (WFLHD), is considering replacing or retrofitting the Rock Creek Bridge on the Denali Park Road at Denali National Park and Preserve (DENA) in 2013 (Figure 1-1). The bridge spans the deep, well-defined Rock Creek drainage at Mile 3.3 of the Denali Park Road. It provides year-round access to Park Headquarters, employee housing, and all road accessible facilities west for ninety miles including Kantishna as the only vehicular route, a critical route and a life line.

The Rock Creek Bridge is one of two seismically deficient bridges on the Denali Park Road. The project would also address the current bridge's narrow road width on a curve and short sight distance on a curve. The complete proposed action and alternatives are described in Chapter 2.

The Rock Creek Bridge is used year-round to access Park Headquarters. The bridge is an essential summer road link into DENA and Kantishna area businesses at the western end of the road. A bridge deck width of 24 feet combined with the curved design of the bridge results in some westbound semi and RV trailers off-tracking into the eastbound lane, creating a hazard for oncoming traffic.

A 1999 FHWA seismic evaluation of bridges identified the Rock Creek Bridge as seismically vulnerable and structurally inadequate to withstand a seismic event. In November 2002 the bridge experienced two earthquakes 6.7 and 7.9 in magnitude and again was inspected for its structural integrity. FHWA emphasized that the long term stability of the bridge could be seriously at risk during another seismic event.

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

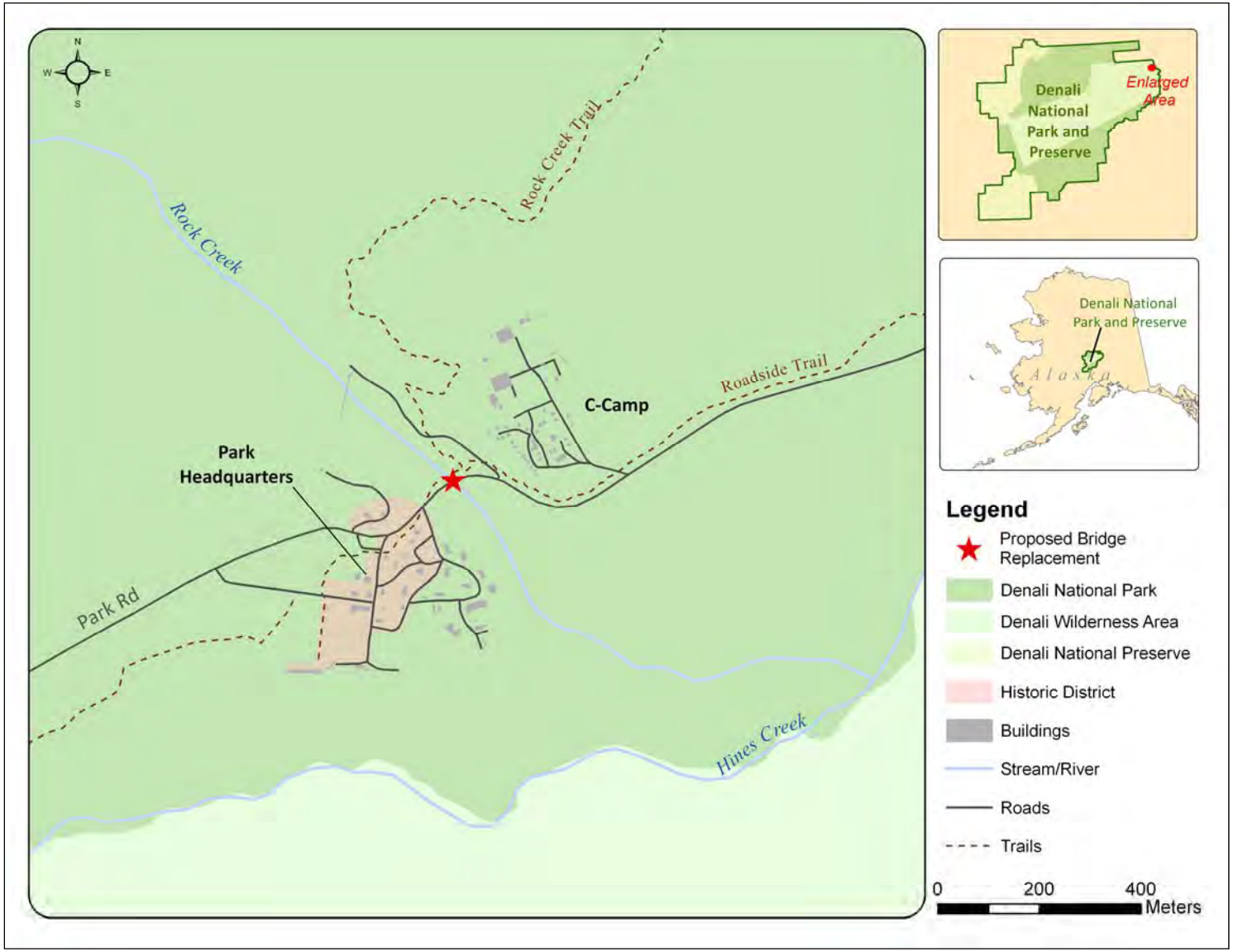

Figure 1-1 Project Area and Vicinity Map

1.2 BACKGROUND

1.2.1 History of Site

The Rock Creek Bridge was constructed as a Mission 66 project in 1959. The previous crossing of Rock Creek had been on a timber bridge approximately 300 yards upstream of the existing bridge. When the existing curved bridge was built, the road alignment was straightened and lowered on the west (headquarters) side. This resulted in cut banks on both sides of the Park Road as it enters into the headquarters historic district. The pre-1959 road alignment has filled in with alders and the timber bridge has been removed.

A 130 foot long pedestrian bridge was constructed in 1999 upstream of the vehicle bridge to connect the Rock Creek Trail to the park headquarters historic district. Previously, pedestrians crossed the vehicular bridge to access park headquarters, whether from C-Camp or the Rock Creek Trail. The pedestrian bridge is approximately 30 feet from the vehicle bridge. It is lower than the vehicle bridge so it is generally not visible by drivers on the vehicle bridge.

The trail segment from the pedestrian bridge to park headquarters was also constructed in 1999. It includes a crossing of the Park Road west of the turnoff to the residential area. A trail segment was constructed from the pedestrian bridge east, to connect to the Rock Creek Trail. Neither approach to the pedestrian bridge meets handicapped accessibility guidelines.

A 1999 FHWA seismic evaluation of bridges identified Rock Creek Bridge as seismically vulnerable and structurally inadequate to withstand a seismic event. To retrofit the bridge, it was then estimated to cost in excess of 80% of replacing the bridge.

In November 2002 the bridge experienced two earthquakes of 6.7 and 7.9 in magnitude and again was inspected for its structural integrity. The main problem with the bridge is shearing of two anchor bolts at the west abutment, with loose or bent bolts also present at both abutments. Although an earthquake occurred in the vicinity of the structure, the shearing of the bolts appears to be due to excessive thermal expansion/contraction along the curved alignment of the bridge, and not to seismic effects. The earthquake caused heaving and subsequent settling (up to 4") of the embankment at both ends of the bridge. The long-term stability of the critical crossing could be seriously at risk during another seismic event. FHWA recommended no seismic retrofit for the bridge. However, it was emphasized that the long term stability of the critical crossing would be seriously at risk during another seismic event.

A bridge inspection report completed in 2009 indicated the fifty-year old structure to be in fair condition. Recommendations for maintenance included periodic removal of soil and debris from

expansion joints, cleaning and painting of all bearings, spot painting beams and diaphragms, replacement of missing and bent anchor bolts, and repair of erosion to slopes in front of both abutments.

1.2.2 Laws, Regulations, and Policies

NPS Organic Act

The 1916 NPS Organic Act directed the Secretary of the Interior and the NPS to manage national parks and monuments to:

> …conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (16 United States Code [U.S.C.] 1).

The NPS Organic Act also granted the Secretary the authority to implement "rules and regulations as he may deem necessary or proper for the use and management of the parks, monuments and reservations under the jurisdiction of the National Park Service" (16 U.S.C. 3). Amendments to the 1916 NPS Organic Act in 1978 and the 1970 NPS General Authorities Act expressly articulated the role of the National Park System in ecosystem protection. The amendments further reinforce the primary mandate of preservation by stating:

> The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided for by Congress (16 U.S.C. 1-a1.).

The NPS Organic Act and the General Authorities Act prohibit impairment of park resources and values. The 2006 NPS Management Policies uses the terms "resources and values" to mean the full spectrum of tangible and intangible attributes for which the park is established and managed, including the Organic Act's fundamental purpose and any additional purposes as stated in the park's establishing legislation. The impairment of park resources and values may not be allowed unless directly and specifically provided by statute. The primary responsibility of the NPS is to ensure that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them.

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

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or

- identified as a goal in the park's general management plan or other relevant NPS planning documents.

1.2.3 Relationship of Proposal to Other Plans

Many plans have been developed for DENA, including the 1986 General Management Plan (GMP) (NPS, 1986) and the Entrance Area and Road Corridor Development Concept Plan (DCP)/ Environmental Impact Statement (EIS) (NPS, 1997). The GMP is a broad planning document, setting general management direction for the park. The plan's focus is on managing visitor use to ensure access to a high quality wilderness experience for visitors of all ages and abilities while ensuring that the natural and cultural values are not degraded. The DCP/EIS amended the 1986 GMP. The DCP/EIS provides analysis and management direction for the frontcountry of Denali, including direction for road management and facility development for the entrance area and road corridor. The 2007 Headquarters Area Plan left to the bridge plan the decisions affecting the residence road Park Road junction. The alternatives in this Bridge EA are consistent with the goals identified in these three previous plans.

1.3 ISSUES

To focus this EA, the NPS selected specific issues for further analysis and eliminated others from evaluation. Issues selected for analysis in this EA were determined through internal scoping with the park and NPS Alaska Region staff.

1.3.1 Issues and Impact Topics

Issues are the potential environmental effects if the action is taken. Issue statements show the relationship between an action and a resource; they do not predict the degree or intensity of the action. The resource impact topics selected by the interdisciplinary team are as follows:

<u>Wildlife, Habitat, and Species of Special Concern</u>
Replacing the bridge could impact wildlife by removing habitat in the vicinity of the project area. Construction activities associated with the proposed project could disturb wildlife habitat and cause animals to disperse from nearby areas.

<u>Vegetation and Soils</u>
Low and tall shrub vegetation, and spruce and aspen vegetation could be removed or disturbed during bridge replacement or retrofitting. Invasive plants could colonize soils that are disturbed during the construction process. Existing soil strata could be altered or removed and land contours could be changed as a result of bridge replacement. Soils could be compacted and disturbed by heavy equipment, and erosion could occur.

Cultural Resources
There are no known prehistoric cultural resources present in this area. The proposed construction sites have low probability for undiscovered cultural artifacts. However, the three action alternatives would cut into and disturb a slope that is located in the Headquarters Historic District, which is listed on the National Register of Historic Places, and could affect those resources.

Water Resources
Construction activities have the potential to affect water quality, wetlands, and floodplains in the project area.

Visual Quality
Visual resources within the project area could be altered by bridge replacement or retrofitting. The project area may be visible from trails and viewpoints. There could be traffic and dust during the construction phase of the project, potentially impacting the visual resources in the vicinity of the site.

Visitor Use and Enjoyment
Bridge replacement or retrofitting could interrupt visitor traffic along the park road. The presence of construction equipment and the activity associated with construction could impact the visitor experience.

Park Operations and Safety
Bridge replacement or retrofitting could reduce the potential for loss of continued vehicular use of the bridge following a major earthquake. Bridge replacement or retrofitting could reduce the potential for vehicle accidents on what is currently a too narrow bridge for some vehicles.

1.3.2 Issues Considered but Dismissed

Issues dismissed from detailed analysis will not be addressed further in the EA.

Subsistence
Subsistence activities are not allowed in the project area, so this impact topic does not apply. An ANILCA §810 evaluation is included in Appendix A.

Socioeconomics
Construction activities and costs associated with the proposed project would provide a temporary stimulus to the local or regional economy. Wages, overhead expenses, material costs, and profits would last only as long as the project, thus impacts to local communities and socioeconomic resources would be short-term. Travel delays during construction would be minimized. Delays would have a temporary impact on tourism services and businesses. No long-term impacts on the local economy would occur as a result of the project.

Climate Change
A growing body of scientific research, published in peer reviewed journals and synthesized by groups such as the Intergovernmental Panel on Climate Change and the U.S. Climate Change Science Program, depicts a global climate that is changing. Research also shows that human activities, especially emissions of greenhouse gases into the atmosphere, contribute to this changing climate. Emissions of greenhouse gases would be temporary and minor during construction, but the Preserve's long-term carbon footprint would not change, thus this project's contribution to climate change would not be measurable.

Air Quality
Both the Clean Air Act of 1977 (CAA) and NPS 2006 Management Policies (NPS, 2006a) require the NPS to consider air quality impacts from their projects. The park is a Federal Class 1 Air Quality Area under the CAA. Air quality is monitored near park headquarters and no exceedances of National Ambient Air Quality Standards have been documented within the park. Construction within the park associated with this project would result in short-term, minor, impacts on air quality. These impacts would be partially mitigated by use of a water truck during construction activities to keep the dust down.

Natural Soundscape
Natural soundscapes in the area could be temporarily impacted by construction activities. Park visitors and residents in nearby staff residences located at the park headquarters area could be impacted by construction noise. However, construction associated with this project would be short-term and have negligible to minor impacts on natural soundscape.

Night Sky
Night sky visibility would not be affected by construction activities or the new bridge replacement.

Wilderness
Project activities would not occur in designated or eligible wilderness. Construction would not directly encroach upon the designated wilderness area. The project would not substantially change the visual impacts of the park road as seen from nearby wilderness.

Threatened and Endangered Species and Critical Habitat
The Endangered Species Act of 1973 (ESA) requires an analysis of impacts on all federally listed threatened and endangered species. In compliance with ESA Section (§) 7, the U.S. Fish and Wildlife Service (USFWS) has been consulted. No federally designated threatened or

endangered species are known to occur within the park and none are anticipated to be affected by this project.

Coastal Zone
There is no longer a coastal zone management program in Alaska. Additionally, the project area is not located in a coastal zone.

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

1.4 PERMITS AND APPROVALS NEEDED TO IMPLEMENT PROJECT

This project would require an U.S. Army Corps of Engineers CWA Section 404 permit for filling wetlands.

This project would require a CWA Section 402 permit from ADEC for storm water pollution prevention.

A Fish Habitat permit would be required from the Alaska Department of Fish and Game (ADF&G).

2.0 ALTERNATIVES

2.1 INTRODUCTION

This chapter describes a range of reasonable alternatives, including the NPS preferred alternative and a no action alternative. This chapter also describes those alternatives and actions that will not be considered further (those not analyzed in Chapter 4).

A Value Analysis (VA) was conducted in March 2011(NPS, 2011). The VA team consisted of staff from the Alaska Regional Office of the NPS, DENA, and WFLHD. The VA team evaluated four preliminary options and developed a new option during the VA process. These represented a range of appropriate site solutions and were evaluated through the Choosing by Advantage (CBA) process. Three of these options are brought forth in this EA. The other two were dismissed from further evaluation.

Two tables at the end of this chapter compare the alternatives in terms of actions taken and their environmental impacts.

2.2 ALTERNATIVE 1: NO ACTION

This alternative represents a continuation of the existing situation and provides a baseline for evaluating the changes and impacts of the proposed action alternatives. The existing Rock Creek Bridge (Figure 2-1) would continue to serve year-round traffic up to its design load and width. This steel-multi-beam bridge is currently in fair condition overall (FHWA, 2009). It is 125 feet 6 inches long, 28 feet 6 inches wide (out to out), and has two 12 foot lanes. There is a separate parallel steel pedestrian bridge upstream about 30 feet and at a lower elevation so that the pedestrian bridge generally cannot be seen from the bridge.

Recommendations for maintenance and repairs of the existing bridge from the FHWA (2009) bridge inspection report include periodically removing soil and debris from expansion joints, cleaning and painting all bearings, spot painting beams and diaphragms, replacing missing and bent anchor bolts, and repairing erosion of slopes in front of both abutments. If these measures are undertaken, the cost would range from $100,000 to $130,000.

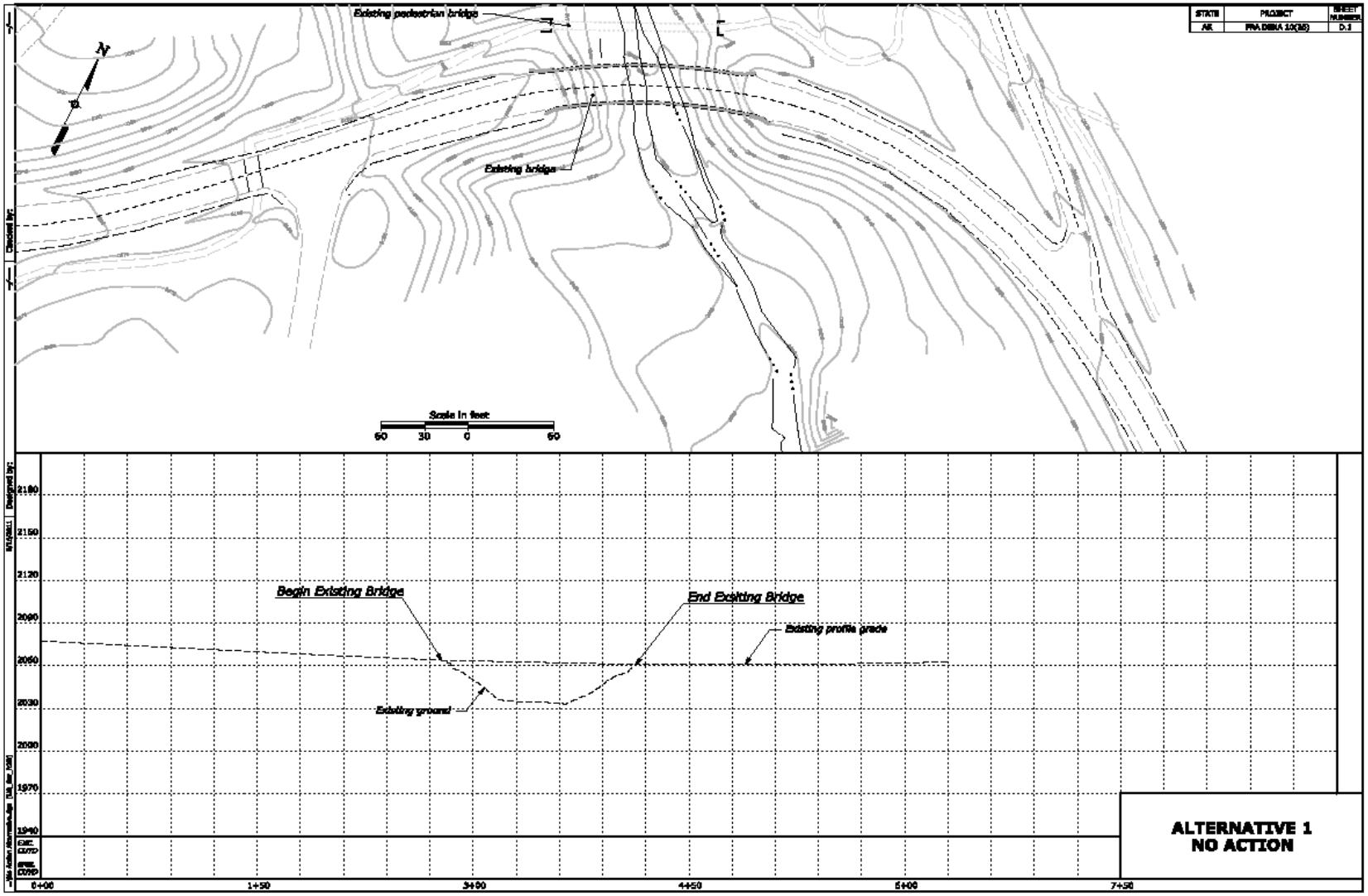

Figure 2-1 No Action Alternative: Existing Bridge.

2.3 ALTERNATIVE 2: NEW CULVERT (NPS PREFERRED ALTERNATIVE)

Under this alternative, the existing bridge would be removed and an 18 foot diameter round culvert would be constructed and covered by gabion (rock filled wire baskets) tiers, mechanically stabilized earth (MSE), and natural grade fill slopes (Figure 2-2). Nearly half the diameter of the culvert would be buried in stream bed gravels, and habitat boulders would be placed inside the culvert. In addition to the main culvert, a 4 foot diameter overflow culvert would be installed.

Construction Sequence (Figure 2-2A):

- Construct temporary access route for heavy down to the creek equipment.
- Create a sump and piping system to de-water the culvert site.
- Excavate and install culvert underneath the existing bridge.
- Remove the pedestrian bridge.
- Install MSE walls (Figure 2-2B) and riprap flow guide
- Construct portion of the fill on top of the MSE walls to the elevation that allows traffic to be diverged away from the existing bridge so that one-way traffic and pedestrian access can be maintained during most of the construction.
- Remove the existing bridge superstructure and portions of existing substructures as needed; piers and abutments, or portions thereof, may be able to remain in place.
- Backfill the remaining roadway.
- Pave to create a 34 foot out-to-out width, with two 15 foot traffic lanes and an adjacent 8 foot pedestrian trail.
- Realign pedestrian trails. The new pedestrian trail alignment south of the road would require cutting into the slope just before the residential area. This slope is located in the Headquarters Historic District.

Bicycles would continue to use the vehicular roadway.

The total area of impact would be 2.3 acres.

Construction would start in the summer of 2013, and it would be completed in one season (5 months). Constructing a new culvert and causeway would cost between $2,300,000 and $2,800,000.

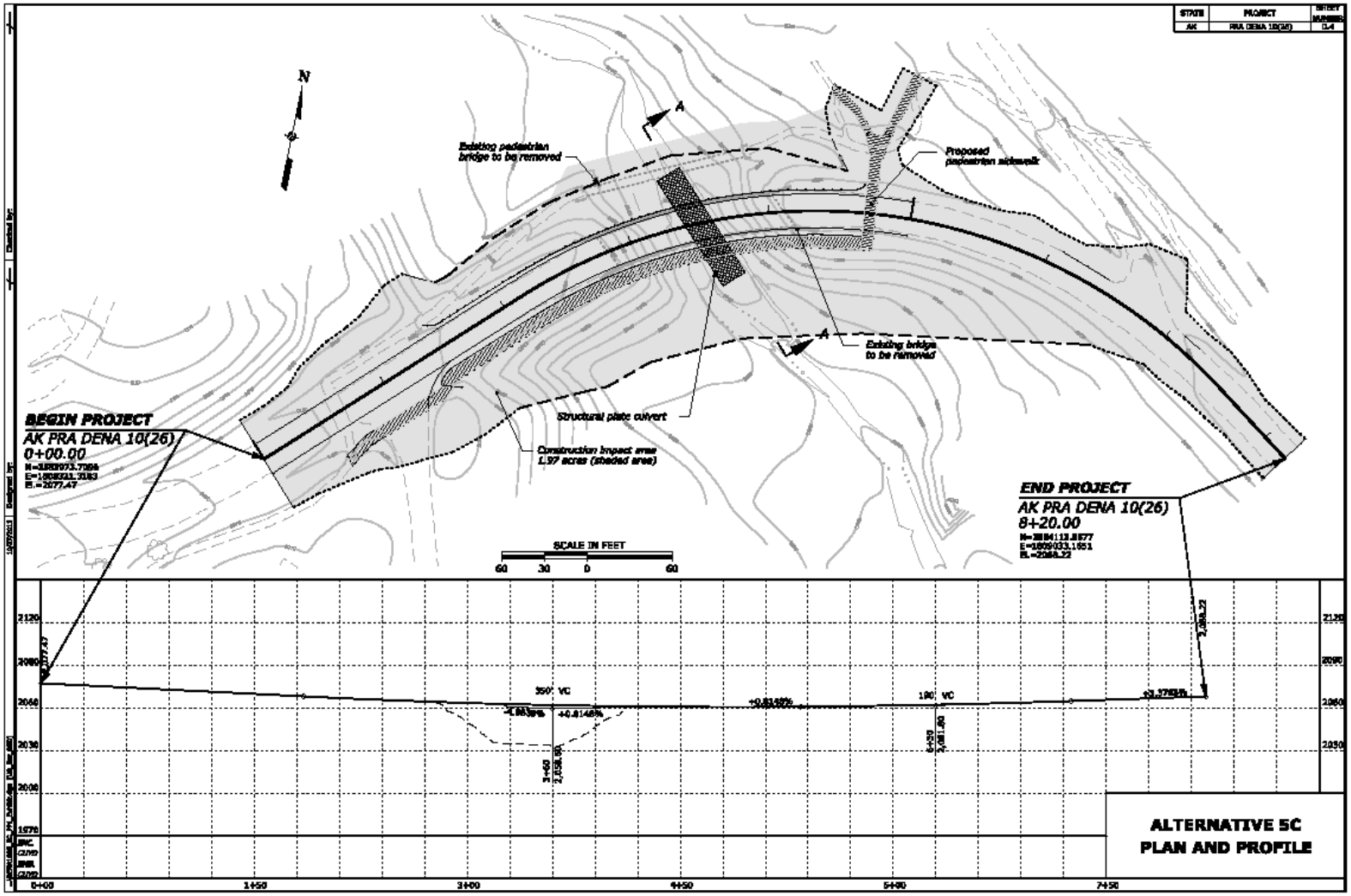

Figure 2-2 Alternative 2: New Culvert (NPS Preferred Alternative)

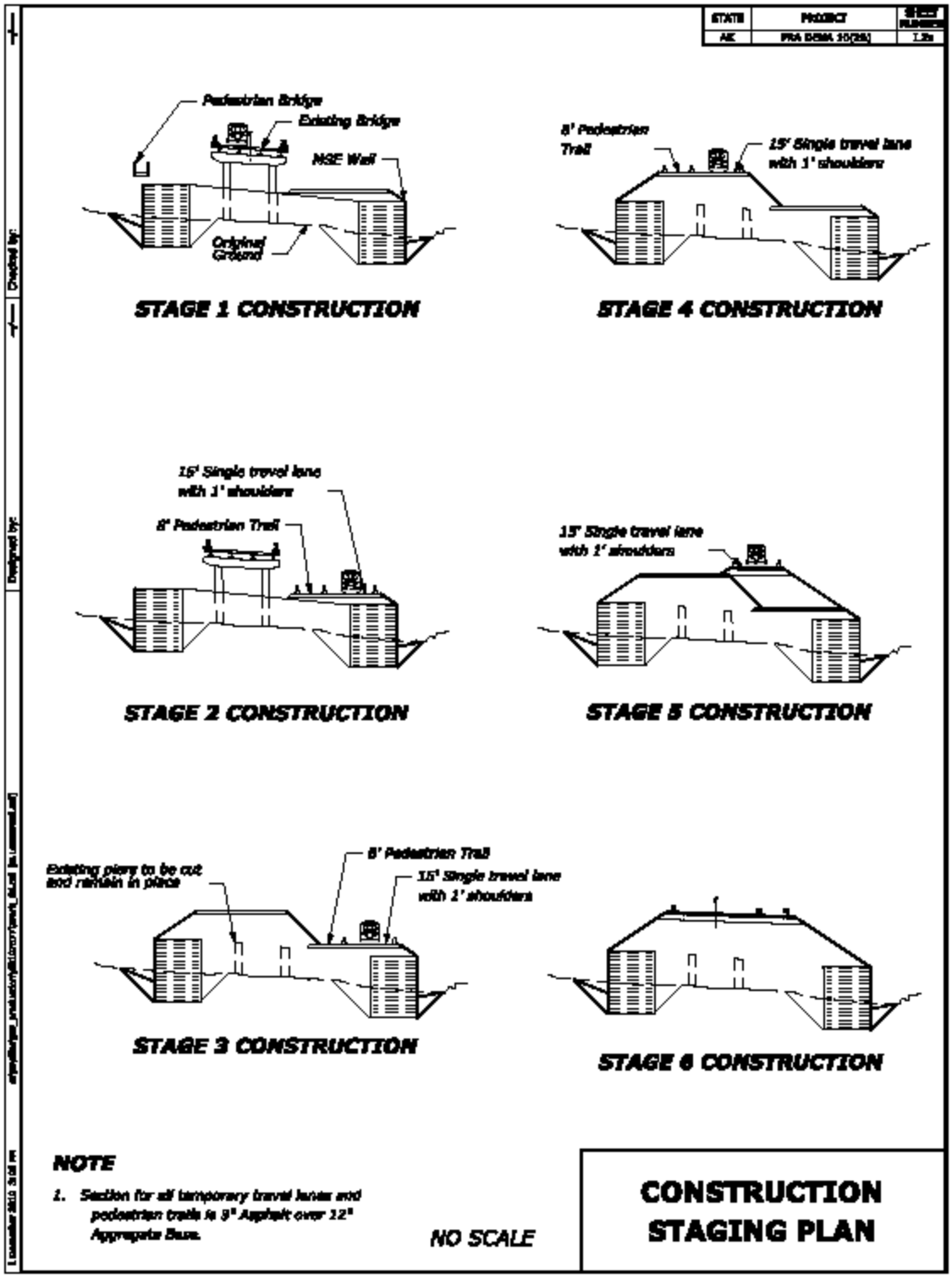

Figure 2-2A Alternative 2, Construction Staging Plan

2.4 ALTERNATIVE 3: RETROFIT BRIDGE, EXISTING ALIGNMENT

This alternative would consist of two main categories of work: seismic retrofitting of the existing bridge substructure, and rehabilitating the existing superstructure.

The seismic retrofitting would be based on a review of the Seismic Retrofit Study performed for this bridge in 1999 (USDOT, 1999). The report recommends the following measures:

- Retrofitting piers (footings, columns and crossbeams)
- Retrofitting abutments to allow more girder displacement without hitting the back-walls
- Installing transverse restrainers at both abutments and piers
- Installing longitudinal restrainers at piers
- Installing longitudinal restrainers at abutments tied to dead-man anchors in fill

The rehabilitation of the existing superstructure consists of:

- Replacing the existing steel beams with weathering steel beams
- Replacing the existing concrete deck, widening it to 34 feet out-to-out
- Replacing the existing bridge rails with two-tube rails

One lane traffic access over the bridge would be maintained throughout the entire construction operation. The superstructure would be replaced in two stages by using temporary supports to support the girders and deck. This would allow one lane of traffic to be maintained on half of the existing bridge during the superstructure replacement. The temporary supports would be used during substructure demolition and replacement. The life span of the replaced elements would be approximately 75 years, but the remaining elements that are not addressed would be shorter to varying degrees.

A temporary access route would be constructed down to the creek for heavy equipment. Pedestrian traffic would remain on the existing pedestrian bridge (Figure 2-3). Bicycles would use the vehicular bridge.

The total area of impact would be 1.6 acres.

Construction would start in the summer of 2013, with planned completion in fall of 2014. Operations would cease over winter. The construction schedule would take place over a 15 month period, but active only for eight months (two seasons). Retrofitting the bridge would cost between $2,700,000 and $3,300,000.

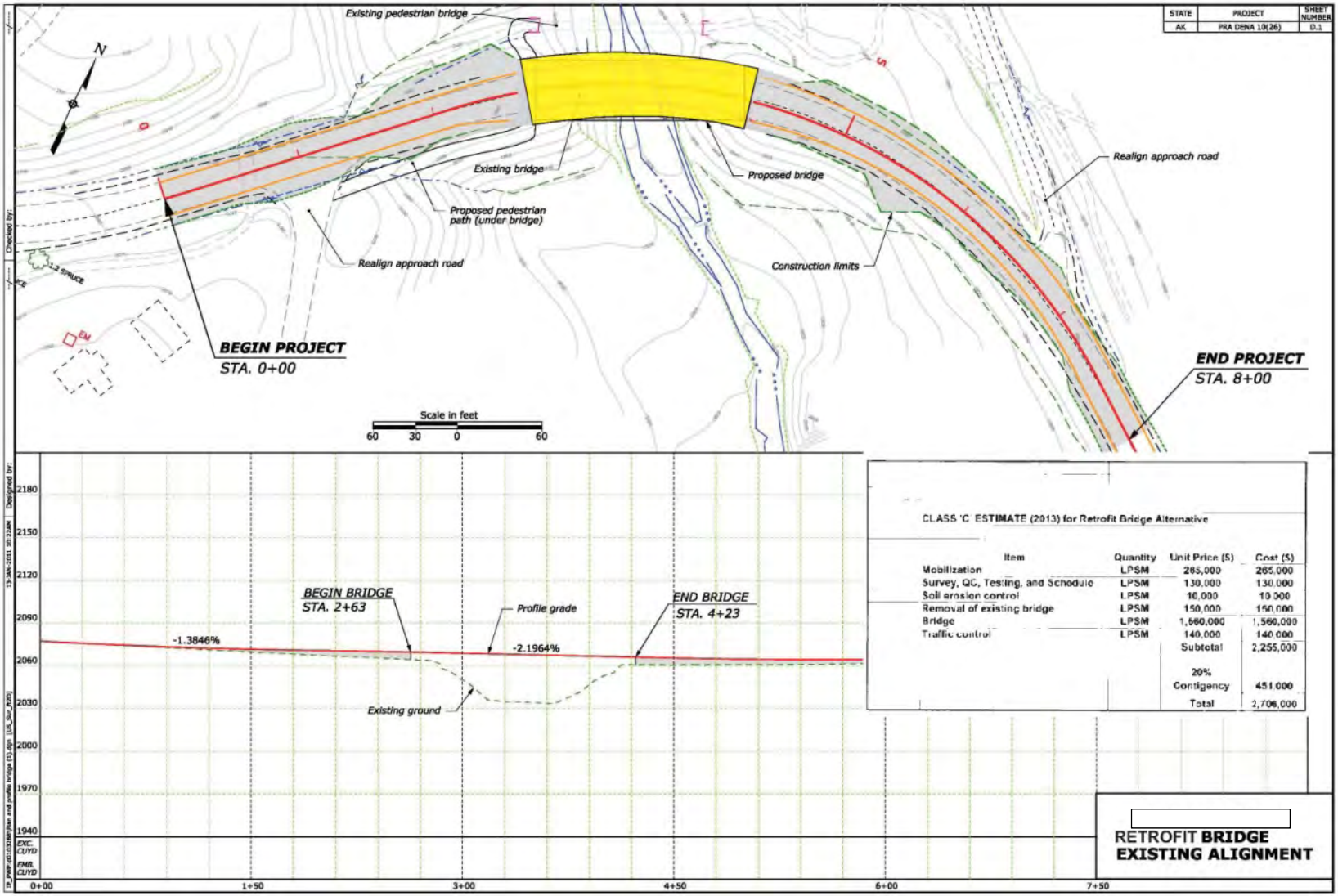

Figure 2-3 Alternative 3: Retrofit Bridge, Existing Alignment

2.5 ALTERNATIVE 4: NEW BRIDGE, DOWNSTREAM ALIGNMENT

A new bridge would be a single span structure on a curved alignment on the downstream side of the existing bridge, approximately 180’ in length with a 34’ out-to-out width (Figure 2-4). The total superstructure depth would be 8’-0”. It would have deep pile foundation, semi-integral reinforced concrete abutments, weathering steel beams with cast-in-place deck, and two-tube barrier rails.

The replacement bridge would be constructed adjacent to the existing bridge on a new alignment prior to removing the existing bridge. Two-way traffic would be maintained across the existing bridge during construction.

A temporary access route would be constructed down to the creek for heavy equipment. Pedestrian traffic would remain on the existing pedestrian bridge. Bicycles would use the vehicular bridge.

The total area of impact would be 2.3 acres.

Construction would start in the summer of 2013, with planned completion in fall of 2014. Operations would cease over winter. The construction schedule would take place over an 18 month period, but active only for ten months (two seasons). Constructing a new bridge downstream would cost between $4,600,000 and $5,700,000.

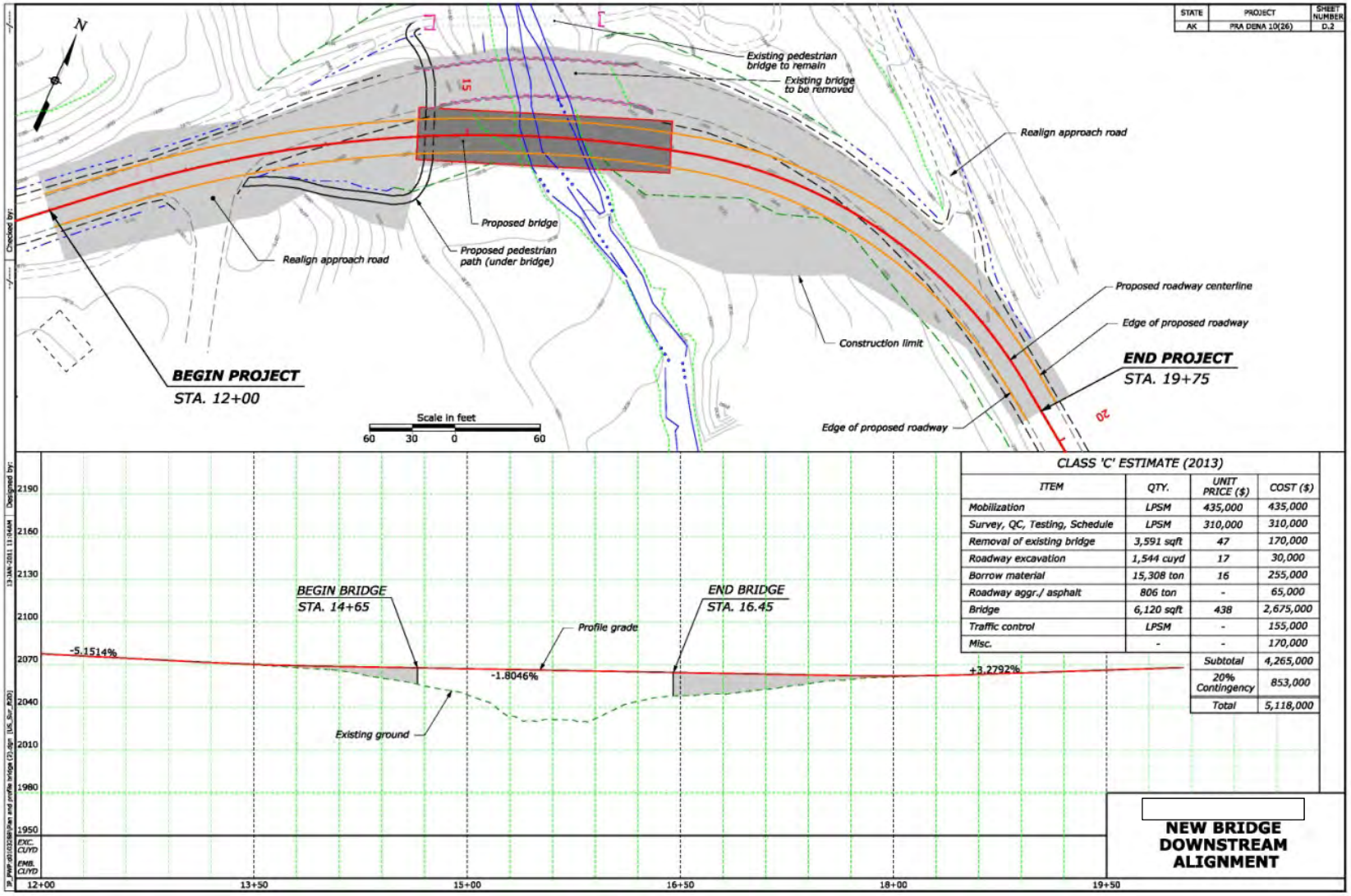

Figure 2-4 Alternative 4: New Bridge, Downstream Alignment.

2.6 MITIGATION MEASURES

For all three of the action alternatives, best management practices (BMPs) and mitigation measures would be used to prevent or minimize potential adverse effects associated with replacing or retrofitting the Rock Creek Bridge. These practices and measures would be incorporated to reduce the magnitude of impacts. Mitigation measures undertaken during project implementation would include, but would not be limited to, those listed below. The impact analysis in the "Environmental Consequences" section of this EA assumes that these BMPs would be implemented as part of all action alternatives.

Soils and Vegetation

- The area of disturbance would be kept to a minimum. For example, heavy construction equipment would be kept on the road surface to the extent possible (i.e., when performing excavation adjacent to the roadway).
- Construction areas would be identified by and fenced with construction tape, snow fencing, or some similar material prior to any construction activity. The 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 construction activities beyond the construction zone, as delineated by the construction zone fencing. Construction materials would be stored in previously disturbed areas.
- Soil erosion due to wind and rain would be minimized. The erosion prevention practices could include using silt screening around any disturbed areas, mulching all exposed slopes, placing staked hay bales in drainages, and sprinkling exposed soil to prevent wind erosion. Upon completion of the construction project, all disturbed soils would be revegetated to prevent erosion.
- Topsoil would be removed and stockpiled for reapplication to disturbed areas when construction is complete.
- Disturbed areas would be restored to natural contours to the extent possible to reduce the potential for erosion, and native species from genetic stocks originating in the Park, or from plants previously removed from the construction area whenever possible, would be used for revegetation. Revegetation efforts would be designed to reconstruct the natural spacing, abundance, and diversity of native plant species.
- Subsequent to project completion, park staff would monitor and require removal of any invasive plant species observed.
- Gravel and fill for construction or maintenance would be obtained from sources certified free of non-native plants. Gravel pits and fill sources would be inspected to identify sources free of non-native plants. There would be no quarrying or borrow of construction materials from inside the park.
- All debris would be removed from the park for legal and proper disposal.

Wildlife and Habitat

- If erosion matting/netting is required, a biodegradable type with mesh that is small enough (1/2" or less) to not entangle small animals would be used.

- Mitigation for the minor loss of habitat would include the revegetation with native plants and removing exotic vegetation in the remaining habitat.
- Under the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703), it is illegal to "take" migratory birds, their eggs, feathers, or nests. "Take" includes by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing, or transporting any migratory bird, nest, egg, or part thereof. The MBTA does not distinguish between intentional and unintentional take. Vegetation clearing, site preparation, or other construction activities that may result in the destruction of active bird nests or nestlings would violate the MBTA. In order to avoid violations of the MBTA, bird habitat (vegetation) would not be removed during the nesting season, April through July 15. After completing all the nesting vegetation removal required for the project, there would be no seasonal restriction for construction activities, even during subsequent nesting seasons. If an active nest were encountered at any time, it would be protected from destruction.

Water Resources

- Storm water runoff control measures, including silt capture techniques such as silt fences and natural filters, would be employed to improve quality of runoff and prevent degradation of the creek and wetlands.
- Design and construction measures would include development of surface water control features to minimize post-construction run-off.
- Construction vehicles could leak fluids into the creek and wetlands, introduce noise pollution, and emit pollutants to the atmosphere. To minimize this possibility, equipment would be checked frequently to identify and repair any leaks, mufflers would be checked for proper operation, and only equipment that is within proper operating specifications would be used.
- Fuel and oil services for construction machinery would be provided in a designated area away from the stream channel and wetlands. This would include secondary containment for all fuel storage tanks and on-site availability of a specialized "spill kit" with capacity to contain a 95 gallon fuel spill.

Visitor Use and Experience and Visual Quality

- Signs would be posted to warn travelers about road construction and traffic delays.
- Construction phasing and timing would be coordinated with the park bus systems and low visitor use times to minimize traffic delays on the park road.
- Well-tuned construction equipment with properly operating mufflers would be used.
- During construction activities, traffic flows would be maintained by keeping construction equipment out of the traffic lanes when possible.
- Adverse impacts to visitor use and experience of the natural landscape would be minimized by the use of coloring on constructed elements to blend their appearance with the surrounding landscape.

Cultural Resources

The National Historic Preservation Act (NHPA) requires that if newly discovered cultural resources are identified during project implementation, work in that area (within 600 feet) must stop and the Superintendent notified immediately (36 CFR 800.13). The Native American Graves Protection and Repatriation Act (NAGPRA), requires that if inadvertent discovery of

Native American Remains or Objects occurs, activity must cease in the area of discovery, a reasonable effort made to protect the item(s) discovered, and immediate notice made to the Superintendent, as well as the appropriate Native American group(s)and State Historic Preservation Officer (SHPO). Further actions also require compliance under the provisions of NHPA and the Archaeological Resource Protection Act.

2.7 ENVIRONMENTALLY PREFERRED ALTERNATIVE

In accordance with DO-12, the NPS is required to identify the "environmentally preferred alternative" in all environmental documents, including EAs. The environmentally preferred alternative is determined by applying the criteria suggested in NEPA, which is guided by the CEQ. As stated in Section 2.7 (D) of the NPS DO-12 Handbook, "The environmentally preferred alternative is the alternative that will best promote the national environmental policy expressed in NEPA (Section 101(b))." This environmental policy is stated in six goal statements, which include:

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

In sum, the environmentally-preferred alternative is the alternative that, not only results in the least damage to the biological and physical environment, but also that best protects, preserves, and enhances historic, cultural, and natural resources.

As evaluated against the CEQ regulations, Alternative 1, the No-Action, is the Environmentally Preferred Alternative as it would have no additional adverse environmental impact. Replacing the Rock Creek bridge would impact 2.3, 1.6, and 2.3 acres under the action alternatives, and it would affect fish, wildlife and habitat; soils and vegetation; cultural resources; water resources including wetlands and floodplains; and visual quality. Bridge replacement or rehabilitation under any of the action alternatives would provide a crossing that could safely withstand another seismic event, which would not occur under Alternative 1.

2.8 ALTERNATIVES AND ACTIONS CONSIDERED BUT REJECTED

The following project alternatives were considered but were eliminated for consideration and will not be analyzed further in this environmental assessment. The rationale for eliminating

alternatives from further analysis is based primarily on factors relating to whether the alternative is reasonable or feasible.

2.8.1 New Bridge Existing Alignment

A replacement bridge was proposed as a single span curved bridge on the existing alignment, approximately 160 feet in length with 34 feet out to out width. The total superstructure depth would be 6'-3". A net estimated grade raise would be approximately 4'-6", which includes a few inches of clearance for construction tolerance over the existing piers. It is assumed to have a deep pile foundation, semi-integral abutments, curved weathering steel beams with cast-in-place deck, and two tube rails.

The replacement bridge would be constructed in stages to allow one lane of traffic to be maintained on half of the existing bridge during the construction. The staged construction would be as follows:

- Stage 1: Partial removal of the existing superstructure and abutments; construction of the first half of the new structure.
- Stage 2: Removal of the remaining existing superstructure and abutments; construction of the remaining half of the new structure.
- Stage 3: Construction of the deck closure pour; removal of the existing piers.

This alternative was rejected because it would be similar to retrofitting the existing bridge (Alternative 3), and the cost would be higher than any other alternative.

2.8.2 Box Culvert – Downstream Alignment and Sloped Fill

An 18 foot wide box culvert would be designed to accommodate fish passage, flood flow, abrasion, sediment transport, and woody debris transport. Half the height of the culvert would be buried to achieve the fish passage. The culvert would be placed under sloped fill. The profile would match existing terrain. Two-way traffic would be maintained across the existing bridge during construction.

This alternative was rejected because the footprint of impact would be much larger than any other alternative and would have a longer culvert. The MSE and gabions in the Preferred Alternative would be able to minimize the footprint and return to the original alignment. Also, sight distance would not be improved as originally thought.

Table 2-1 Summary of Alternatives

Element	Alternative 1: No Action	Alternative 2: New Culvert (Preferred Alt)	Alternative 3: Retrofit Bridge	Alternative 4: New Bridge Downstream
Initial Capital Construct Costs	$0	$2,482,000	$2,700,000	$4,627,000
Total Life Cycle Costs over 50 yrs	$120,000	$2,593,000	$3,159,000	$5,071,000
Operating and Maint Costs	$37,000	$127,000	$319,000	$319,000
Duration of Construction	N/A	5 months in 1 season	8 months in 2 seasons	10 months in 2 seasons
Construction Impact Area	0 acres	2.3 acres	1.6 acres	2.3 acres
Affects Historic District	No	Yes	Yes	Yes
Uses Existing Foot Bridge	Yes	No	Yes	Yes
Traffic During Construction	N/A	One-way	One-way	Two-way
Meets Seismic Standards	No	Yes	Yes	Yes
Traffic Lane Width	12 ft	15 ft	15 ft	15 ft
Improves Sight Distance	No	No	No	Yes
Wetland Disturbance	0 acres	0.2 acres	0.2 acres	0.4 acres

Table 2-2 Summary of Alternative Impacts

Impact Topic	Alternative 1: No Action	Alternative 2: New Culvert (Preferred Alternative)	Alternative 3: Retrofit Bridge	Alternative 4: New Bridge Downstream
Fish and Wildlife and Habitat	No new impacts on fish, wildlife, and habitat.	Adverse minor impacts due to temporary construction activities and increased human presence. Proposed bridge replacement would impact 2.3 acres of wildlife habitat.	Adverse minor impacts due to temporary construction activities and increased human presence. Retrofitting the bridge would impact 1.6 acres of wildlife habitat.	Adverse minor impacts due to temporary construction activities and increased human presence. Constructing a new bridge would impact 2.3 acres of wildlife habitat.
Soils and Vegetation	No new impacts on soils and vegetation.	Adverse moderate impacts. 2.3 acres would be impacted by soil disturbance and vegetation removal, creating long-term impacts to soils and vegetation in the project area.	Adverse moderate impacts. 1.6 acres would be impacted by soil disturbance and vegetation removal, creating long-term impacts to soils and vegetation in the project area.	Adverse moderate. 2.3 acres would be impacted by soil disturbance and vegetation removal, creating long-term impacts to soils and vegetation in the project area.
Cultural Resources	No impacts on cultural resources.	Adverse minor impact from cutting back slope to build the new pedestrian trail.	Minor impacts from widening and retrofitting the 1959 bridge.	Minor impacts from widening and retrofitting the 1959 bridge.
Water Resources	No new impacts on water resources.	Adverse moderate impact from manipulation of the stream bed.	Adverse minor impact from temporary disturbances of the stream bed.	Adverse minor impact from temporary disturbances of the stream bed.
Visual Quality	No new impacts on visual quality.	Adverse moderate impacts from changes in road configuration and relocation of the pedestrian crossing/trail.	Adverse minor impacts from construction and retrofitted bridge would be wider than the existing bridge.	Adverse minor impacts from construction and as a new bridge would replace the existing bridge in a downstream alignment.

Impact Topic	Alternative 1: No Action	Alternative 2: New Culvert (Preferred Alternative)	Alternative 3: Retrofit Bridge	Alternative 4: New Bridge Downstream
Visitor Use and Enjoyment	Long-term adverse minor impacts as the quantity of traffic could become too great for bridge carrying capacity, and another seismic event could compromise bridge integrity.	Adverse minor impacts during construction due to noise and possible traffic delays. Long-term beneficial effects as capacity concerns of the current bridge would be alleviated.	Adverse minor impacts on visitor use and enjoyment during construction due to noise and traffic delays. Long-term beneficial effects as capacity concerns of the current bridge would be alleviated.	Adverse minor impacts during construction due to noise and sights of construction. Long-term beneficial effects as capacity concerns of the current bridge would be alleviated, including improved vehicular sight distance.
Park Operations and Safety	Long-term moderate adverse impacts on park operations due to seismic inadequacy, vehicle sight distance and narrow lanes.	Beneficial moderate impacts due to improved access and traffic flow and greater assurance of continued operations without interruptions that may have otherwise been caused by an unexpected failure of the existing bridge. The level of effort to maintain the culvert would be lower than all other alternatives.	Beneficial moderate impacts due to improved access and traffic flow and greater assurance of continued operations without interruptions that may have otherwise been caused by an unexpected failure of the existing bridge.	Beneficial moderate impacts due to improved access and traffic flow and greater assurance of continued operations without interruptions that may have otherwise been caused by an unexpected failure of the existing bridge.

3.0 AFFECTED ENVIRONMENT

3.1 PROJECT AREA

DENA encompasses 9,419 square miles in central Alaska. The main entrance to the park is at MP 238.0 of the George Parks Highway, approximately 240 miles north of Anchorage and 12 miles south of Healy. The Rock Creek Bridge and project site is located just after C-Camp and just before the park headquarters, at MP 3.3 of the 92-mile long park road.

3.2 FISH AND WILDLIFE AND HABITAT

The mosaic of tundra, forest, shrubland, wetland, and open meadow vegetation types found throughout the park and adjacent to the project area provide optimal habitat for several large mammal species. These species include moose (*Alces alces*), caribou (*Rangifer tarandus granti*), brown bear (*Ursus arctos*), black bear (*Ursus americanus*), and gray wolf (*Canis lupus*). Some of these species can be observed in the landscape surrounding the project area, others may be observed crossing the park road where it bisects wildlife movement or migration corridors.

Smaller mammals potentially found near the project area include red fox (*Vulpes vulpes*), snowshoe hare (*Lepus americanus*), ermine (*Mustela erminea*), arctic ground squirrel (*Spermophilus parryii*), lynx (*Lynx canadensis*), coyote (*Canis latrans*), wolverine (*Gulo gulo*), and red squirrel (*Tamiasciurus hudsonicus*) (NPS, 2007a). Red fox are common and very visible along the park road, whereas snowshoe hares and red squirrels are commonly found in forested areas. Other mammal species in the vicinity may include shrews (*Sorex* spp.), several species of voles and lemmings.

The resident bird species common to the project area include spruce grouse (*Dendragapus canadensis*), willow ptarmigan (*Lagopus lagopus*), common raven (*Corvus corax*), black-billed magpie (*Pica pica*), boreal chickadees (*Poecile hudsonica*), common redpolls (*Carduelis flammea*), and three-toed woodpeckers (*Picoides tridactylus*). The great-horned owl (*Bubo virginanus*) and boreal owls (*Aegolius funereus*) are the most common resident owl species in Denali, while great gray owls (*Strix nebulosa*), and the northern hawk owls (*Surnia ulula*) occur at very low densities (NPS, 2006).

The numerous migratory bird species found in the project area include ruby-crowned kinglets (*Regulus calendula*), sparrows (American tree sparrow [*Spizella arborea*], savannah sparrow [*Passerculus sandwichensis*], fox sparrow [*Passerella iliaca*], white-crowned sparrow [*Zonotrichia leucophrys*]), warblers (yellow-rumped warbler [*Dendroica coronata*] and orange crowned warbler [*Vermivora celata*], Wilson's warbler [*Wilsonia pusilla*]), violet green swallow (*Tachycineta thalassina*), dark-eyed junco (*Junco hyemalis*), American robin (*Turdus migratorius*), and several species of thrush (*Catharus* spp.) (NPS 2006). Other common migrants include northern harrier (*Circus cyaneus*), mew gull (*Larus canus*), and golden eagle (*Aquila chrysaetos*). Wetland-nesting shorebirds include lesser yellowlegs (*Tringa flavipes*), common snipe (*Gallinago gallinago*), solitary sandpiper (*T. solitaria*), and wandering tattler (*Heteroscelus incanus*).

Currently there are no mammal or bird species listed under the jurisdiction of the ESA. One federal species of concern, the olive-sided flycatcher (*Contopus cooperi*), is found within the general project area. This bird nests in open coniferous forests with bog ponds and marshy streams, and in woodland/dwarf forests (NPS, 2006). The State of Alaska no longer maintains a Species of Special Concern list as of August 15, 2011(ADFG, 2011).

Fish found in Rock Creek are Dolly Varden, sculpins and Arctic grayling (Miller, 1981).

Conn (1998) identified 26 taxa of benthic macroinvertebrates, including six families of Diptera, six genera of mayflies, seven stonefly genera, and six Trichoptera genera. The only non-insects found were Oligochatae worms. Abundance of benthic macroinvertebrates has been shown to vary markedly from year to year, and certain taxa may not be found at all in some streams in all years. Such variability in macroinvertebrate abundance is likely due to channel stability, flow variability, and climatic conditions such as snowfall. Generally, however, undisturbed streams show less variability in macroinvertebrate communities over time than streams with unstable channels.

The wood frog is the only species of amphibian that occurs in DENA (NPS, 1986). It is widespread across DENA and populations are relatively dense across the landscape.

3.3 SOILS AND VEGETATION

The park is composed of a mosaic of tundra, forest, shrubland, and open meadow. The project area, located at approximately 2,100 feet, lies within the Alaska Range Transition ecoregion, which is a more narrowly defined subset of the general Boreal ecoregion (Nowacki et al., 2002).

The project area is in an ecoregion consisting mostly of mixed needleleaf/deciduous forest of white spruce (*Picea glauca*), black spruce (*P. mariana*), and white spruce-black spruce hybrids (*P. glauca* X *mariana*) mixed with paper birch (*Betula papyrifera*) and small amounts of aspen (*Populus tremuloides*). White spruce, birch, and aspen typically occupy areas of well-drained soil on ridges, while black spruce is usually found in areas with poor drainage underlain by shallow permafrost. White spruce-black spruce hybrids are usually found in wetter, poorly drained areas. Common tall shrubs include high-bush cranberry (*Viburnum edule*) and Sitka alder (*Alnus viridis*) in dryer areas and diamondleaf willow (*Salix planifolia* spp. *pulchra*) in wetter areas along intermittent stream flows. Low shrub and herbaceous species include prickly rose (*Rosa acicularis*) in more well-drained areas and dwarf birch (*B. nana*), bog blueberry (*Vaccinium uliginosum*), bog cranberry (*Vaccinium oxycoccus*), Labrador tea (*Ledum palustre*), and various sedges (*Carex* spp.) in wetter locales. Ground cover typically consists of lichens and mosses, including true mosses (*Polytrichum* spp.) in dryer areas and peat mosses (*Sphagnum* spp.) in wetter areas (Nowacki et al. 2002; NPS, 2007a).

Three species of exotic plants have been the target of extensive control efforts at DENA: white sweetclover (*Melilotus officinalis*), common dandelion (*Taraxacum officinale*), and narrowleaf hawksbeard (*Hieracium umbellatum*) (NPS, 2008). Other species are present as isolated small populations, including bird vetch (*Vicia cracca*), yellow toadflax (*Linaria vulgaris*), oxeye daisy

(*Leucanthemum vulgare*), annual sowthistle (*Sonchus oleraceus*), smooth brome grass (*Bromus inermus*), common timothy (*Phleum pratense*), and bigleaf lupine (Lupinus polyphyllus). Almost all of the populations of these species are found within the first few miles of the Park Road.

Soils within the project area vary according to parent material, topography, and vegetation coverage. These soils have undergone relatively minor modification of the soil parent material by soil-forming processes and are found on both well-drained upland areas and in wet lowland areas.

3.4 CULTURAL RESOURCES

There are two major historic properties in the project area: the Headquarters Historic District and the Park Road. Both are listed (or eligible to be listed) on the National Register of Historic Places. Whether listed or eligible, the NPS treats them then same.

The Rock Creek Bridge was constructed in 1959. It has not been evaluated as the whether it is a contributing element of the historic Park Road. A determination of eligibility has not been completed for the bridge.

A section of the project area overlaps the acre Headquarters Historic District (see Figure 1-1), which encompasses 11.9 acres, 18 buildings and a network of narrow connecting roads. In keeping with the NPS philosophy of rustic architecture, the physical features of the majority of buildings in the District reflect a conscious attempt to harmonize with their natural surroundings through the use of building materials and techniques indigenous to interior Alaska and through sensitive siting. The buildings which are contributing elements to the Historic District were erected between 1926 and 1941. Fourteen buildings maintain significant exterior integrity and contribute to the ambience of the Historic District. The historic buildings are adaptively used for both administrative and residential purposes. The park kennels building hosts a program interpreting the history and current use of sled dog patrols in the park.

The Headquarters Historic District is historically significant since it illustrates the presence and early growth of the NPS in the State of Alaska. The NPS was established for the stated purpose of conserving areas of outstanding national beauty and wildlife and for providing outdoor recreational opportunities to the American public. The Civilian Conservation Corps (CCC), a Depression-era program whose life extended from 1933 to 1942, contributed greatly to the expansion and development of the Headquarters Historic District in the late l930s. Throughout the nation and locally at (the formerly named) Mount McKinley National Park, the CCC facilitated and enhanced the efforts of the NPS. The Headquarters Historic District represents the two historical themes of conservation and recreation (NPS, 2007b).

3.5 WATER RESOURCES

3.5.1 Wetlands

Wetlands are transitional areas between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands cover a portion of the project area. Under the Cowardin Classification System outlined in "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin et al., 1979), the project area wetlands are classified as riverine upper perennial unconsolidated bottom cobble gravel (R3UB1) and riverine upper perennial unconsolidated shore cobble gravel/vegetated (R3US1/5). These wetlands are subject to NPS wetlands compliance procedures. Figure 7 illustrates wetland classifications in the project area.

Wetlands of the riverine, vegetated classifications are exposed long enough to be colonized by herbaceous plants. This vegetation, unlike that of emergent wetlands, is usually killed by rising water levels or sudden flooding. Vegetation found in the project area includes felt leaf willow, Bebb willow, glaucus willow, and low forbs.

These wetlands function to retain sediment during high flows and spring breakup. These wetlands also provide habitat for small mammals, such as red squirrels, snowshoe hares, and porcupine; and bird species, including gray jays, robins, thrushes, sparrows, and warblers. Moose frequent the area for forage (NPS, 2007a).

A Statement of Findings is in the Appendix.

3.5.2 Floodplains

Peak discharges were estimated using USGS regression equations. The regression equations use drainage area, lake area, and forest area. Based on USGS topographic mapping, the drainage area is 3.13 square miles, the lake area is 0 percent, and the forest area is 20 percent. The resulting 2, 50, and 100-year peak discharges are 57, 240, 289 ft3/sec, respectively. The existing bridge abutments pinch the 100-year floodplain. The 100-year water surface flow depth at the upstream face of the bridge is approximately 3.0 feet.

Natural stream processes include floodplain connectivity, woody debris transport, sediment transport, channel migration, and ice conveyance. Except for where road embankment is placed in the valley (approximately 4,800 ft2), the stream will continue exchanging overbank flow to existing floodplain areas. The rate and type of flow exchange will remain unchanged.

The woody debris is predominantly willow and spruce. Typical sizes available for woody debris recruitment and conveyance is 4 to 8 inches trunk diameter and 10 to 15 feet trunk length. The existing active channel is 12 to 20 feet wide and 1 to 2 feet deep. The channel likely only recruits and conveys large woody debris during the extreme flood events (> 25-year) when flows are deep enough in the channel for floating the wood.

The existing stream has a gravel-cobble-boulder bed. It is sediment limited and generally degrading (stream profile lowering over time). The degradation is controlled by the relative large cobble-boulder bed material. The boulder material is likely derived from fluvial-glacial lag deposits. Localized depressions in the stream profile of 2 to 4 feet occur where water plunges over transverse boulder clusters creating a scour hole. These localized depressions may migrate

upstream or downstream with extreme flood discharges. The stream currently develops mid-channel sediment deposits and braids around those and glacial-derived lag deposits, eroding channel banks and widening the channel.

Valley floor is approximately 40 to 60 feet wide. It narrows to 40 feet beneath the existing bridge where the proposed culvert will be installed. Except for where road embankment is placed in the valley (approximately 4,800 ft2), the channel will be allowed to migrate freely across the valley floor. It is likely that the narrowness of the valley floor and the coarse stream bed and bank materials restrict channel migration.

A Statement of Findings is attached in the Appendix. It provides additional information and analysis on wetlands and floodplains.

3.5.3 Water Quality

Rock Creek experiences periods of high turbidity during intense or prolonged rainfall events. During spring break-up high levels of tannins and other leaf decay products can color the stream water for a couple of weeks. The domestic water supply for the park headquarters and C-Camp is found in a gallery of horizontal collection pipes about 400 yards upstream of the project site. Water quality is considered excellent.

There are no impaired waters listed on Alaska's Integrated Report that are within the Nenana River watershed (USEPA, 2011).

3.6 VISUAL QUALITY

The visual landscape along the park road transitions with each mile. After leaving the main entrance area where bustling activity is centered around the railroad depot and Visitor Center Complex, natural taiga and tundra vegetation as well as scenic vistas of the Alaskan Range begin to dominate the park road.

The park road bisects the natural landscape, but the linear form of the road is buffered by surrounding vegetation. Road signs and related items are kept to a minimum and natural features dominate the view. Motorists, bicyclists, and pedestrians can see vegetation and the creek on either side of the road when passing MP 3.3. Driving across the bridge, on the north side the views are limited due to vegetation; drivers can see the stream and river valley and views are short to intermediate (Schrooten, 2011). On the south side there are intermediate to extended views out over the open valley. No buildings or other structures, other than the pedestrian bridge, are visible from the project site. If walking, visitors and staff can look down and see Rock Creek. There is a screened view of the project site from the Rock Creek Trail. If walking from the east (from C-Camp), the project site is not visible until visitors and staff are almost right on top of it. If walking from the west (headquarters area), visitors would see more of the project site from farther away because the view is not as vegetated.

3.7 VISITOR USE AND ENJOYMENT

The park road is the conduit for summer access that provides an opportunity to visitors of all abilities to experience the park's resources. The first 15 miles of the park road provides visitors opportunities to experience the park without the use of public transportation. Approximately 400,000 people visit the park annually, primarily during the months of June, July, and August (NPS, No date). The primary visitor activity in the park is a shuttle or tour bus ride along the park road, which stretches from the Parks Highway for over 90 miles into the park, ending at Kantishna. Annually, about 280,000 visitors embark upon a shuttle bus trip or tour beyond the Savage River checkpoint for travel into the park interior (NPS, 2007a). Most of the remaining visitors stay in the frontcountry and explore this area of the park via the Savage River Shuttle bus, tour bus, private car, bicycle, or on foot. The nexus between the character of the park road and the surrounding landscape is essential to the visitor experience.

Within the project area, summer visitor use generally consists of shuttle bus tours, independent visitors in passenger vehicles, bicycling along the road, and foot traffic. During the peak visitation season, pedestrians frequently walk the Roadside Trail which connects to the Rock Creek Trail near the project site. Day-use visitors are the primary trails users, in addition to use by park staff. Skiing, dog sled mushing, and snowshoeing are common winter activities in this area of the park. Winter recreationists use the snow-covered road as a non-motorized recreational trail. Motor vehicles are not allowed beyond headquarters from about early October until the middle of April, but the dates are highly variable and depend on several factors (such as weather, snow depth, success in clearing aufeis, administrative needs, and destination of vehicles). The park road is always open for visitor use, either motorized (and pedestrian and bicycle) use during the summer, or non-motorized (over snow) use during the winter.

3.8 PARK OPERATIONS AND SAFETY

The Superintendent and principal personnel in concessions management, interpretation, communications, law enforcement/emergency medical services, information technology, administration, and research and resource management all have offices in the headquarters area, which is located on the main park road west of the proposed bridge. Some functions, particularly communications, law enforcement/emergency medical services, and fire management either have moved or will move to a new facility in the C-Camp area, which is east of the proposed bridge project (NPS, 2007b).

The headquarters area also hosts park resource and interpretive libraries, the park's museum collection, central files, the computer network and phone hubs, and both temporary and permanent storage. Six of the structures inside the historic district and most of the structures outside of the historic district are residential housing. There are a total of 24 housing units in the headquarters area, occupied primarily by permanent employees. Some are used for transient or temporary housing. There are over 30 full-time residents, including several children. A playground is located to the east of the six-plex apartment building (B51). In the basement of building #51 is the "Permanent Rec Hall," which has been used as a gathering place, exercise room, and entertainment area for residents in permanent housing but is also used as a conference room for administrative purposes (NPS, 2007b).

Non-residential functions include building #53 – a former 6-bay garage – which primarily hosts the storage, offices, and computer network hub for the information technology team; and the steam plant (building 54) which provides heat through an underground utilidor to many headquarters area buildings. The utilidor also holds water and sewer pipes and electrical service lines (NPS, 2007b).

Along the road running east of the kennels building are a variety of storage buildings. Three storage containers at the end of the road are utilized for storage by law enforcement/emergency medical services, resource management, and fire management. The park's National Weather Service weather station is also located here. To the north of the project area, the driveway that provides access to residences #111 and #22 goes further uphill to end in an administrative area that supports the headquarters water system. (NPS, 2007b)

An air quality research site and a research snow course are also located here. The air quality site provides uninterrupted data through national monitoring networks. Measured parameters include atmospheric deposition, ground-level ozone, sulfur and nitrogen oxides, fine particles and aerosols. The maintenance division uses formerly residential garage bays for storage in building #217, and some residential storage occurs in building #53. The gravel pad south of the steam plant is presently used for several small, temporary storage buildings and a temporary office trailer. Also south of the steam plant is the leach field for the headquarters area (NPS, 2007b).

The main headquarters road starting by the flagpole and visitor parking lot has been the primary entry point to the headquarters area historically and continues to serve as the primary entry point for administrative traffic today. The service road to the west primarily serves west-bound administrative traffic and access to the parking area west of the Cache (building #103) and to the kennels. Sled dog demonstration buses also enter the headquarters area along this road. In winter when the park road is closed at the headquarters gate, some winter maintenance continues out to mile 7 of the road to minimize ice build-up on the road surface, during which time road equipment also uses the service road (NPS, 2007b).

Employee parking is near the administrative buildings where they work or in the new lots along the spur road to the Kennels parking lot. The gravel pad to the east of the steam plant (building #54) was expanded to provide space specifically for storage of employee recreational vehicles in 2001 (NPS, 2001; NPS, 2007b).

There are several areas important as snow dumps to store snow removed from headquarters roads (NPS, 2007b).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

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

4.2 METHODOLOGY

For each issue selected for detailed analysis (see section 1.3.1) and for which the subject resources are described in Chapter 3, the direct, indirect, and cumulative effects are analyzed. The effects to the subject resources are analyzed on the basis of type (adverse or beneficial), context, duration, and intensity of the impacts. Summary impact levels (characterized as negligible, minor, moderate, or major) are given for each impact topic in the analyses. Definitions of impact terms are provided below. Table 4-1 presents a summary of impact level thresholds.

Overall, the NPS based the following impact analyses and conclusions on review of existing literature and Denali National Park and Preserve studies, information provided by experts within the NPS and other agencies, professional judgments and park staff insights, and previous projects in the area.

Direct verses Indirect Impacts:
Direct – Effects are impacts caused by the alternative(s) at the same time and in the same location as the action.
Indirect – Effects are impacts caused by the alternative(s) that occur later in time or farther in distance than the action, but still reasonably foreseeable. An indirect impact could occur because of a change to another resource or impact topic.

Intensity of Impact:
Low – A change in resource condition is perceptible, but does not measurably alter the resource function in the park ecosystem, cultural context, or visitor opportunity.
Medium – A change in a resource condition is measurable or observable and an alteration is detectable to the resource function in the park ecosystem, cultural context, or visitor opportunity.
High – A change in a resource condition is measurable or observable and an alteration to the resource function in the park ecosystem, cultural context, or visitor opportunity is clearly and consistently observable.

Duration of Impact:
Temporary – Impacts would last only a single visitor season or for the duration of the discreet activity, such as weather station installation or maintenance.
Long-term – Impacts would extend for several years up to the life of the facility.

Permanent – Impacts are a permanent change to the resource that would last beyond the life of the facility even if the actions causing the impacts were to cease.

Context:
Common – The affected resource is widespread and is not identified in enabling legislation as important to the park, nor is it rare within or outside the park. The portion of the affected resource does not fill a unique role within the park or its region of the park.
Important – The affected resource is identified by enabling legislation or is rare either within or outside the park. The portion of the affected resource does not fill a unique role within the park of its region of the park.
Unique – The affected resource is identified by enabling legislation and the portion of the affected resource uniquely fills a role within the park and its region of the park.

Table 4-1 Summary Impact Levels

Negligible	Minor	Moderate	Major
Effects would generally be low intensity, temporary, & would not affect unique resources.	Effects would tend to be low intensity & short duration, but common resources may sustain medium intensity & long-term effects.	Common resources would be affected by higher intensity & longer term impacts while important & unique resources are affected by medium to low intensity & shorter-term to temporary impacts, respectively.	Effects are generally medium to high intensity, long-term to permanent & affect important to unique resources.

4.2.1 Cumulative Impacts

CEQ regulations (40 CFR 1508.7) require the assessment of cumulative impacts in the decision-making process for Federal projects. A cumulative impact is an impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or non-Federal), organization, or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

Cumulative impacts are considered for all alternatives and are presented at the end of each impact topic discussion analysis. To determine potential cumulative impacts, projects in the vicinity of the proposed project site were identified. Potential projects identified as cumulative actions included any planning or development activity that was currently being implemented or that would be implemented in the reasonably foreseeable future.

In the past, cumulative impacts on resources in the area have been dominated by the development of administrative facilities and visitor services along the park road. The entrance area is the area along the park road from the intersection with the George Parks Highway to the park headquarters.

There are several relevant past actions and projects that have been completed in the vicinity of the project as well as ongoing actions, facilities, and services in the project vicinity and park entrance area. The developed entrance area, the headquarters area, the paved road, and its associated developments through the Savage River Bridge near MP 14.0, make up the nearby area of development and disturbance examined in this cumulative impacts section. In this area, about 80 acres of park land has been developed. Ongoing actions in the area include upgrades and rehabilitation to existing facilities, road, trails, and campgrounds to support current visitor use.

Implementation of the DCP/EIS is continuing with general programming for all facilities and the design of several development components. Facilities and services in the park entrance area currently include:

- Visitor Center Complex, completed in 2005 with a bookstore/gift shop and cafeteria/deli
- Murie Science and Learning Center Complex
- Wilderness Access Center
- Riley Creek Campground, rehabilitation and expansion
- Railroad Depot
- Post Office
- Airstrip
- A network of hiking trails that connects the Nenana Canyon to the entrance area and the entrance area to the C-Camp/Headquarters Area
- C-Camp facilities including employee housing, parking, common facilities, maintenance area, Emergency Services Building,
- Sled dog kennels at Park Headquarters
- Riley Creek Mercantile, with camper convenience services such as a general store and showers
- Support facilities for the concessionaire (including a housing area) and NPS interpretive programs
- A bus barn to support bus maintenance activities.
- Park Headquarters

Reasonably foreseeable future actions are those actions that are likely or reasonably certain to occur. Typically, they are based on documents such as existing plans, permit applications, or announcements. Significant planned actions in this area that were either identified in the DCP/EIS or elsewhere include rehabilitation of utility infrastructure with new buried utility lines; upgrading the sewage treatment system; realignment of the dog kennel road and expansion of public parking; and road improvements. Several upgrades to existing facilities are also planned but would not increase the existing footprint of development in the area.

Other future and ongoing projects in the entrance area that were not specifically addressed in the DCP/EIS include cyclically removing brush from beneath the overhead power line; repairing

roads and trails; continuing remediation of contaminated soils and groundwater at various locations; periodic resurfacing of Park Road in the entrance area; and converting to natural gas as a heat source.

4.3 ALTERNATIVE 1: NO ACTION ALTERNATIVE

4.3.1 Fish and Wildlife and Habitat

Under Alternative 1, there would be no additional impacts to fish, wildlife, and habitat as the bridge would not be replaced.

Cumulative Impacts

Past construction actions that have impacted wildlife include the Visitor Center and the Murie Science and Learning Center. Various transportation projects, including road and trail construction and maintenance, have also been conducted throughout the park. Wildlife impacts related to these activities have included harassment or displacement of individuals; the loss or degradation of habitat as a result of land use changes; introduction of invasive species; and higher levels of human presence and activity. Wildlife impacts generally increased in intensity during the short-term construction period; however, the extent of impacts has typically been limited to the immediate vicinity of human activities (e.g., habitat removal or alteration, species displacement or mortality, noise).

Reasonably foreseeable future actions that could contribute to cumulative impacts to wildlife and habitat include facility modification, removal, and construction, as well as road and trail construction and rehabilitation. These activities would result in similar impacts to wildlife, as discussed for past and present actions.

The cumulative impact on fish, wildlife, and habitat from such actions would be adverse and minor to moderate. Alternative 1 would not contribute any cumulative impacts on fish, wildlife, and habitat. Combined with known past, current and future projects and actions, there would be moderate adverse cumulative impacts on fish, wildlife, and habitat.

Conclusion

Alternative 1 would have no additional impacts on fish, wildlife, and habitat.

4.3.2 Soils and Vegetation

There would be no additional impacts on soils and vegetation under Alternative 1 as there would be no bridge replacement. Annual vegetation brushing to protect bridge abutments would have a negligible impact.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to vegetation and soils in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has required clearing of vegetation in the vicinity of the proposed project area. The total acreage of existing disturbance to vegetation in the vicinity of the proposed project area is about 80 acres (NPS, 2007a). Impacts related to these activities include creation of social trails and trampling of vegetation, soil compaction, placement of fill in vegetated areas, potential

introduction of invasive species, channelization of runoff from impervious surfaces, and subsequent erosion of soils.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts from these actions would include the direct loss of vegetation and soil disturbance and would be similar to those described under past actions.

The cumulative impact on soils and vegetation from such actions would be adverse and moderate. Alternative 1 would not contribute any cumulative impacts on soils and vegetation. Combined with known past, current and future projects and actions, there would be moderate, adverse cumulative impacts on soils and vegetation.

Conclusion
Alternative 1 would have no additional impacts on soils and vegetation.

4.3.3 Cultural Resources

There would be no additional impacts on cultural resources, including the Headquarters Historic District, under Alternative 1.

Cumulative Impacts
Since the Headquarters Historic District was added to the National Register of Historic Places in 1987, NPS activities have both enhanced and detracted from the character of the district. Historic building rehabilitation since completion of the 1997 *Entrance Area and Road Corridor DCP* has emphasized the reconstruction of the historic exterior appearance of the buildings. However, new non-contributing structures have been added to the district, such as the comfort station serving kennels visitors in 2005 and one residence in 1994. Formal and informal parking has expanded along road edges. The Headquarters Historic District received substantial beneficial effects from actions in the Headquarters Area Plan of 2007, such as rehabilitation of the cultural landscape returning it to an appearance more similar to what it had been during the district's historic period of significance between 1928 and 1941. Other actions, such as new parking areas and new non-contributing structures, had adverse effects on the District's character.

The cumulative impact on the Headquarters Historic District from such actions have been mixed, but with an overall moderate, beneficial influence since the completion of the 1997 DCP. Alternative 1 would not contribute any cumulative impacts on the historic district. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on cultural resources.

Conclusion
Alternative 1 would have no additional impacts on cultural resources.

4.3.4 Water Resources

Under Alternative 1, the Rock Creek Bridge would be left in place and current operations for maintenance on the bridge would continue. There would be no changes introduced as a result of implementing this option and therefore, no additional impacts to wetlands, floodplains, or water quality from continuance of current conditions at the existing bridge.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to water resources in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has resulted in impacts to approximately 4 acres of wetlands in and near the project area. Some development has occurred in floodplains and in types of wetlands that are common throughout the eastern area of the park; no sensitive areas have been impacted. Impacts related to these activities have included draining, filling, or sedimentation of wetlands, which has produced results such as direct wetland losses and/or changes to functions and values (i.e., floodwater attenuation and contaminant filtration). Careful location to avoid uncommon or unique wetlands, and adherence to BMPs to protect wetlands and floodplains during construction have served to mitigate potential impacts. The impacts of past and ongoing actions on wetlands and floodplains have lasted longer than 2 years.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts would be similar to those described for past and present actions and would be greatest during the construction phases for these projects. However, carefully locating project actions to avoid uncommon or unique wetlands and adherence to BMPs to protect wetlands during construction would serve to mitigate potential impacts.

The cumulative impact on water resources from such actions would be adverse and minor. Alternative 1 would not contribute any cumulative impacts on water resources. Combined with known past, current and future projects and actions, there would be minor, adverse cumulative impacts on water resources.

Conclusion

There would be no additional impact to water resources from the implementation of the Alternative 1.

4.3.5 Visual Quality

There would be no new impacts to visual resources resulting from Alternative 1. Existing landscapes and viewpoints would not be altered.

Cumulative Impacts

Cumulative impacts to visual resources have been dominated by past and present actions that have altered the natural environment, landscapes, and viewpoints in the area. Several construction projects have shaped the landscape to serve visitors and staff, including the park road, hiking trails, construction of visitor and education centers, and construction and maintenance of administrative facilities. The park facilities and roads have typically been

designed to mimic the features of the natural landscape, incorporating natural colors and textures, and landscaping with native materials. Past and present actions have contributed persistent impacts to visual resources of the park. Reasonably foreseeable future actions include further improvements to administrative sites, involving actions such as brush removal under power lines and other routine maintenance activities.

The cumulative impact on visual quality from such actions would be adverse and minor to moderate. Alternative 1 would not contribute any cumulative impacts on visual quality. Combined with known past, current and future projects and actions, there would be minor to moderate, adverse cumulative impacts on visual quality.

Conclusion
There would be no new impacts on visual quality from the Alternative 1. No new direct or indirect impacts would occur, and existing landscapes and viewpoints would not be altered.

4.3.6 Visitor Use and Enjoyment

Under Alternative 1, the existing Rock Creek Bridge would not be replaced. The level of visitor use is expected to continue at the present rate or to increase. In the near term, visitor use and enjoyment would not change from current conditions. While there would be no noise or disturbances to traffic flow during construction, there would also be no long-term road improvements. In the future, bridge safety measures, such as limits on the amount of traffic, may be needed for bridge crossings, which would likely have an adverse effect on visitor experience.

Cumulative Impacts
Past and present actions have contributed to cumulative impacts to visitor use, including: road resurfacing projects to improve transportation corridors for summer visitation, a railroad depot that provides access to the park from other areas of the state, several services geared towards park visitors to enhance their experience, and many recreation trails and facilities. Cumulative impacts to visitor use have included redistribution of accommodation services to surrounding communities and greater convenience and access to visitor information from new facilities in the park entrance area (e.g., Visitor Center, trails, and campgrounds). Recreation facilities that have contributed to cumulative impacts on visitor use in the area include the sled dog kennels at park headquarters, expansion of Riley Creek Campground, and rerouting or rehabilitating area trails. Reasonably foreseeable future actions that could contribute to cumulative impacts to visitor use are road and trail improvements.

The cumulative impact on visitor use from such actions would be beneficial and moderate. Alternative 1 would contribute minor, adverse cumulative impacts on visitor use. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on visitor use.

Conclusion
In the long-term, impacts on visitor use and enjoyment would be adverse and minor as the quantity of traffic could become too great for the bridge's carrying capacity, and another seismic event could compromise bridge integrity.

4.3.7 Park Operations and Safety

Under Alternative 1, the Rock Creek Bridge would be left in place and current operations for maintenance on the bridge would continue. There would be no changes in park operations as a result of implementing this alternative and, therefore, no new impacts would occur.

Long-term facility maintenance would be required for the existing bridge in this alternative. The level of effort required for maintenance of the existing bridge and roadway would be greater than that expected for the culvert and gabions of Alternative 2, the retrofit bridge of Alternative 3, or the new bridge of Alternative 4.

Although there would be no changes in current conditions at the bridge, those conditions would perpetuate several current sub-optimal challenges for ongoing park operations that include:

- Operational concerns that a seismic event could temporarily prohibit use of the bridge (Taylor, 2011);
- Poor sight distances on the Park Road in the vicinity of the bridge;
- Loaded trucks must have flag person at the bridge to restrict travel on the bridge due to the heavy loads; and
- Narrowness of the bridge limits the use of longer vehicles that even under the best conditions requires a 5 mile-per-hour speed and straddling the centerline; and

In addition, a deck width of 24 feet, combined with the curved design of the bridge, currently results in westbound semi and RV trailers off-tracking into the eastbound lane, creating a hazard for oncoming tour and shuttle bus traffic. This visitor safety issue would not be alleviated under this alternative.

Cumulative Impacts

Past, present, and future park operations entail concessions management, interpretation, communications, law enforcement/emergency services, information technology, administration, facilities maintenance, and research and resource management. The developed entrance area, the headquarters area, the paved road, and its associated developments require maintenance. Ongoing actions in the area include upgrades and rehabilitation to existing facilities, road, trails, and campgrounds to support current visitor use. Future park operations would address such activities as rehabilitation of utility infrastructure with new buried utility lines; upgrading the sewage treatment system; realignment of the dog kennel road and expansion of public parking; road improvements; and upgrades to existing facilities.

The cumulative impact on park operations from such actions would be moderate, and can be either beneficial or adverse. Alternative 1 would contribute minor, adverse cumulative impacts on park operations. Combined with known past, current and future projects and actions, there would be moderate, beneficial and adverse cumulative impacts on park operations.

Conclusion

There would be long-term moderate adverse impacts to park operations and safety from No Action due to continued seismic inadequacy of the bridge, poor vehicular sight distance, and poor lane width.

4.4 ALTERNATIVE 2: NEW CULVERT (NPS Preferred Alternative)

4.4.1 Fish and Wildlife and Habitat

Construction activities for installation of the new culvert and dismantling of the old bridge would cause temporary displacement and disturbance of resident wildlife for the five months duration of construction. It is estimated that a total of 2.3 acres of wildlife habitat would be disturbed. Direct wildlife and habitat impacts would occur as a result of habitat removal or alteration, potential mortality, and wildlife displacement from construction activities (increased human presence and noise impacts). Temporary construction noise, although perceptible by wildlife above the background noise, would likely cause only temporary displacement of small mammals and birds, which would return to the area after construction has ceased. Moose, which are common in the area, and occasional wolves and grizzly bears, would be temporarily displaced from adjacent habitats, but are likely to utilize similar abundant habitats in the vicinity. Small mammals would be displaced from the immediate area of vegetation clearing and disturbance during construction. Displaced animals would occupy adjacent areas of similar habitat, which is common throughout the vicinity. Resident and migrant bird species would also be displaced from the area of disturbance to some degree, although many would likely utilize similar habitats in adjacent areas. Some small mammals, such as snowshoe hare and Arctic ground squirrels, could potentially experience direct mortality during construction activities. Given the amount of impacted habitat involved and the low number of affected individuals, mortality impacts on wildlife would be few. No indirect effects are anticipated as a result of this alternative. Activities would be confined to the construction zones and no surrounding wildlife habitats would be physically disturbed. All disturbed areas in the project site would be revegetated after construction is complete.

A primary concern for this alternative is the effect of the new culvert on fish species in Rock Creek. To address this issue, half the diameter of the culvert would be buried to achieve fish passage under the road. There may be temporary blockage of fish passage during construction while the gabion tiers, MSE, a natural grade fill slope, and new culvert are being placed; however, over the long-term, fish would be able to move freely through the culvert. Adverse effects on water quality during construction, as described in Section 4.4.4, would likely be minimal, thus impacts on fish would be expected to be negligible to minor from any water quality degradation.

Another important concern is the potential construction impact during the bird breeding season, which could result in nest destruction or abandonment, direct mortality, or bird displacement. However, mitigation measures stipulate that bird habitat (vegetation) would not be removed during the nesting season, April through July 15, and active nests would be protected. Habitat degradation from exotic and invasive plant species is another wildlife concern. Mitigation measures would require park staff to survey the gravel source pit for exotic plant species prior to transportation to the project site and remove weeds annually at the proposed project area after gravel has been placed.

Increased traffic levels on the park road since the 1970s have not caused a significant change in abundance, distribution, or behavior of large mammals within the park (NPS, 2007a). Further, a reduction in adverse wildlife response to traffic has been documented over time, potentially

resulting from wildlife habituation to the road and consistent traffic levels. Wildlife habitat types found directly adjacent to the existing road are not considered crucial or sensitive due to widespread abundance and availability in the vicinity and throughout the park.

Cumulative Impacts

Past construction actions that have impacted wildlife include the Visitor Center and the Murie Science and Learning Center. Various transportation projects, including road and trail construction and maintenance, have also been conducted throughout the park. Wildlife impacts related to these activities have included harassment or displacement of individuals; the loss or degradation of habitat as a result of land use changes; introduction of invasive species; and higher levels of human presence and activity. Wildlife impacts generally increased in intensity during the short-term construction period; however, the extent of impacts has typically been limited to the immediate vicinity of human activities (e.g., habitat removal or alteration, species displacement or mortality, noise).

Reasonably foreseeable future actions that could contribute to cumulative impacts to wildlife and habitat include facility modification, removal, and construction, as well as road and trail construction and rehabilitation. These activities would result in similar impacts to wildlife, as discussed for past and present actions.

The cumulative impact on fish, wildlife, and habitat from such actions would be adverse and minor to moderate. Alternative 2 would contribute minor, adverse cumulative impacts on fish, wildlife, and habitat. Combined with known past, current and future projects and actions, there would be minor, adverse cumulative impacts on fish, wildlife, and habitat.

Conclusion

Impacts on fish, wildlife, and habitat from Alternative 2 would be adverse and minor due to temporary construction activities and increased human presence. Proposed bridge replacement would impact 2.3 acres of wildlife habitat.

4.4.2 Soils and Vegetation

Alternative 2 would disturb soils during bridge replacement. Site preparation would require construction of a temporary access road to the creek bed, grading, excavation, and filling, but some of this would occur in soil that was previously disturbed, consisting of road base material placed during the construction of the road. Some previously undisturbed soils may be disturbed by compaction from heavy equipment, soil removal, or soil erosion.

There would be alteration of soil function from construction activities. If any natural soil horizons exist, they would likely be lost during the earthwork. Construction would compact and destroy the structure and function of the organic soil horizon and mineral soils, potentially resulting in increased runoff and erosion. Best management practices would be implemented during construction to prevent or minimize soil erosion due to wind and rain. All disturbed areas would be reseeded to prevent further erosion.

Construction activities associated with Alternative 2 would necessitate removal of some plants located on the project site for construction equipment access, installation of the new culvert, and

removal of the old bridge. Trees, shrubs, and ground cover would be removed from the roadsides for site preparation. Repeated disturbance of vegetation (i.e., due to vehicle passes or foot traffic) during construction in areas where plants are not cleared would cause damage to plants and destruction of the vegetation mat. Impacts to surrounding vegetation would be minimized by plainly demarcating clearing limits.

Fugitive dust from construction activities would indirectly affect nearby vegetation. These impacts would be temporary, localized, and minimized through the use of dust abatement practices (i.e., watering the exposed soil) and plainly demarcating clearing limits. Activities would be confined to the construction zone and surrounding habitats would not be disturbed.

Exotic plants or seeds could be brought to the site with fill material or topsoil. New introductions could allow for exotic plants to become established and spread, especially in areas where the ground is disturbed by construction activities. Exotic plants currently growing in the area can also become established and spread on newly disturbed substrates. However, mitigation to ensure that imported material does not contain exotic plant material would be implemented. Park staff would both survey the fill source pit for exotics prior to transportation into the park and remove weeds annually after fill has been placed.

It is estimated that a total of 2.3 acres would be impacted by construction. In order to minimize soil erosion, inhibit the establishment and propagation of invasive exotic plant species, and reestablish the natural vegetation community, the excavated area would be reseeded with locally-gathered seeds. Due to active revegetation, not all of the impact area would have permanent loss of native vegetation cover.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to vegetation and soils in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has required clearing of vegetation in the vicinity of the proposed project area. The total acreage of existing disturbance to vegetation in the vicinity of the proposed project area is about 80 acres (NPS, 2007a). Impacts related to these activities include creation of social trails and trampling of vegetation, soil compaction, placement of fill in vegetated areas, potential introduction of invasive species, channelization of runoff from impervious surfaces, and subsequent erosion of soils.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts from these actions would include the direct loss of vegetation and soil disturbance and would be similar to those described under past actions.

The cumulative impact on soils and vegetation from such actions would be adverse and moderate. Alternative 2 would contribute minor, adverse cumulative impacts on soils and vegetation. Combined with known past, current and future projects and actions, there would be moderate, adverse cumulative impacts on soils and vegetation.

Conclusion
Alternative 2 would have moderate, adverse impacts on soils and vegetation in the project area. 2.3 acres would be impacted by soil disturbance and vegetation removal, creating long-term impacts to soils and vegetation in the project area.

4.4.3 Cultural Resources

The new pedestrian trail alignment south of the Park Road would require cutting into the slope on both sides of the residential road at the junction with the Park Road. This back slope is located at the edge of the Headquarters Historic District and was constructed in 1959 to match the new road alignment coming off the new bridge. New soil disturbance for the trail construction would affect the less than 0.1 acres in the Historic District. The new trail alignment would follow existing trail design for appearance, width; tread type, and vegetation clearing.

Cumulative Impacts
Since the Headquarters Historic District was added to the National Register of Historic Places in 1987, NPS activities have both enhanced and detracted from the character of the district. Historic building rehabilitation since completion of the 1997 *Entrance Area and Road Corridor DCP* has emphasized the reconstruction of the historic exterior appearance of the buildings. However, new non-contributing structures have been added to the district, such as the comfort station serving kennels visitors in 2005 and one residence in 1994. Formal and informal parking has expanded along road edges. The Headquarters Historic District received substantial beneficial effects from actions in the Headquarters Area Plan of 2007, such as rehabilitation of the cultural landscape returning it to an appearance more similar to what it had been during the district's historic period of significance between 1928 and 1941. Other actions, such as new parking areas and new non-contributing structures, had adverse effects on the District's character.

The cumulative impact on the Headquarters Historic District from such actions have been mixed, but with an overall moderate, beneficial influence since the completion of the 1997 DCP. Alternative 2 would contribute minor, adverse cumulative impacts on the historic district. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on cultural resources.

Conclusion
Alternative 2 would have an adverse, minor impact on cultural resources, specifically the Headquarters Historic District, from cutting into the back slope to build the new pedestrian trail.

4.4.4 Water Resources

The interior of the proposed culvert would be backfilled with 7 feet of gravel-cobble-boulder material matching the existing natural stream bed material. When the 18-foot diameter culvert is sloped 5.8 percent, the water depth at the inlet for the 2-year and 100-year peak discharges would be approximately 1.0 feet and 3.0 feet, respectively. Clearance between the culvert crown and predicted 100-year water surface elevation at the culvert inlet would be approximately 8 feet. The proposed culvert would not cause an increase in the 100-year flood water surface elevation.

Natural stream processes include floodplain connectivity, woody debris transport, sediment transport, channel migration, and ice conveyance. Except for where road embankment is placed in the valley (approximately 4,800 ft^2), the stream would continue exchanging overbank flow to existing floodplain areas. The rate and type of flow exchange would remain unchanged.

The woody debris is predominantly willow and spruce. Typical sizes available for woody debris recruitment and conveyance would be 4 to 8 inches trunk diameter and 10 to 15 feet trunk length. The existing active channel is 12 to 20 feet wide and 1 to 2 feet deep. The channel likely only recruits and conveys large woody debris during the extreme flood events (> 25-year) when flows are deep enough in the channel for floating the wood. The 18 feet wide culvert and 8 feet of clearance between the culvert crown and 100-year water surface would allow woody debris to be transported at nearly the same rate as the existing stream.

The existing stream has a gravel-cobble-boulder bed. It is sediment limited and generally degrading (stream profile lowering over time). The degradation is controlled by the relative large cobble-boulder bed material. The boulder material is likely derived from fluvial-glacial lag deposits. Localized depressions in the stream profile of 2 to 4 feet occur where water plunges over transverse boulder clusters creating a scour hole. These localized depressions may migrate upstream or downstream with extreme flood discharges. Placing the culvert invert 7 feet below the projected streambed surface, backfilling with gravel-cobble-boulder material matching the existing natural streambed material, and matching the culvert slope to the natural stream gradient would promote unrestrained sediment conveyance through the culvert. It also would accommodate the expected stream degradation and localized adjustments in the stream profile. The culvert would be of sufficient size to effectively convey sediment. Sediment deposited upstream of the inlet as a result of excessive backwater would not be expected. The stream currently develops mid-channel sediment deposits and braids around those and glacial-derived lag deposits, eroding channel banks and widening the channel. The process would continue with the proposed culvert. Sediment deposited inside the culvert by the bank erosion-channel widening processes would be transported out of the culvert with succeeding flood flows. Clearance of 11 feet between bed material surface and the culvert crown would accommodate the expected sediment deposition.

The valley floor is approximately 40 to 60 feet wide. It narrows to 40 feet beneath the existing bridge where the proposed culvert would be installed. Except for where road embankment is placed in the valley, the channel would be allowed to migrate freely across the valley floor. It is likely that the narrowness of the valley floor and the coarse stream bed and bank materials restrict channel migration where the culvert would be installed. Only a small reduction in channel migration potential would be expected.

The 18 foot wide culvert and 11 feet of clearance between the culvert crown and bed material surface provides ample passage and storage for ice. The Park would need to monitor the ice accumulation and take appropriate steps to ensure the culvert would be able to convey stream flows during early spring.

Disturbance caused by excavation, grading, and recontouring during construction would increase the likelihood of soil erosion and sediment delivery to channels and streams. The effects to local

water quality would be adverse and short- term. Best management practices to control erosion, sediment release, and floodplain function would be utilized during all construction activities to minimize these impacts. Identifying and staking the limits of clearing and grading, installing silt fences, establishing a controlled area for construction material and equipment, and preparing and implementing a sediment and erosion control plan would minimize the potential for adverse impacts to water quality, floodplains, and wetlands. All disturbed areas would be revegetated after construction to stabilize soils, reducing long-term erosion and sedimentation.

Fuel products (petroleum, oils, and lubricants) would be needed to operate some of the equipment used to construct the bridges and realign the road; therefore, there is some risk of an accidental fuel or chemical spill, which could adversely affect water quality if the spill were to enter Rock Creek. To prevent accidental fuel or chemical spills, no fuels would be stored at the construction site and no refueling would occur near the creek. The fueling operation would be closely monitored, and an emergency spill kit, containing absorption pads, absorbent material, a shovel or rake, and other cleanup items, would be readily available on-site in the event of an accidental spill.

Alternative 2 would require construction activities to take place within the creek channel and within the floodplain. These actions would result in potential contamination (i.e., fuel or oil spills) of riparian and riverine habitats and sedimentation, which could disturb organisms and raise water temperatures.

Rock Creek is a watercourse that flows year-around. Excessive turbidity and sediment load in the creek that could affect water quality during construction. It would be minimized or eliminated by constructing a sump upstream of the bridge that would collect water from the stream and pump it past the construction site where it would then discharge into the natural streambed (Taylor, 2011).

Protective measures would be taken, for water inlet conditions at the sump and outlet conditions at the discharge, that would minimize streambed erosion and associated sediment generation due to concentration of flows at the intake and discharge points of the temporary diversion system.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to water resources in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has resulted in impacts to approximately 4 acres of wetlands in and near the project area. Some development has occurred in floodplains and in types of wetlands that are common throughout the eastern area of the park; no sensitive areas have been impacted. Impacts related to these activities have included draining, filling, or sedimentation of wetlands, which has produced results such as direct wetland losses and/or changes to functions and values (i.e., floodwater attenuation and contaminant filtration). Careful location to avoid uncommon or unique wetlands, and adherence to BMPs to protect wetlands and floodplains during construction have served to mitigate potential impacts. The impacts of past and ongoing actions on wetlands and floodplains have lasted longer than 2 years.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts would be similar to those described for past and present actions and would be greatest during the construction phases for these projects. However, carefully locating project actions to avoid uncommon or unique wetlands and adherence to BMPs to protect wetlands during construction would serve to mitigate potential impacts.

The cumulative impact on water resources from such actions would be adverse and minor. Alternative 2 would contribute minor, adverse cumulative impacts on water resources. Combined with known past, current and future projects and actions, there would be minor, adverse cumulative impacts on water resources.

Conclusion
Impacts to water resources from the implementation of Alternative 2 would be moderate due to manipulation of the natural stream bed onto a large culvert.

4.4.5 Visual Quality

Under this alternative, visual components of the project area would be altered: the existing bridge would be removed and replaced with a culvert, and the existing pedestrian bridge would be removed and replaced with a new road crossing and an ADA-compliant pedestrian trail adjacent to the new road section. There would be short-term impacts to visual resources during the construction phase from vegetation clearing, presence of equipment, a temporary access route down to the creek, dust, and fresh cut banks. In the long-term, a new culvert would replace the existing bridge, giving the roadway a different appearance.

Although bridge replacement would change the current landscape of the site with the new culvert constructed below gabion tiers, mechanically stabilized earth, and a natural grade fill slope, once the trees grow back it may not be readily apparent to most drivers and some pedestrians on the roadway. When walking from the west (headquarters area), the project site and new culvert would be more visible as people approach because the view is not thickly vegetated.

The constructed surface of the slope under the roadway and above the culvert would be exposed gabion construction. It would be different from the visual character along the Park Road and would lack the rustic NPS architectural design that many visitors associate with NPS area infrastructure. (See Figure 2-2B, Gabion Construction, Example Appearance.)

The project site would be revegetated; however, it would appear uncharacteristically bare compared to the existing densely vegetated surrounding area for a period of years until the area could fill in.

Cumulative Impacts
Cumulative impacts to visual resources have been dominated by past and present actions that have altered the natural environment, landscapes, and viewpoints in the area. Several construction projects have shaped the landscape to serve visitors and staff, including the park road, hiking trails, construction of visitor and education centers, and construction and

maintenance of administrative facilities. The park facilities and roads have typically been designed to mimic the features of the natural landscape, incorporating natural colors and textures, and landscaping with native materials. Past and present actions have contributed persistent impacts to visual resources of the park. Reasonably foreseeable future actions include further improvements to administrative sites, involving actions such as brush removal under power lines and other routine maintenance activities.

The cumulative impact on visual quality from such actions would be adverse and minor to moderate. Alternative 2 would contribute minor, adverse cumulative impacts on visual quality. Combined with known past, current and future projects and actions, there would be minor, adverse cumulative impacts on visual quality.

Conclusion

Alternative 2 would have moderate, adverse impacts on visual quality due to the exposed gabion structure design features. In the long-term, there would be adverse impacts due to visual changes in road configuration and relocation of the pedestrian crossing and trail.

4.4.6 Visitor Use and Enjoyment

Under this alternative, the existing bridge would be removed and replaced with a culvert. The existing pedestrian bridge would be removed and replaced with an ADA compliant pedestrian crossing/trail. Two-way traffic can be maintained during most of the construction, although there could be some traffic delays, and the speed limit would be reduced. Possible traffic delays would have adverse impacts on the visitor experience for five months during one peak visitor season as people would be inconvenienced by the extra time spent in traffic. However, the altered traffic patterns would be temporary during construction, and visitors would have two-lane traffic for most of the project duration.

The sight of construction activities and the clearing of trees and vegetation from the embankment slope would reduce the sense of naturalness in the area, and thus may detract from visitor enjoyment. However, the site would be revegetated once construction is completed and regain as natural a look as possible given the roadside setting.

Noise from traffic and construction would occur during the construction period from the use of heavy equipment. These impacts would be noticeable in the area where construction activities are occurring. Visitors driving by in their vehicles would only be subject to the noise for a short time. Visitors recreating nearby would hear the noise throughout their picnic, hike, or whatever activity they engage in. However, these noises would be less noticeable as the distance increases from the construction site as noise decreases with distance from the source.

In the future, park visitors would be safer traveling this section of road because there would be no compromise of bridge integrity from another seismic event. Although there would be no improvement to vehicular sight distance, there would also be no need to limit traffic due to bridge capacity issues.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to visitor use, including: road resurfacing projects to improve transportation corridors for summer visitation, a railroad depot that provides access to the park from other areas of the state, several services geared towards park visitors to enhance their experience, and many recreation trails and facilities. Cumulative impacts to visitor use have included redistribution of accommodation services to surrounding communities and greater convenience and access to visitor information from new facilities in the park entrance area (e.g., Visitor Center, trails, and campgrounds). Recreation facilities that have contributed to cumulative impacts on visitor use in the area include the sled dog kennels at park headquarters, expansion of Riley Creek Campground, and rerouting or rehabilitating area trails. Reasonably foreseeable future actions that could contribute to cumulative impacts to visitor use are road and trail improvements.

The cumulative impact on visitor use from such actions would be beneficial and moderate. Alternative 2 would contribute minor, adverse and minor, beneficial cumulative impacts on visitor use. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on visitor use.

Conclusion
Alternative 2 would have minor, adverse impacts on visitor use and enjoyment during construction due to noise and traffic delays. In the long-term, there would be minor, beneficial effects as many of the safety and capacity concerns of the current bridge would be alleviated.

4.4.7 Park Operations and Safety

Alternative 2 uses a short-term strategy to maintain one lane of traffic flow during construction. The effect of this strategy is that traffic may continue during the construction period through this critical passage to the remainder of the park, although at a reduced speed and traffic volume. Even at reduced speed, it is possible that there would temporarily be a slightly elevated safety risk, particularly for construction workers in the streambed below.

In the long term, this alternative would allow heavier and longer vehicles to use Park Road over the new culvert, which would have a beneficial effect on park operations. Sight distance would not be improved over the current situation because the existing alignment of the road was chosen for the new creek crossing. Because of the road improvements, increased speed would be possible at the crossing, making it more difficult to enforce the speed limit at that point.

Long-term facility maintenance would be required for the culvert and gabions installed for this alternative. The level of effort required for maintenance is less than what would be required for the new bridge of Alternative 4, the retrofit bridge of Alternative 3, or the existing bridge of Alternative 1.

Because there would be greater seismic resilience with this alternative, park operations would benefit from greater assurance that a bridge failure would not be as likely to occur, continued access to the major portion of the park would be more certain, and contingency operations in the event of bridge failure would not be as likely to be necessary.

Due to the reduced cost of maintenance for this alternative in comparison to the other three alternatives, finite maintenance resources would be more available to attend to other maintenance needs in the park.

Cumulative Impacts

Past, present, and future park operations entail concessions management, interpretation, communications, law enforcement/emergency services, information technology, administration, facilities maintenance, and research and resource management. The developed entrance area, the headquarters area, the paved road, and its associated developments require maintenance. Ongoing actions in the area include upgrades and rehabilitation to existing facilities, road, trails, and campgrounds to support current visitor use. Future park operations would address such activities as rehabilitation of utility infrastructure with new buried utility lines; upgrading the sewage treatment system; realignment of the dog kennel road and expansion of public parking; road improvements; and upgrades to existing facilities.

The cumulative impact on park operations from such actions would be moderate, and can be either beneficial or adverse. Alternative 2 would contribute minor, beneficial cumulative impacts on park operations. Combined with known past, current and future projects and actions, there would be moderate, beneficial and adverse cumulative impacts on park operations.

Conclusion

The effects of implementing Alternative 2 would be moderate beneficial for park operations as it would result in improved access and traffic flow to all and would also provide greater assurance of continued operations without interruptions that may have otherwise been caused by unexpected failure of the existing bridge. With the short-term exception of reduced traffic volume and increased travel time at the new Rock Creek crossing during construction, this would most likely result in greater efficiency in operations as a result of the project.

4.5 ALTERNATIVE 3: RETROFIT BRIDGE, EXISTING ALIGNMENT

4.4.1 Fish and Wildlife and Habitat

Impacts on wildlife and habitat for Alternative 3 would be similar to those described in Alternative 2, with the following differences: a total of 1.6 acres of wildlife habitat would be disturbed, and wildlife disturbance would occur over eight months in two seasons. Fish passage would not be an issue as the creek would continue to flow freely under the retrofitted bridge, however equipment and temporary supports under the bridge would be in the water.

Cumulative Impacts

Past construction actions that have impacted wildlife include the Visitor Center and the Murie Science and Learning Center. Various transportation projects, including road and trail construction and maintenance, have also been conducted throughout the park. Wildlife impacts related to these activities have included harassment or displacement of individuals; the loss or degradation of habitat as a result of land use changes; introduction of invasive species; and higher levels of human presence and activity. Wildlife impacts generally increased in intensity during the short-term construction period; however, the extent of impacts has typically been

limited to the immediate vicinity of human activities (e.g., habitat removal or alteration, species displacement or mortality, noise).

Reasonably foreseeable future actions that could contribute to cumulative impacts to wildlife and habitat include facility modification, removal, and construction, as well as road and trail construction and rehabilitation. These activities would result in similar impacts to wildlife, as discussed for past and present actions.

The cumulative impact on fish, wildlife, and habitat from such actions would be adverse and moderate. Alternative 3 would contribute minor, adverse cumulative impacts on fish, wildlife, and habitat. Combined with known past, current and future projects and actions, there would be minor to moderate, adverse cumulative impacts on fish, wildlife, and habitat.

Conclusion

Impacts on fish, wildlife, and habitat from Alternative 3 would be adverse and minor due to temporary construction activities and increased human presence. Retrofitting the bridge would impact 1.6 acres of wildlife habitat.

4.5.2 Soils and Vegetation

Impacts on soils and vegetation for Alternative 3 would be similar to those described in Alternative 2, with the difference that 1.6 acres would be impacted by construction activities.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to vegetation and soils in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has required clearing of vegetation in the vicinity of the proposed project area. The total acreage of existing disturbance to vegetation in the vicinity of the proposed project area is about 80 acres (NPS, 2007a). Impacts related to these activities include creation of social trails and trampling of vegetation, soil compaction, placement of fill in vegetated areas, potential introduction of invasive species, channelization of runoff from impervious surfaces, and subsequent erosion of soils.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts from these actions would include the direct loss of vegetation and soil disturbance and would be similar to those described under past actions.

The cumulative impact on soils and vegetation from such actions would be adverse and moderate. Alternative 3 would contribute minor, adverse cumulative impacts on soils and vegetation. Combined with known past, current and future projects and actions, there would be moderate, adverse cumulative impacts on soils and vegetation.

Conclusion

Alternative 3 would have moderate, adverse impacts on soils and vegetation in the project area. 1.6 acres would be impacted by soil disturbance and vegetation removal, creating long-term impacts to soils and vegetation in the project area.

4.5.3 Cultural Resources

This alternative would require some grading on the slope on both sides of the residential road at the junction with the Park Road within the Headquarters Historic District. New soil disturbance for the trail construction would affect the less than 0.1 acres in the Historic District. The new trail alignment would follow existing trail design for appearance, width; tread type, and vegetation clearing.

There would be impacts to the Park Road, which is eligible for the National Register. The Rock Creek Bridge would be rehabilitated and so its historic character would change. The bridge lanes would be widened and the guard rails and curbing would be replaced.

Cumulative Impacts

Since the Headquarters Historic District was added to the National Register of Historic Places in 1987, NPS activities have both enhanced and detracted from the character of the district. Historic building rehabilitation since completion of the 1997 *Entrance Area and Road Corridor DCP* has emphasized the reconstruction of the historic exterior appearance of the buildings. However, new non-contributing structures have been added to the district, such as the comfort station serving kennels visitors in 2005 and one residence in 1994. Formal and informal parking has expanded along road edges. The Headquarters Historic District received substantial beneficial effects from actions in the Headquarters Area Plan of 2007, such as rehabilitation of the cultural landscape returning it to an appearance more similar to what it had been during the district's historic period of significance between 1928 and 1941. Other actions, such as new parking areas and new non-contributing structures, had adverse effects on the District's character.

The cumulative impact on the Headquarters Historic District from such actions have been mixed, but with an overall moderate, beneficial influence since the completion of the 1997 DCP. Alternative 3 would not contribute any cumulative impacts on the historic district. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on cultural resources.

Conclusion

Alternative 3 would have minor impacts on cultural resources from widening and retrofitting the 1959 bridge.

4.5.4 Water Resources

Impacts on water resources for Alternative 3 would be similar to those described in Alternative 2, with the difference that less wetland area (5,000 sf) 0.2 acres would be impacted. Streambed disturbance would be temporary, during the construction period.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to water resources in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has resulted in impacts to approximately 4 acres of wetlands in and near the project area. Some development has occurred in floodplains and in types of wetlands that are common throughout the eastern area of the park; no sensitive areas have been impacted. Impacts related to these activities have included draining, filling, or sedimentation of wetlands, which has produced results such as direct wetland losses and/or changes to functions and values (i.e., floodwater attenuation and contaminant filtration). Careful location to avoid uncommon or unique wetlands, and adherence to BMPs to protect wetlands and floodplains during construction have served to mitigate potential impacts. The impacts of past and ongoing actions on wetlands and floodplains have lasted longer than 2 years.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts would be similar to those described for past and present actions and would be greatest during the construction phases for these projects. However, carefully locating project actions to avoid uncommon or unique wetlands and adherence to BMPs to protect wetlands during construction would serve to mitigate potential impacts.

The cumulative impact on water resources from such actions would be adverse and minor. Alternative 2 would contribute minor cumulative impacts on water resources. Combined with known past, current and future projects and actions, there would be minor, adverse cumulative impacts on water resources.

Conclusion
A conclusion of the impacts to water resources from the implementation of Alternative 3 would be minor with 0.2 acres of wetlands temporarily disturbed during construction.

4.5.5 Visual Quality

Under this alternative, visual components of the project area would be altered over the long-term as some tall trees would be removed from the temporary construction access road, the existing bridge would be retrofitted, widened, but remain in place, and the existing pedestrian crossing would not change. The retrofitted bridge would look different than the existing bridge. As in Alternative 2, there would be short-term impacts to visual resources during the construction phase from vegetation clearing, presence of equipment, a temporary access route down to the creek, and dust.

The project site would be revegetated; however, it would appear uncharacteristically bare compared to the existing densely vegetated surrounding area for a period of years until the area could fill in. Revegetation of the site would allow the area to eventually look similar to current conditions.

Cumulative Impacts
Cumulative impacts to visual resources have been dominated by past and present actions that have altered the natural environment, landscapes, and viewpoints in the area. Several

construction projects have shaped the landscape to serve visitors and staff, including the park road, hiking trails, construction of visitor and education centers, and construction and maintenance of administrative facilities. The park facilities and roads have typically been designed to mimic the features of the natural landscape, incorporating natural colors and textures, and landscaping with native materials. Past and present actions have contributed persistent impacts to visual resources of the park. Reasonably foreseeable future actions include further improvements to administrative sites, involving actions such as brush removal under power lines and other routine maintenance activities.

The cumulative impact on visual quality from such actions would be adverse and moderate. Alternative 3 would contribute minor, adverse cumulative impacts on visual quality. Combined with known past, current and future projects and actions, there would be moderate, adverse cumulative impacts on visual quality.

Conclusion
Alternative 3 would have minor, adverse impacts on visual quality during construction. In the long-term, there would be minor, adverse impacts.

4.5.6 Visitor Use and Enjoyment

Alternative 3 would retrofit the bridge to meet seismic standards, widen it, and improve it to carry larger loads. One-lane traffic access over the bridge would be maintained throughout the entire construction operation. The existing pedestrian bridge would continue to be used. Impacts on visitor use would be similar to those described in Alternative 2, with the following differences:

Impacts on visitor use and enjoyment, such as short-term traffic delays, sights of construction, and noise, would have adverse effects for eight months over two peak visitor seasons.

Although the project would span one winter, there would be no impacts on winter visitor use as operations would cease and the road would be fully accessible to visitors.

Cumulative Impacts
Past and present actions have contributed to cumulative impacts to visitor use, including: road resurfacing projects to improve transportation corridors for summer visitation, a railroad depot that provides access to the park from other areas of the state, several services geared towards park visitors to enhance their experience, and many recreation trails and facilities. Cumulative impacts to visitor use have included redistribution of accommodation services to surrounding communities and greater convenience and access to visitor information from new facilities in the park entrance area (e.g., Visitor Center, trails, and campgrounds). Recreation facilities that have contributed to cumulative impacts on visitor use in the area include the sled dog kennels at park headquarters, expansion of Riley Creek Campground, and rerouting or rehabilitating area trails. Reasonably foreseeable future actions that could contribute to cumulative impacts to visitor use are road and trail improvements.

The cumulative impact on visitor use from such actions would be beneficial and moderate. Alternative 3 would contribute negligible, adverse and minor, beneficial cumulative impacts on

visitor use. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on visitor use.

Conclusion
Alternative 3 would have minor, adverse impacts on visitor use and enjoyment during construction due to noise and traffic delays. In the long-term, there would be minor, beneficial effects as many of the safety and capacity concerns of the current bridge would be alleviated.

4.5.7 Park Operations and Safety

The impacts of Alternative 3 would be similar to those described for Alternative 2, and uses a short-term strategy to maintain one lane of traffic flow during construction similar to that described for Alternative 2.

Long-term facility maintenance would be required for the retrofit bridge installed for this alternative. The level of effort required for maintenance is more than what is required for Alternatives 2 and 4, but less than what is required for the existing bridge in Alternative 1.

Cumulative Impacts
Past, present, and future park operations entail concessions management, interpretation, communications, law enforcement/emergency services, information technology, administration, facilities maintenance, and research and resource management. The developed entrance area, the headquarters area, the paved road, and its associated developments require maintenance. Ongoing actions in the area include upgrades and rehabilitation to existing facilities, road, trails, and campgrounds to support current visitor use. Future park operations would address such activities as rehabilitation of utility infrastructure with new buried utility lines; upgrading the sewage treatment system; realignment of the dog kennel road and expansion of public parking; road improvements; and upgrades to existing facilities.

The cumulative impact on park operations from such actions would be moderate, and can be either beneficial or adverse. Alternative 3 would contribute minor, beneficial cumulative impacts on park operations. Combined with known past, current and future projects and actions, there would be moderate, beneficial and adverse cumulative impacts on park operations.

Conclusion
The effects of implementing Alternative 3 would be moderate and beneficial for park operations and safety due to improved access and traffic flow to all facilities and improvements and greater assurance of continued operations without interruptions that may have otherwise been caused by an unexpected failure of the existing bridge. With the short-term exception of reduced traffic volume and increased travel time at the new Rock Creek crossing during construction, this would most likely result in greater efficiency in operations as a result of the project.

4.6 ALTERNATIVE 4: NEW BRIDGE, DOWNSTREAM ALIGNMENT

4.6.1 Fish and Wildlife and Habitat

Impacts on wildlife and habitat for Alternative 4 would be similar to those described in Alternative 2, with the following differences: a total of 2.3 acres of wildlife habitat would be

disturbed, wildlife disturbance would occur over ten months in two seasons, and fish passage would not be an issue as the creek would continue to flow freely under the new bridge.

Cumulative Impacts

Past construction actions that have impacted wildlife include the Visitor Center and the Murie Science and Learning Center. Various transportation projects, including road and trail construction and maintenance, have also been conducted throughout the park. Wildlife impacts related to these activities have included harassment or displacement of individuals; the loss or degradation of habitat as a result of land use changes; introduction of invasive species; and higher levels of human presence and activity. Wildlife impacts generally increased in intensity during the short-term construction period; however, the extent of impacts has typically been limited to the immediate vicinity of human activities (e.g., habitat removal or alteration, species displacement or mortality, noise).

Reasonably foreseeable future actions that could contribute to cumulative impacts to wildlife and habitat include facility modification, removal, and construction, as well as road and trail construction and rehabilitation. These activities would result in similar impacts to wildlife, as discussed for past and present actions.

The cumulative impact on fish, wildlife, and habitat from such actions would be adverse and moderate. Alternative 4 would contribute minor, adverse cumulative impacts on fish, wildlife, and habitat. Combined with known past, current and future projects and actions, there would be minor to moderate, adverse cumulative impacts on fish, wildlife, and habitat.

Conclusion

Impacts on fish, wildlife, and habitat from Alternative 4 would be adverse and minor due to temporary construction activities and increased human presence. Constructing a new bridge would impact 2.3 acres of wildlife habitat.

4.6.2 Soils and Vegetation

Impacts on soils and vegetation for Alternative 4 would be similar to those described in Alternative 2, with a similar number of acres, 2.3 acres, impacted by construction activities.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to vegetation and soils in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has required clearing of vegetation in the vicinity of the proposed project area. The total acreage of existing disturbance to vegetation in the vicinity of the proposed project area is about 80 acres (NPS, 2007a). Impacts related to these activities include creation of social trails and trampling of vegetation, soil compaction, placement of fill in vegetated areas, potential introduction of invasive species, channelization of runoff from impervious surfaces, and subsequent erosion of soils.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts from these

actions would include the direct loss of vegetation and soil disturbance and would be similar to those described under past actions.

The cumulative impact on soils and vegetation from such actions would be adverse and moderate. Alternative 4 would contribute minor, adverse cumulative impacts on soils and vegetation. Combined with known past, current and future projects and actions, there would be moderate, adverse cumulative impacts on soils and vegetation.

Conclusion
Alternative 4 would have moderate adverse impacts on soils and vegetation in the project area. About 2.3 acres would be impacted by soil disturbance and vegetation removal, creating long-term impacts to soils and vegetation in the project area.

4.6.3 Cultural Resources

The edge of the Headquarters Historic District would be affected by the new pedestrian trail. The Park Road is eligible for the National Register. The existing 1959 bridge is part of the Park Road. Under this alternative, the 1959 bridge would be removed and replaced with a new bridge downstream, so this would be an impact to the historic Park Road.

Cumulative Impacts
Since the Headquarters Historic District was added to the National Register of Historic Places in 1987, NPS activities have both enhanced and detracted from the character of the district. Historic building rehabilitation since completion of the 1997 *Entrance Area and Road Corridor DCP* has emphasized the reconstruction of the historic exterior appearance of the buildings. However, new non-contributing structures have been added to the district, such as the comfort station serving kennels visitors in 2005 and one residence in 1994. Formal and informal parking has expanded along road edges. The Headquarters Historic District received substantial beneficial effects from actions in the Headquarters Area Plan of 2007, such as rehabilitation of the cultural landscape returning it to an appearance more similar to what it had been during the district's historic period of significance between 1928 and 1941. Other actions, such as new parking areas and new non-contributing structures, had adverse effects on the District's character.

The cumulative impact on the Headquarters Historic District from such actions have been mixed, but with an overall moderate, beneficial influence since the completion of the 1997 DCP. Alternative 4 would not contribute any cumulative impacts on the historic district. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on cultural resources.

Conclusion
Alternative 4 would have a minor impact on cultural resources at the Headquarters Historic District and the Park Road.

4.6.4 Water Resources

Impacts on water resources for Alternative 4 would be similar to those described in Alternative 2, with the difference that more wetland area (14,600 sf) would be impacted by construction activities.

Cumulative Impacts

Past and present actions have contributed to cumulative impacts to water resources in the project area. Development of the entrance area, headquarters area, park road, as well as facility upgrades has resulted in impacts to approximately 4 acres of wetlands in and near the project area. Some development has occurred in floodplains and in types of wetlands that are common throughout the eastern area of the park; no sensitive areas have been impacted. Impacts related to these activities have included draining, filling, or sedimentation of wetlands, which has produced results such as direct wetland losses and/or changes to functions and values (i.e., floodwater attenuation and contaminant filtration). Careful location to avoid uncommon or unique wetlands, and adherence to BMPs to protect wetlands and floodplains during construction have served to mitigate potential impacts. The impacts of past and ongoing actions on wetlands and floodplains have lasted longer than 2 years.

Reasonably foreseeable future actions that could occur near the project area include rehabilitation of utility infrastructure with new buried utility lines, upgrading the sewage treatment system, expansion of public parking, and road improvements. Impacts would be similar to those described for past and present actions and would be greatest during the construction phases for these projects. However, carefully locating project actions to avoid uncommon or unique wetlands and adherence to BMPs to protect wetlands during construction would serve to mitigate potential impacts.

The cumulative impact on water resources from such actions would be adverse and minor. Alternative 4 would contribute minor, adverse cumulative impacts on water resources. Combined with known past, current and future projects and actions, there would be minor, adverse cumulative impacts on water resources.

Conclusion

A conclusion of the impacts to water resources from the implementation of Alternative 4 would be minor with 0.2 acres of wetlands temporarily disturbed during construciton.

4.6.5 Visual Quality

In Alternative 4, a new bridge would be constructed on the downstream side and adjacent to the existing bridge; the existing pedestrian crossing would not change. As in Alternatives 2 and 3, there would be short-term impacts to visual resources during the construction phase from vegetation clearing, presence of equipment, a temporary access route down to the creek, dust, and fresh cut banks. In the long-term, a new bridge would replace the existing bridge on a different alignment, giving it a different appearance.

Although the bridge replacement would change the current visual quality of the site with a new bridge in a slightly different location, it would still represent the same visual element in the area.

However, the road alignment would need to change as well. Once construction is completed and the site recovers, drivers would not likely notice a change in that section of road.

More vegetation would be removed in this alternative than in the other alternatives as the new bridge would be constructed in a shifted location, and would have an incrementally greater impact on visual quality. The project site would be revegetated; however, it would appear uncharacteristically bare compared to the existing densely vegetated surrounding area for a period of time until the area could fill in.

Cumulative Impacts

Cumulative impacts to visual resources have been dominated by past and present actions that have altered the natural environment, landscapes, and viewpoints in the area. Several construction projects have shaped the landscape to serve visitors and staff, including the park road, hiking trails, construction of visitor and education centers, and construction and maintenance of administrative facilities. The park facilities and roads have typically been designed to mimic the features of the natural landscape, incorporating natural colors and textures, and landscaping with native materials. Past and present actions have contributed persistent impacts to visual resources of the park. Reasonably foreseeable future actions include further improvements to administrative sites, involving actions such as brush removal under power lines and other routine maintenance activities.

The cumulative impact on visual quality from such actions would be adverse moderate. Alternative 4 would contribute minor, adverse cumulative impacts on visual quality. Combined with known past, current and future projects and actions, there would be minor to moderate, adverse cumulative impacts on visual quality.

Conclusion

Alternative 4 would have minor adverse impacts on visual quality during construction. In the long-term, there would be minor adverse impacts as a new bridge would replace the existing bridge in a downstream alignment.

4.6.6 Visitor Use and Enjoyment

Under Alternative 4, a replacement bridge would be constructed adjacent to the existing bridge on a new alignment, prior to removing the existing bridge. Two-way traffic would be maintained across the existing bridge during construction. The existing pedestrian bridge would continue to be used. Impacts on visitor use would be similar to those described in Alternative 2, with the following differences:

Impacts on visitor use and enjoyment, such as sights of construction and noise, would have adverse effects for ten months over two peak visitor seasons. It is expected that there would not be any traffic delays as the existing bride would be in use until the new bridge is completed.

Although the project would span one winter, there would be no impacts on visitor use as operations would cease and the road would be fully accessible to visitors.

This alternative would improve vehicular sight distance.

Cumulative Impacts
Past and present actions have contributed to cumulative impacts to visitor use, including: road resurfacing projects to improve transportation corridors for summer visitation, a railroad depot that provides access to the park from other areas of the state, several services geared towards park visitors to enhance their experience, and many recreation trails and facilities. Cumulative impacts to visitor use have included redistribution of accommodation services to surrounding communities and greater convenience and access to visitor information from new facilities in the park entrance area (e.g., Visitor Center, trails, and campgrounds). Recreation facilities that have contributed to cumulative impacts on visitor use in the area include the sled dog kennels at park headquarters, expansion of Riley Creek Campground, and rerouting or rehabilitating area trails. Reasonably foreseeable future actions that could contribute to cumulative impacts to visitor use are road and trail improvements,

The cumulative impact on visitor use from such actions would be beneficial and moderate. Alternative 4 would contribute negligible, adverse and minor, beneficial cumulative impacts on visitor use. Combined with known past, current and future projects and actions, there would be moderate, beneficial cumulative impacts on visitor use.

Conclusion
Alternative 4 would have minor, adverse impacts on visitor use and enjoyment during construction due to noise and sights of construction. In the long-term, there would be minor, beneficial effects as the capacity concerns of the current bridge would be alleviated, including improved vehicular sight distance.

4.6.7 Park Operations and Safety

The impacts of Alternative 4 would be similar to those described for Alternative 2, and uses a short-term strategy to maintain one lane of traffic flow during construction similar to that described for Alternative 2.

Long-term facility maintenance would be required for the new bridge installed for this alternative. The level of effort required for maintenance would be less than what is required for the retrofit bridge of Alternative 3 or the existing bridge of Alternative 1, but more than what is required for the culvert and gabions of Alternative 2.

Cumulative Impacts
Past, present, and future park operations entail concessions management, interpretation, communications, law enforcement/emergency services, information technology, administration, facilities maintenance, and research and resource management. The developed entrance area, the headquarters area, the paved road, and its associated developments require maintenance. Ongoing actions in the area include upgrades and rehabilitation to existing facilities, road, trails, and campgrounds to support current visitor use. Future park operations would address such activities as rehabilitation of utility infrastructure with new buried utility lines; upgrading the sewage treatment system; realignment of the dog kennel road and expansion of public parking; road improvements; and upgrades to existing facilities.

The cumulative impact on park operations from such actions would be moderate, and can be either beneficial or adverse. Alternative 4 would contribute minor, beneficial cumulative impacts on park operations. Combined with known past, current and future projects and actions, there would be moderate, beneficial and adverse cumulative impacts on park operations.

Conclusion

The effects of implementing Alternative 4 would be moderate beneficial for park operations and safety due to improved seismic stability, vehicular access and traffic flow. There would be greater assurance of continued operations without interruptions that may have otherwise been caused by an unexpected failure of the existing bridge. With the short-term exception of reduced traffic volume and increased travel time at the new Rock Creek crossing during construction, this would most likely result in greater safety efficiency in operations as a result of the project.

5.0 CONSULTATION AND COORDINATION

5.1 PUBLIC INVOLVEMENT

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

A press release announcing the public comment period and availability of the environmental assessment was issued by the National Park Service.

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APPENDIX A: 810 SUBSISTENCE EVALUATION

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

I. INTRODUCTION

This section was prepared to comply with Title VIII, Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA). It summarizes the evaluation of potential restrictions to subsistence activities that could result from the replacement of the Rock Creek Bridge in the headquarters area of Denali National Park and Preserve.

II. THE EVALUATION PROCESS

Section 810(a) of ANILCA states:

> "In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands . . . the head of the federal agency . . . over such lands . . . shall evaluate the effect of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be effected until the head of such Federal agency -
>
> "(1) gives notice to the appropriate State agency and the appropriate local committees and regional councils established pursuant to section 805;
>
> "(2) gives notice of, and holds, a hearing in the vicinity of the area involved; and
>
> "(3) determines that (A) such a significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of the public lands, (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition, and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions."

ANILCA created new units and additions to existing units of the National Park System in Alaska. Denali National Park and Preserve was created by ANILCA Section 202(3)(a):

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

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

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

> ". . . to preserve unrivaled scenic and geological values associated with natural landscapes; to provide for the maintenance of sound populations of, and habitat for, wildlife species of inestimable value to the citizens of Alaska and the Nation, including those species dependent on vast relatively undeveloped areas; to preserve in their natural state extensive unaltered arctic tundra, boreal forest, and coastal rainforest ecosystems to protect the resources related to subsistence needs; to protect and preserve historic and archeological sites, rivers, and lands, and to preserve wilderness resource values and related recreational opportunities including but not limited to hiking, canoeing, fishing, and sport hunting, within large arctic and subarctic wildlands and on free-flowing rivers; and to maintain opportunities for scientific research and undisturbed ecosystems.
>
> ". . . consistent with management of fish and wildlife in accordance with recognized scientific principles and the purposes for which each conservation system unit is established, designated, or expanded by or pursuant to this Act, to provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so."

The potential for significant restriction must be evaluated for the proposed action's effect upon ". . . subsistence uses and needs, the availability of other lands for the purposes sought to be achieved and other alternatives which would reduce or eliminate the use. . . ." (Section 810(a))

III. PROPOSED ACTION ON FEDERAL LANDS

Alternatives 1, 2, 3 and 4 are described in detail in the environmental assessment. Customary and traditional subsistence use on NPS lands will continue as authorized by federal law under all alternatives. Federal regulations implement a subsistence priority for rural residents of Alaska under Title VIII of ANILCA.

The NPS proposes to replace or rehabilitate the Rock Creek Bridge on the Denali Park Road between C-Camp and Park Headquarters. The site is in the former Mount McKinley National Park wherein subsistence activities are not allowed.

IV. AFFECTED ENVIRONMENT

Subsistence uses within Denali National Park and Preserve are permitted in accordance with Titles II and VIII of ANILCA. Section 202(3)(a) of ANILCA allows local residents to engage in subsistence uses in the ANILCA additions to the park where such uses are traditional in accordance with the provisions in Title VIII. Lands within former Mount McKinley National Park are closed to subsistence uses.

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

The NPS realizes that Denali National Park and Preserve may be especially important to certain communities and households in the area for subsistence purposes. The resident zone communities of Minchumina (population 22) and Telida (population 11) use park and preserve lands for trapping and occasional moose hunting along area rivers. Nikolai (population 122) is a growing community and has used park resources in the past. Cantwell (population 147) is the largest resident zone community for Denali National Park and Preserve, and local residents hunt moose and caribou, trap, and harvest firewood and other subsistence resources in the new park area.

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

The NPS recognizes that patterns of subsistence use vary from time to time and from place to place depending on the availability of wildlife and other renewable natural resources. A subsistence harvest in any given year many vary considerably from previous years because of such factors as weather, migration patterns and natural population cycles. However, the pattern is assumed to be generally applicable to harvests in recent years with variations of reasonable magnitude.

V. SUBSISTENCE USES AND NEEDS EVALUATION

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

The evaluation criteria are:

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

The potential to reduce populations:

Provisions of ANILCA and Federal and State regulations provide protection for fish and wildlife populations within Denali National Park and Preserve.

Replacement of the Rock Creek Bridge near park headquarters would have a minor impact on wildlife habitat and populations due to vegetation removal on 2.3 acres and construction-related disturbance.

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

Restriction of Access:

All rights of access for subsistence harvests on NPS lands are granted by Section 811 of ANILCA. Denali National Park and Preserve is managed according to legislative mandates, NPS management policies and the park's General Management Plan.

> *Alternative 1 (No Action), the status quo would not significantly limit or restrict access to subsistence resources in Denali National Park and Preserve.*
>
> *Alternative 2 (Replace Bridge with a Large Culvert: Proposed Action), will not limit or restrict the access of subsistence users to natural resources within the ANILCA additions of Denali National Park or Denali National Preserve. Federal and State regulations assure the continued viability of fish and wildlife populations.*
>
> *Alternative 3 (Retrofit Bridge), will not limit or restrict the access of subsistence users to natural resources within the ANILCA additions of Denali National Park or Denali National Preserve. Federal and State regulations assure the continued viability of fish and wildlife populations.*
>
> *Alternative 4 (New Bridge Downstream), will not limit or restrict the access of subsistence users to natural resources within the ANILCA additions of Denali National Park or Denali National Preserve. Federal and State regulations assure the continued viability of fish and wildlife populations.*

Increase in Competition:

Alternative 1 (No-Action Alternative), maintaining the status quo would not result in increased competition for fish, wildlife or other resources that would significantly impact subsistence users in Denali National Park and Preserve.

Alternative 2, 3 and 4 (Including the Proposed Action). The proposed action and other action alternatives would not result in increased competition for fish, wildlife or other resources that would significantly impact subsistence users in Denali National Park and Preserve. Federal and State regulations assure the continued viability of particular fish or wildlife populations. If it is necessary to restrict the taking of fish and wildlife to assure the continued viability of a fish or wildlife population or the continuation of subsistence uses of such population, subsistence uses are given a priority over other consumptive uses.

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

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

VI. AVAILABILITY OF OTHER LANDS

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

VII. ALTERNATIVES CONSIDERED

The alternatives considered for this project were limited to the lands at the existing crossing of Rock Creek by the Denali Park Road. The alternatives are: 1) continue the existing conditions (No Action) which includes continuing to use the 1959 bridge that had width and seismic deficiencies; 2) replacing the existing bridge with a half-buried 18 foot diameter culvert and fill section; 3) retrofitting the existing bridge to increase the width and improve the seismic stability; and 4) construct a new road bridge immediately downstream of the existing bridge and then remove the existing bridge.

VIII. FINDINGS

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

APPENDIX B: STATEMENT OF FINDINGS

STATEMENT OF FINDINGS FOR EXECUTIVE ORDER 11990 (PROTECTION OF WETLANDS) STATEMENT OF FINDINGS FOR EXECUTIVE ORDER 11988 (FLOODPLAIN MANAGEMENT)

REPLACE ROCK CREEK BRIDGE
DENALI NATIONAL PARK AND PRESERVE, ALASKA

March 2012

Recommended:

_____

Superintendent, Denali National Park and Preserve Date

Certified for Technical Accuracy and Servicewide Consistency:

_____

Chief, Water Resources Division, Washington Office Date

Approved:

_____

Regional Director, Alaska Region Date

PURPOSE AND NEED FOR ACTION

The National Park Service (NPS) has prepared and made available for public review an environmental assessment to evaluate the impacts of replacing the Rock Creek Bridge near park headquarters in Denali National Park and Preserve (DENA).

The bridge spans the deep, well-defined Rock Creek drainage at Mile 3.3 of the park road and provides crucial, year-round access to Park Headquarters, employee housing, and to all road accessible facilities west for ninety miles. The bridge is an essential link on the only road into DENA's backcountry, which also provides access for Kantishna area businesses at the western end of the road. In addition, a deck width of 24 feet combined with the curved design of the bridge results in westbound semi and RV trailers off-tracking into the eastbound lane, creating a hazard for oncoming tour and shuttle bus traffic. The Rock Creek Bridge is one of two seismically deficient bridges on the Denali Park Road which have been identified by the Federal Highways Administration (FHWA) as costing nearly as much to retrofit as to replace. The project would also eliminate width deficiency present in the current bridge.

Executive Order 11990 (Protection of Wetlands) and Executive Order 11988 (Floodplain Management requires the NPS, and other federal agencies, to evaluate the likely impacts of actions in wetlands and floodplains. The executive order requires that short and long-term adverse impacts associated with occupancy, modification or destruction of wetlands and floodplains be avoided whenever possible. Indirect support of development and new construction in such areas should also be avoided wherever there is a practicable alternative.

To comply with these orders, the NPS has developed a set of agency policies and procedures which can be found in Director's Order 77-1: Wetland Protection, Procedural Manual 77-1: Wetland Protection, and in Director's Order 77-2: Floodplain Management, Procedural Manual 77-2: Floodplain Management. The policies and procedures related to wetlands and floodplains emphasize: exploring all practical alternatives to building on, or otherwise affecting, wetlands and floodplains; reducing impacts to wetlands and floodplains whenever possible; mitigating impacts from building in floodplains, and providing direct compensation for any unavoidable wetland impact by restoring degraded or destroyed wetlands on other NPS properties.

The purpose of this Statement of Findings (SOF) is to present the NPS rationale for its proposed plan to construct portions of the Rock Creek Bridge replacement project in the wetland and floodplain area. This SOF also documents the anticipated effects on these resources.

WETLANDS WITHIN THE PROJECT AREA

Wetland boundaries were identified in the field by NPS personnel and the boundaries were transferred to 2004 air photos and transferred to a GIS layer by NPS staff to determine wetland acreage. Of the 2.3 acres affected by the proposed action, 0.2 acres were classified as wetlands (figure 2-2 of EA) under the "Classification of Wetlands and Deepwater Habitats of the United States," the Cowardin Classification System (Cowardin et al. 1979), and are therefore subject to NPS wetlands compliance procedures. Of the total 2.3 acres of disturbed land, 2.1 acres are

upland, as evidenced by the white spruce associations, the lack of hydrologic indicators, and the presence of well-draining soils.

The wetlands located within the proposed project area consist of riverine bottomlands and shores. The streambed is classified as Riverine Upper Perennial Unconsolidated Bottom Cobble-Gravel (R3UB1). The immediate floodplain surrounding the streambed core is classified as Riverine Upper Perennial Unconsolidated Shore Cobble-Gravel/Vegetated (R3US1/5). These wetlands provide habitat for macroinvertebrates and fish, including very low numbers of grayling and slimy sculpin, small mammals, such as snowshoe hares, and voles, and bird species, including sparrows, and warblers. Moose frequent the area for willow forage.

The major plant species in the riverine areas include willow spp., including Salix alaxensis, young white spruce, and forbs such as Erigeron and dwarf fireweed. A very light ground cover includes Mnium mosses and liverworts. No threatened or endangered animal or plant species are found in the area and no research or reference sites have been developed in the project area.

There is a well located 300 yards above the project area. No water supply points or wells are located downhill between the project site and the park entrance area water supply wells and stream galleries, approximately 7,000 feet away. Floods are common during spring break-up and during heavy rainstorms in the upstream mountains.

Numerous similar upper perennial riverine systems are found along the slopes of the schist ridges that extend from the park entrance out 30 miles to the Teklanika area and again in the Kantishna Hills. The park has determined that the wetland acreage located at the project site is a relatively minor part of the numerous local small stream valleys, and that removing the wetlands would have no impact on cultural resources, would improve fish passage on Rock Creek, and would have a minor impact on surface water quality, including sediment control and water purification, flood flow and animal and macroinvertebrate habitat.

FLOODPLAINS WITHIN THE PROJECT AREA

Rock Creek is a mountain stream originating on the slopes of the 5600 foot Mt. Healy. The elevation at the bridge is about 2100 feet. Mt. Healy is a high point on a schist ridge that is north of and parallels the Denali Park Road for about 30 miles. Rock Creek at the bridge is typically about 4 feet wide in summer and flows about 2-3 cubic feet per second. The flow is low enough in winter so that most of the flow between October and April is within the floodplain gravels and not on the surface. Ice can form four to five feet deep in short reaches during the winter.

Floods can occur with heavy snowmelt during spring breakup or due to heavy rainfall events. The upper drainage slopes with little vegetation do not hold water during rainfall events, but the moss-covered forested areas on the lower slopes attenuate snowmelt and heavy rains. Past floods have removed the macroinvetebrate fauna from the reach at the bridge, but they return within a year. Floods can carry significant loads of sand and gravel and move cobbles short distances. The large boulders in the streambed were likely carried into place during glacial recession.

The floodplain at the bridge would include the stream channel and the lower benches that can get covered with ice or by flooding during heavy rainfall. The floodplain averages about 46 feet wide (the bridge abutments narrow down some of the floodplain) and the project area is about 165 feet long upstream to downstream. Floodplain values at the site include macroinvertebrate habitat, potential (low quality) fish habitat, minor flood control and water purification.

THE PROPOSAL IN RELATION TO WETLANDS AND FLOODPLAINS

The proposal and alternatives are described in detail in the project EA.

The replacement of the Rock Creek Bridge with a large culvert and bridge-level embankment will impact a maximum of 0.2 acres of wetlands and floodplains. The extent of disturbance is shown on the attached project plan. Most of the disturbance will be from installing mechanically stabilized earth (MSE) walls at each end of the culvert and filling up to the level of the existing bridge with a causeway. The 18 foot wide culvert would be wide enough at grade to accommodate the whole streambed of Rock Creek.

About 0.07 acres of the streambed would be excavated in order to set the culvert 9 feet below grade. The streambed materials would then be replaced at grade inside the culvert. Habitat boulders would also be placed inside the culvert at prescribed intervals so promote upstream fish passage. Approximately 0.11 acres of the first bench above the water level would end up under the causeway.

Discharge of dredged or fill material into jurisdictional wetlands is regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. It is expected that this project will qualify under Nationwide Permit #10 – Linear Transportation Projects affecting less than 0.5 acre of wetlands.

SITE-SPECIFIC FLOOD RISK

Rock Creek floods would be announced either by heavy rainfall in the local area (Mt. Healy is visible from the bridge and is about 3 miles away) or by experiencing an unusually hot day during the snowmelt of spring break-up. There would be no facilities that would draw the public to the bridge-culvert site and any flooding would be obvious and constrained within the 60 foot high walls of the Rock Creek valley at the site. The public might find it interesting to view the flooding from the pedestrian walkway (presently a detached pedestrian bridge) at the level of the park road, but there would be no danger to them.

Since there is little hydraulic information on Rock Creek discharge during flood events, the level of erosion, sediment deposition or channel adjustments is not known. Channel adjustments within the narrow project area would be minor, and sediment height at the bridge piers does not appear to have changed greatly since bridge installation in 1959. Sediment marks on the bridge piers indicate that material has been carried four to five feet up the piers, but those marks could be left from silty water moving down on top of ice.

WETLANDS MITIGATION PROPOSED

Federal and NPS Policy is to avoid siting projects in wetlands whenever possible. If circumstances make it impracticable to avoid wetlands, then mitigation of unavoidable impacts must be planned. A NPS wetlands no-net-loss policy requires that wetland losses be compensated for by restoration of wetlands, preferably of comparable wetland type and function and in the same watershed (if possible).

Of the 2.3 acres affected by the proposed action, 0.2 acres are classified as wetlands. This SOF commits to full 2:1 compensation for the 0.2 acres of disturbed wetlands.

On-Site Rehabilitation

As much as possible, disturbance of wetlands in and around the project area would be avoided. Silt fences and/or sediment wattles would be set up to define construction impact limits. Any areas disturbed by construction activities would be restored to as near natural conditions as possible. Because of the lack of an organic layer in the area, no salvage of wetland vegetation, topsoil or organic layers is possible. Gravel removed to install the culvert 9 feet below grade would be replaced inside the culvert and habitat boulders would be spaced inside the culvert to create resting areas for upstream grayling passage. It is expected that the macroinvertebrate fauna would return within one year to areas within the culvert gravels.

Off-Site Compensation (Wetland Restoration)

Compensation, by restoration of previously disturbed degraded wetlands, is required under the NPS no-net-loss policy for projects involving disturbance or loss of wetlands. Compensation will occur for the loss of 0.2 acres of riverine wetland. Two-for-one compensation will be completed elsewhere in the park by restoring a riverine and palustrine wetland in the Kantishna Hills region of the park. It is anticipated that the wetland functions and values lost at the project site will be balanced by those functions and values regained at a restored former placer mine site.

A Federal Highways Administration funded project to remove gravel from former placer mined areas in Kantishna is scheduled for 2012-14. 0.4 acre within the park's Eldorado Creek floodplain has been selected for restoration within the scope of this mitigation. These wetlands are classified as Riverine Upper Perennial Unconsolidated Shore with Intermittent Flooding (R3USJ), and Palustrine Unconsolidated Shore Cobble Gravel Seasonally Flooded/Well-Drained (PUS1D). Restoration plans include removing and disposing of debris; stabilizing the channel and floodplain; stabilizing the access road; and revegetating the stripped areas. Preliminary work includes water and soil sampling, and engineering surveys of the existing stream channel, floodplains, and upland topography. Discharge measurements will be collected to aid in stream channel design. Soil sampling will assess the geo-chemistry of the upper watershed, and determine the soil's potential for revegetation efforts. Surveys, both cross-sectional and topographical, will be conducted to supplement site data on the NPS topographic maps. This information will be used to locate and estimate material amounts for use in recontouring the site and reconstructing the stream channel and floodplain.

Cost estimates for this project are approximately $25,000 per acre, based on an unpublished report, "Cost Estimation for Reclamation, National Park Service, Alaska Regional Office, January 1994." This report reviewed three separate mining reclamation projects that were conducted on abandoned claims in Denali National Park and Preserve.

Stream channel and floodplain restoration will be based on the techniques of the Glen Creek restoration project at Denali. Project design requirements will include a channel capacity for a 1.5-year (bankfull) discharge and a floodplain capacity for up to a 100-year discharge. The project design will include the use of bio-revetment, located on meanders, to encourage channel stabilization using natural methods. Brush bars, located in areas of little or no fines, will be employed to dissipate floodwater energy and encourage sediment deposition. Riparian areas will be revegetated with willow cuttings and other appropriate vegetation. Depending on the results from the soils nutrient analysis, fertilizer will be used to ensure a quick start for new vegetation.

Monitoring of the stream channel and riparian areas will occur to determine the success of the reclamation efforts. Vegetation plots and permanently mounted cross-sections will be surveyed and measured again after the first year. Additional seeding and revegetation will occur on areas not vegetated during the first year. It is anticipated that the site will be a functional wetland within 3-5 years, and will be fully-functioning within 15 years.

FLODPLAINS MITIGATION PROPOSED

Federal and NPS Policy is to avoid siting projects in floodplains whenever possible. If circumstances make it impracticable to avoid floodplains, then mitigation of unavoidable impacts must be planned.

The Rock Creek culvert and causeway will be designed to be a safe passageway for vehicles throughout the year, both to the rest of the park road in summer and to park headquarters during the winter. It is likely to be in more usable shape after a serious earthquake than the existing bridge. Once built, the culvert will contain similar macroinvertebrate habitat as at present and will contain enhanced fish habitat. The floodplain acreage that will be buried will lose floodplain values and will be compensated for during improvement of riparian areas in Kantishna, as described above in the wetlands section. Silt fences and/or sediment wattles would be set up to define construction impact limits and help to reduce sediment transport to the stream.

ALTERNATIVES CONSIDERED

Alternative 1 describes the existing conditions (No Action) at the Rock Creek Bridge. Recommendations for maintenance and repairs of the existing bridge from the FHWA bridge inspection report include periodically removing soil and debris from expansion joints, cleaning and painting all bearings, spot painting beams and diaphragms, replacing missing and bent anchor bolts, and repairing erosion of slopes in front of both abutments.

Alternative 2 describes the NPS preferred alternative under which the existing bridge would be removed and a round 18' diameter culvert and structural plates that accommodate fish passage, flood flow, abrasion, sediment transport and woody debris transport would be installed. Half the

diameter of the culvert would be buried to achieve fish passage. An overflow culvert, 4' in diameter, would be located at a higher elevation. The culvert would be constructed below gabion tiers, mechanically stabilized earth, and a natural grade fill slope. This alternative would adversely impact 0.2 acres of wetlands.

Alternative 3 would consist of two main categories of work: seismic retrofitting of the existing bridge substructure to the service limit state, and rehabilitating the existing superstructure. This alternative would adversely impact the same area as Alternative 2, 0.2 acres of wetland, through the use of heavy equipment working under the bridge.

Alternative 4 would include a new single span bridge structure on a curved alignment on the downstream side of the existing bridge, approximately 180' in length with a 34' out-to-out width. It would have deep pile foundation, semi-integral reinforced concrete abutments, weathering steel beams with cast-in-place deck, and two-tube barrier rails.

The replacement bridge would be constructed adjacent to the existing bridge on a new alignment prior to removing the existing bridge. Two-way traffic would be maintained across the existing bridge during construction. This alternative would affect 0.4 acres of wetlands as there would be heavy equipment use under both bridge sites.

Several alternatives were discussed during the project scoping process but were eliminated from further evaluations. These are briefly explained in the EA.

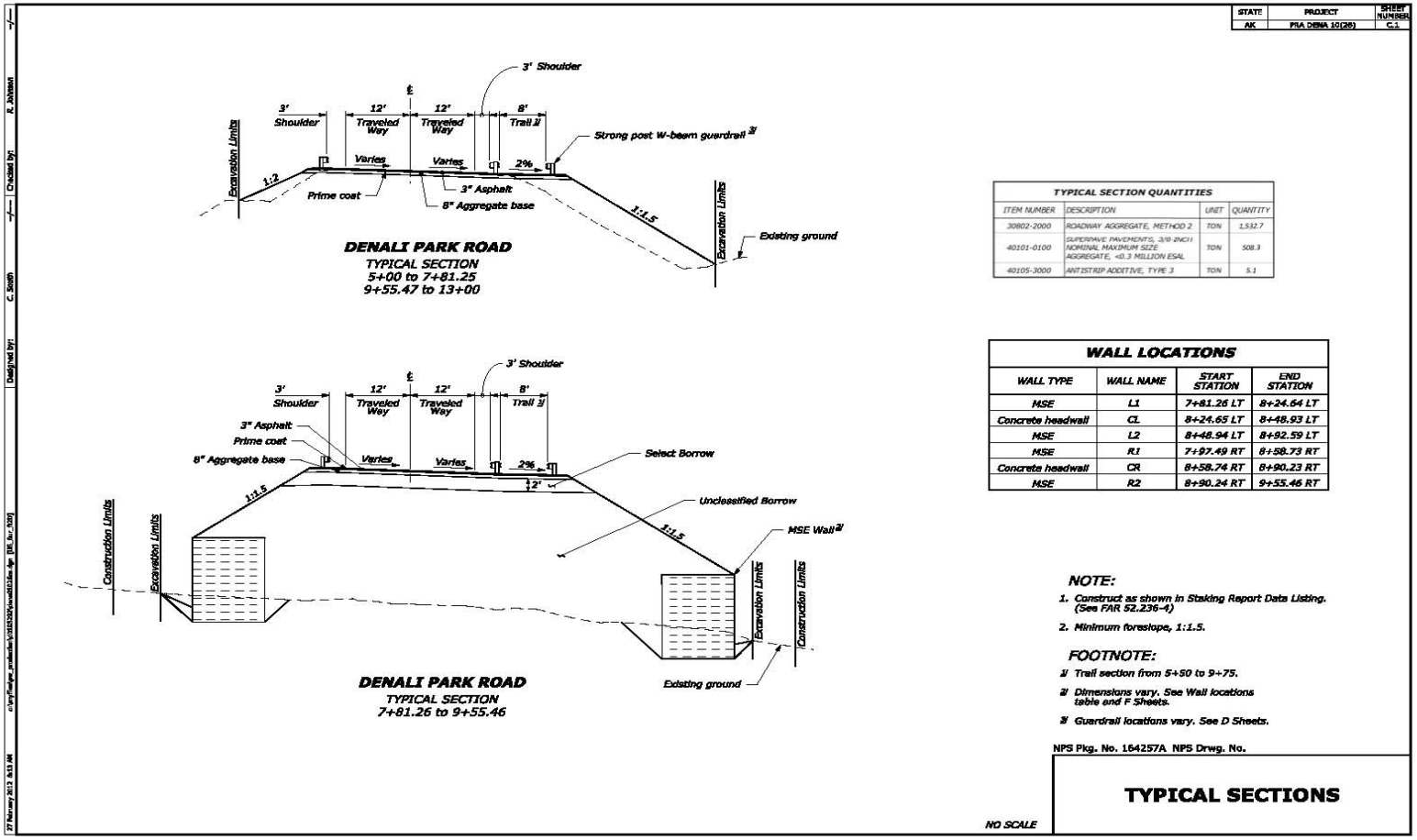
SUMMARY OF ENVIRONMENTAL CONSEQUENCES ASSOCIATED WITH THE PROPOSED ACTION

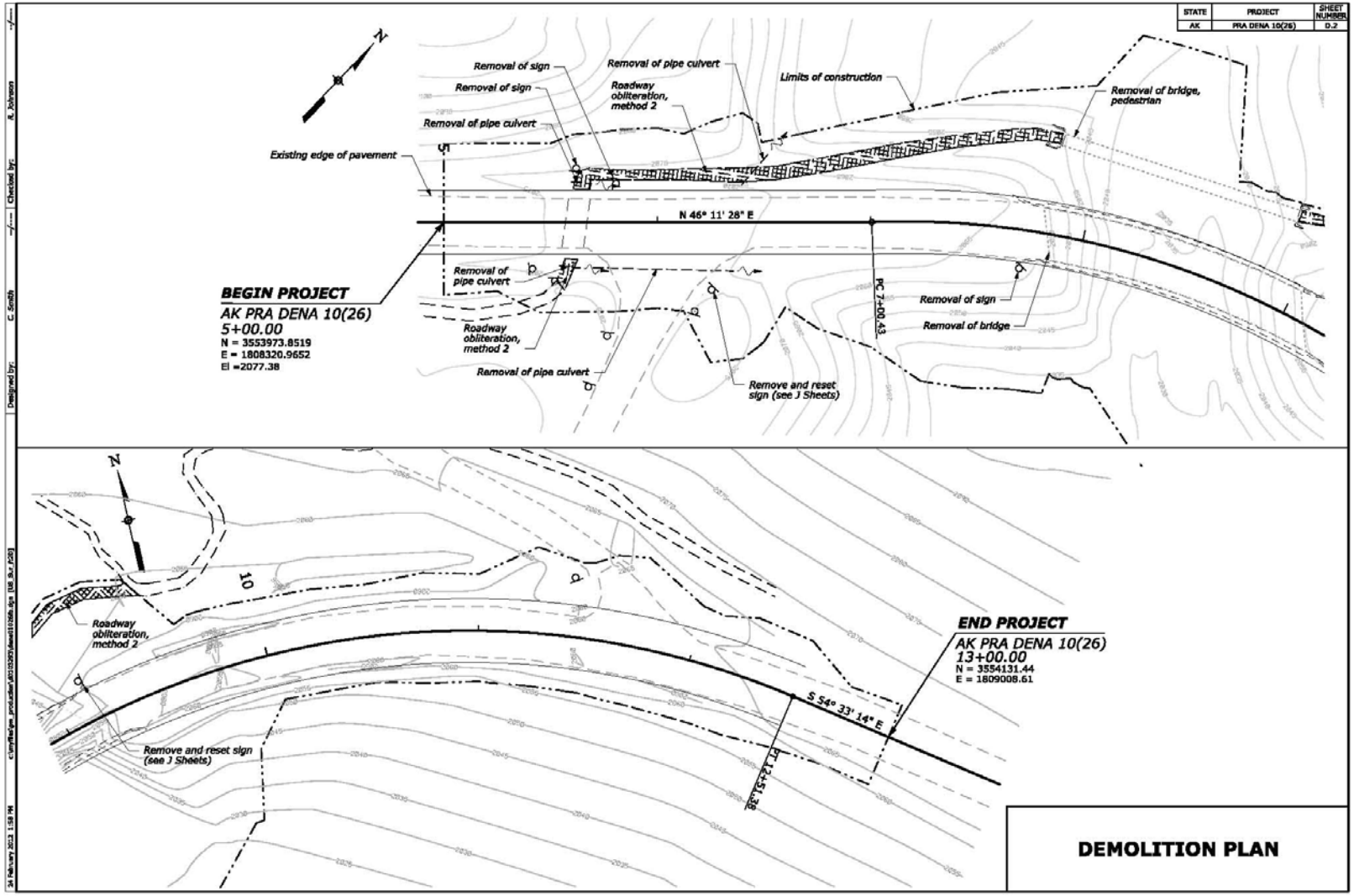
The potential environmental consequences of the proposed action and alternative are fully described in the EA.

CONCLUSION

The NPS concludes that there are no practicable alternatives to disturbing 0.2 acres of wetlands for the replacement of the Rock Creek Bridge Wetlands would be avoided to the maximum practicable extent. The wetland impacts that could not be avoided would be minimized. The streambed macroinvertebrate habitat would be replaced within the culvert and habitat boulders would be installed to enhance fish passage. The NPS acknowledges that some natural localized wetlands processes would be adversely affected. Impacts on the 0.2 acres of wetlands would be compensated for, on a minimum 2-for-1 acreage basis, by restoring riverine and palustrine wetland habitat and associated riparian habitat, in the Kantishna Hills region of the park (formerly placer-mined stream and riparian habitat). The NPS finds that this project is consistent with Procedural Manuals #77-1 and #77-2 *Wetland Protection*, 2011 and *Floodplain Management*, and with NPS Director's Order #s77-1 and 77-2, *Wetland Protection* and *Floodplain Management*. The NPS finds that this project is in compliance with Executive Orders 11990 and 11988, *Wetland Management* and *Floodplain Management*

APPENDIX C: PROJECT PLANS




STATE
PROJECT
SHEET NUMBER
AK
PRA DENA 10(26)
D.2
Removal of sign
Removal of sign
Removal of pipe culvert
Removal of pipe culvert
Roadway obliteration, method 2
Limits of construction
Removal of bridge, pedestrian
Existing edge of pavement
N 46° 11' 28" E
BEGIN PROJECT
AK PRA DENA 10(26)
5+00.00
N = 3553973.8519
E = 1808320.9652
El =2077.38
Removal of pipe culvert
Roadway obliteration, method 2
Removal of pipe culvert
PC 7+00.43
Removal of sign
Removal of bridge
Remove and reset sign (see J Sheets)
Roadway obliteration, method 2
Remove and reset sign (see J Sheets)
END PROJECT
AK PRA DENA 10(26)
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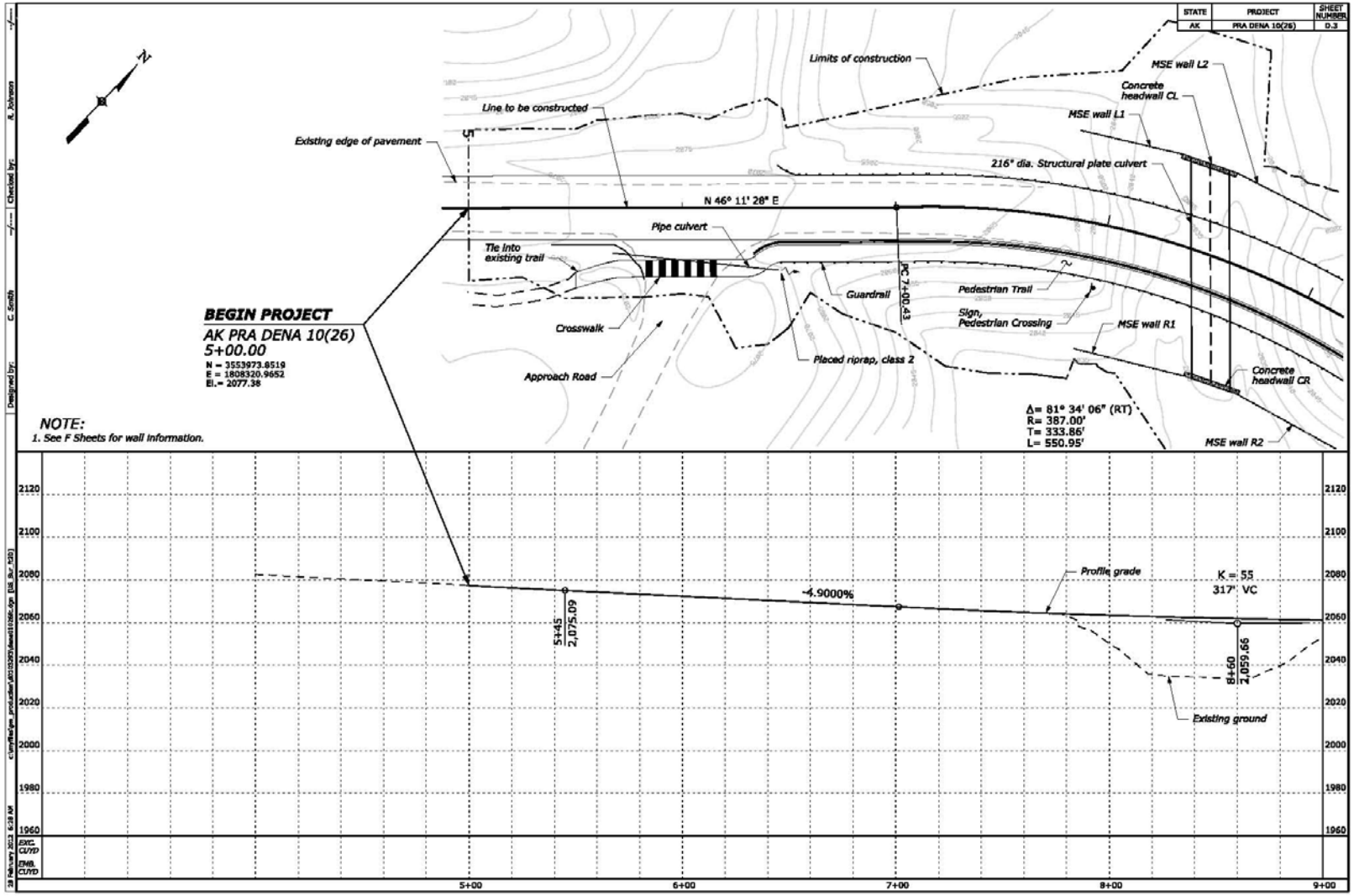
S 54° 33' 14" E
PT 12+51.38
DEMOLITION PLAN


STATE
AK
PROJECT
PRA DENA 10(26)
SHEET NUMBER
D.3
Limits of construction
MSE wall L2
Concrete headwall CL
MSE wall L1
Line to be constructed
Existing edge of pavement
216" dia. Structural plate culvert
N 46° 11' 28" E
Pipe culvert
Tie into existing trail
PC 7+00.43
Guardrail
Pedestrian Trail
Sign, Pedestrian Crossing
MSE wall R1
Crosswalk
Placed riprap, class 2
Approach Road
Concrete headwall CR
BEGIN PROJECT
AK PRA DENA 10(26)
5+00.00
N = 3553973.8519
E = 1808320.9652
El.= 2077.38
Δ= 81° 34' 06" (RT)
R= 387.00'
T= 333.86'
L= 550.95'
MSE wall R2
NOTE:
1. See F Sheets for wall information.
Profile grade
-4.9000%
K = 55
317' VC
5+45
2,075.09
8+60
2,059.66
Existing ground
EXC. CUYD
EMB. CUYD
5+00
6+00
7+00
8+00
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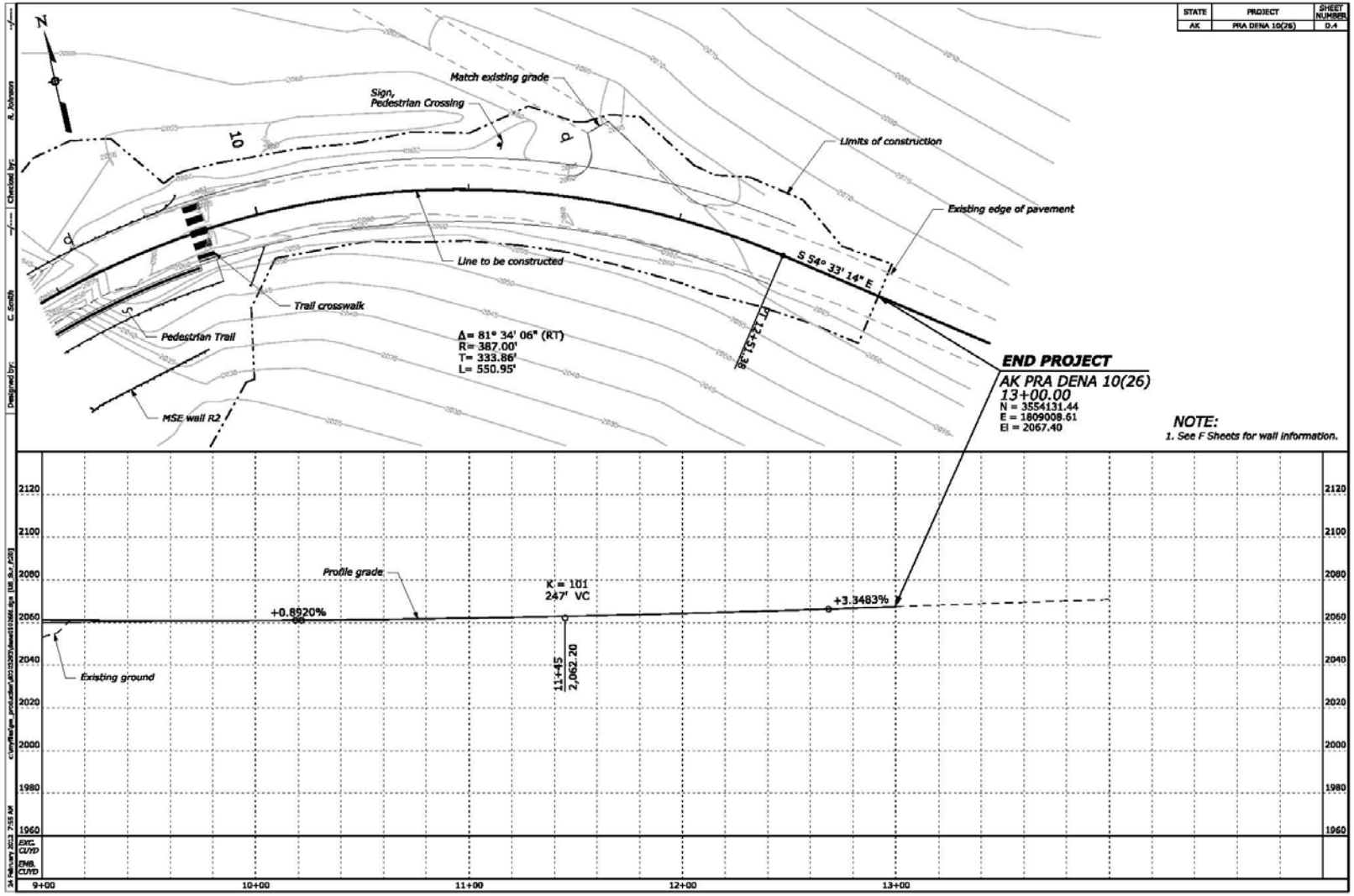
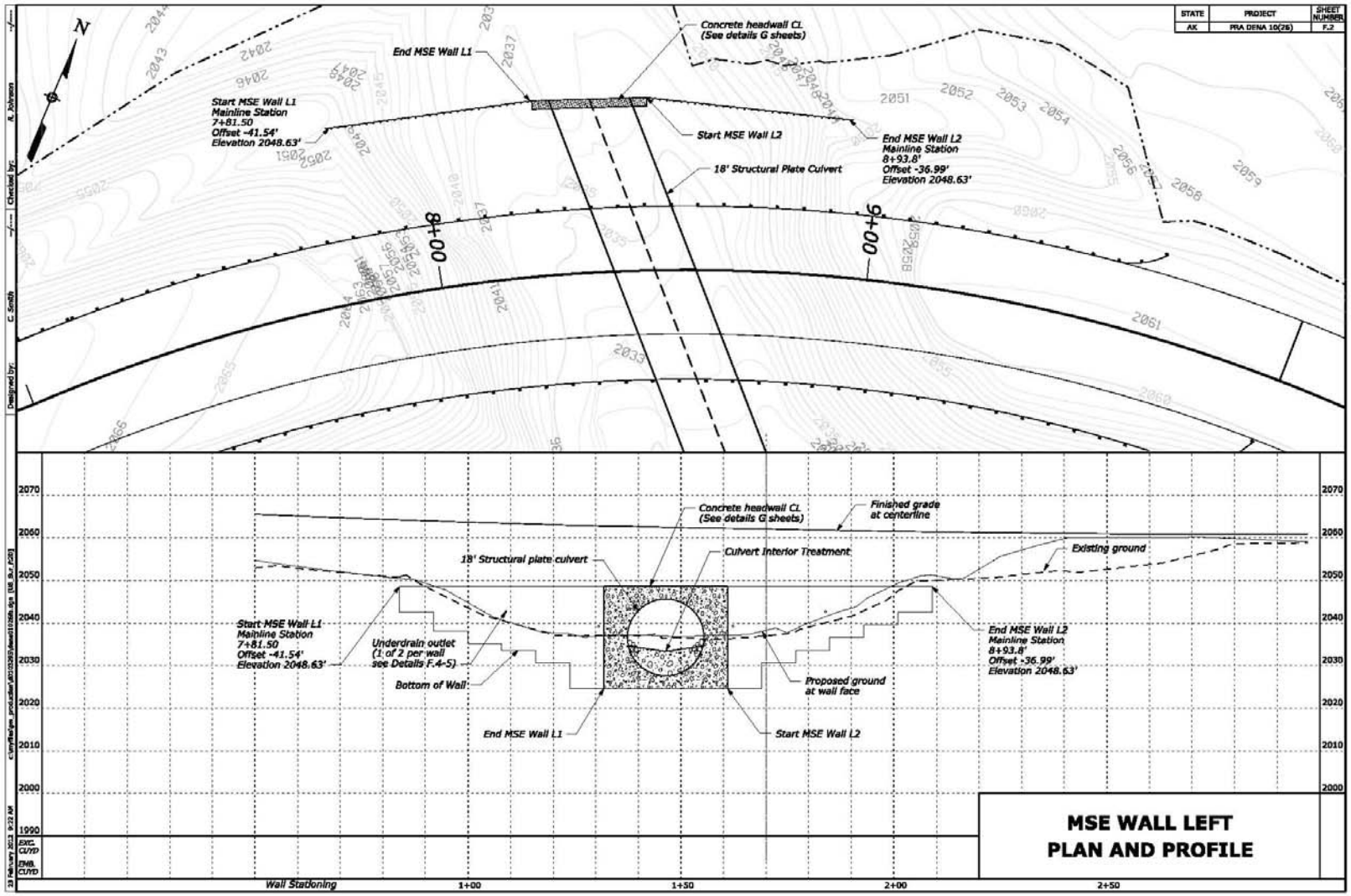
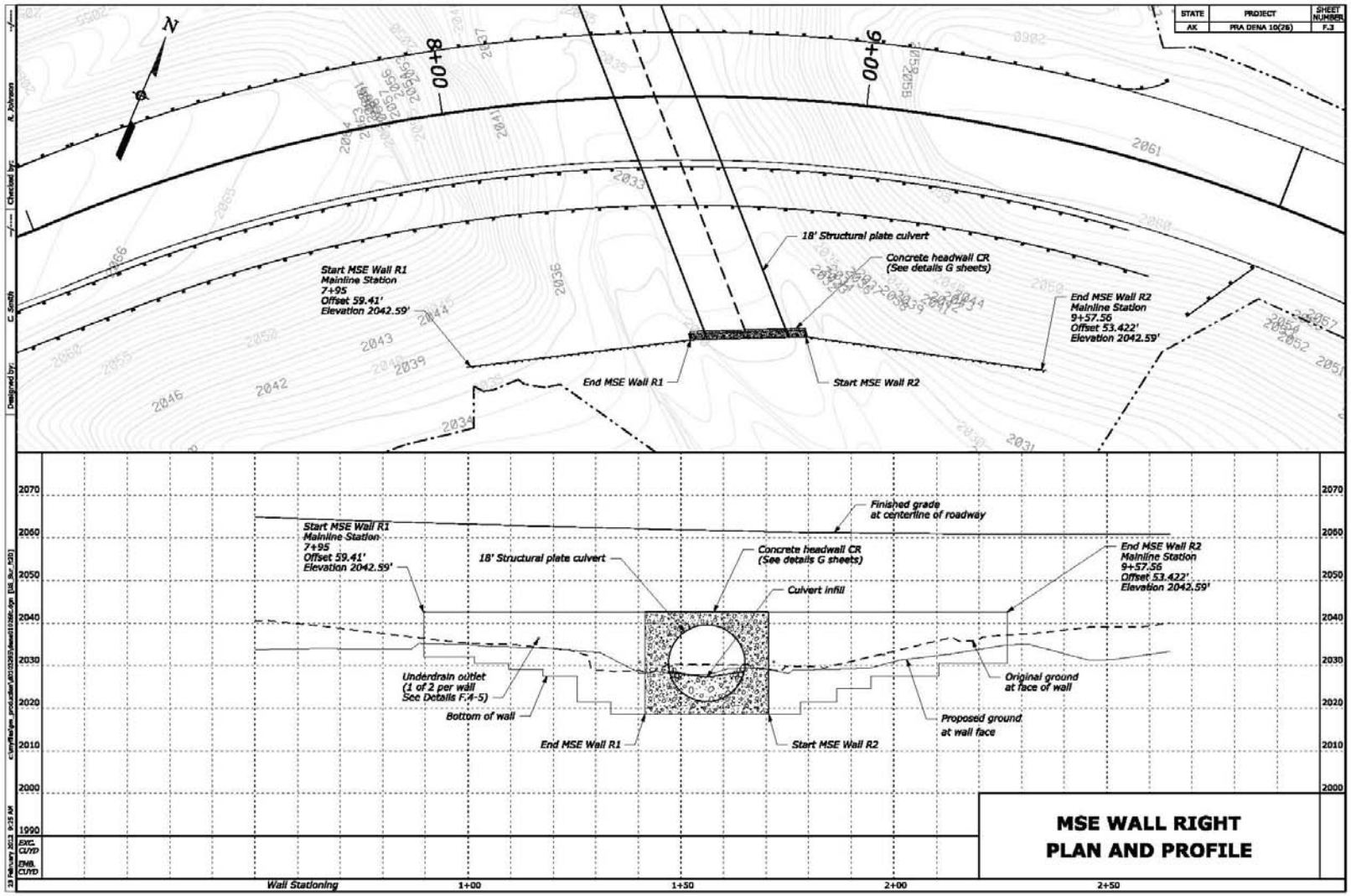
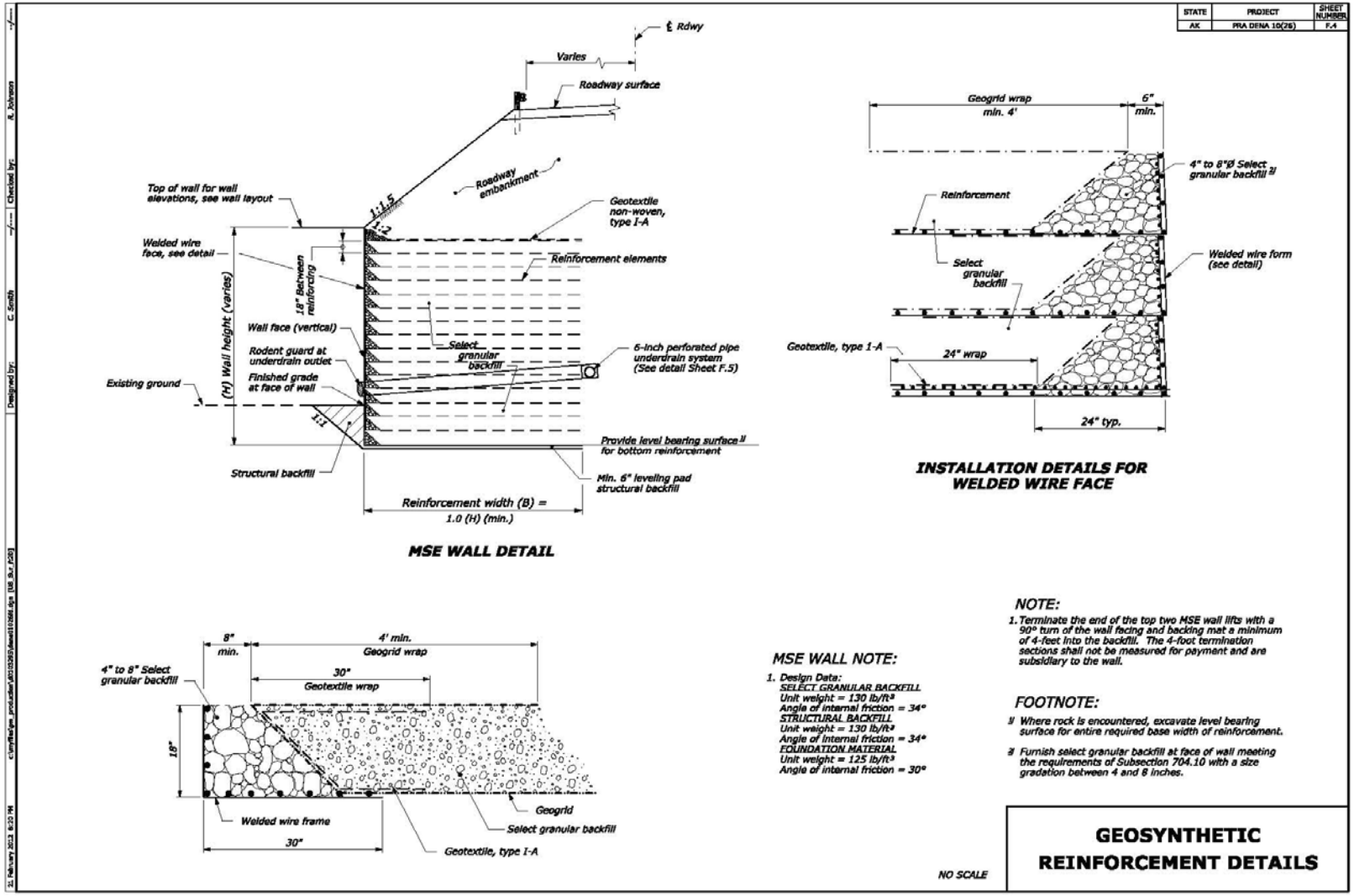
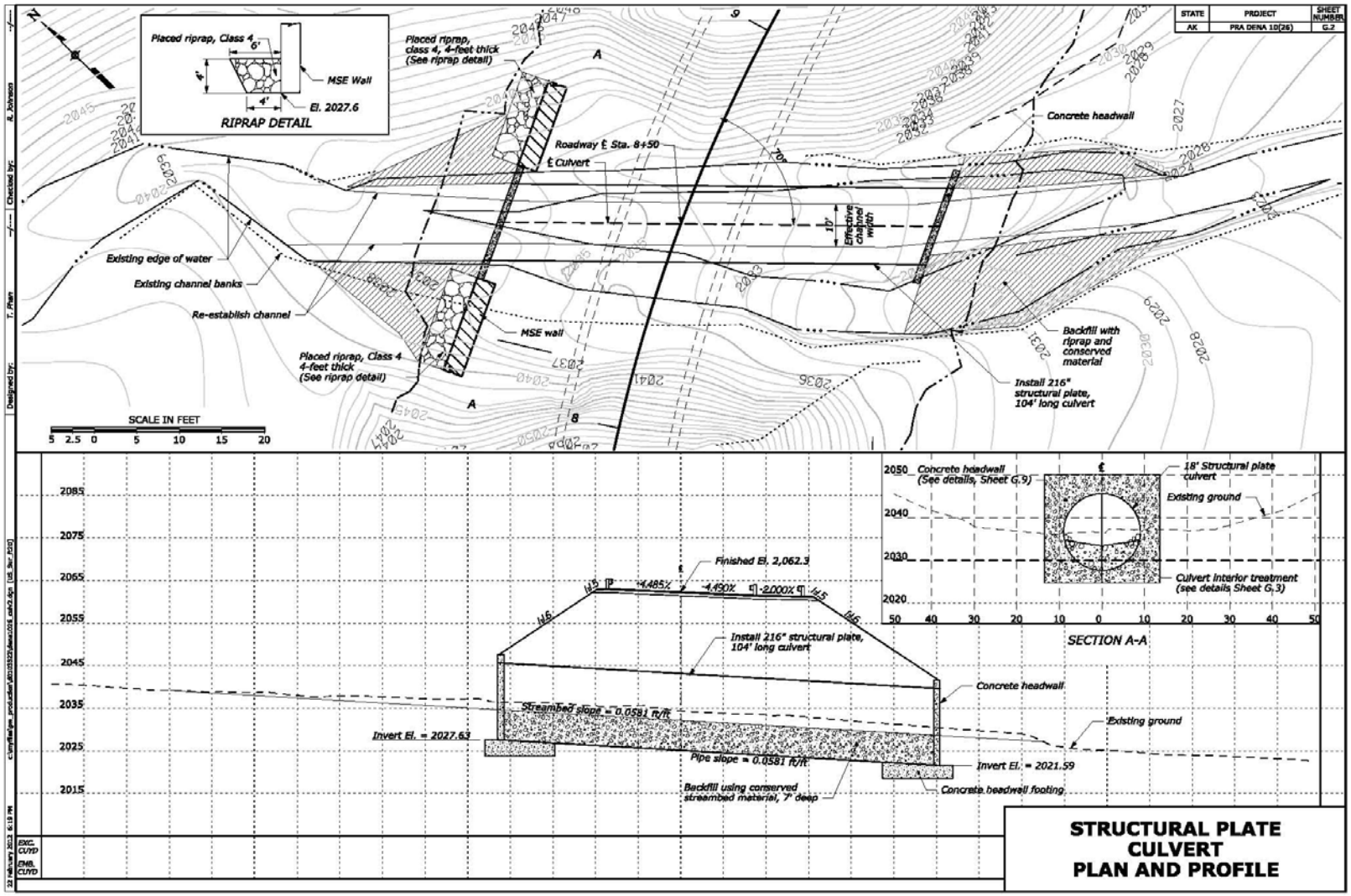
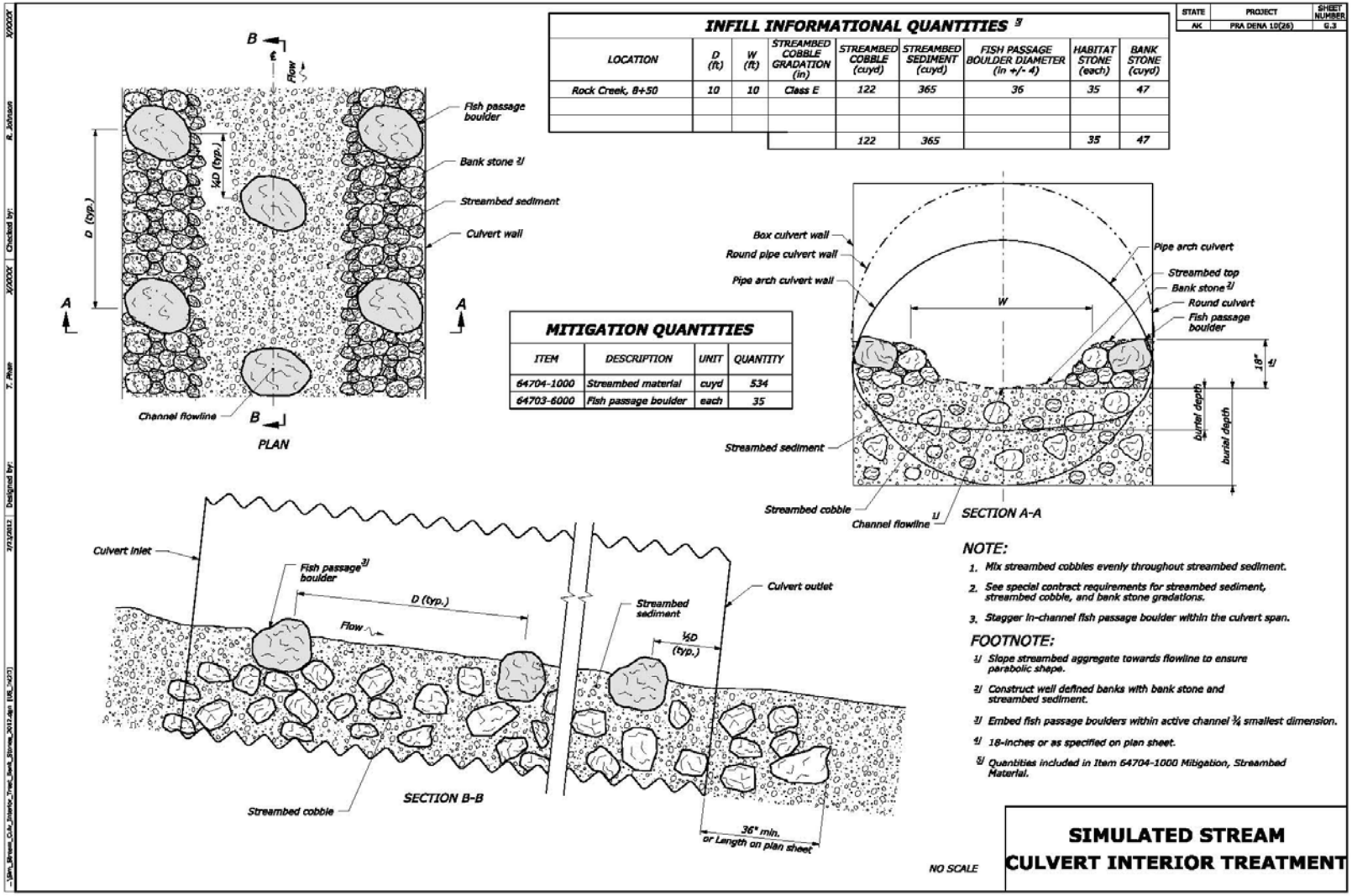

STATE
PROJECT
SHEET NUMBER
AK
PRA DENA 10(26)
D.4
N
Match existing grade
Sign, Pedestrian Crossing
Limits of construction
Existing edge of pavement
Line to be constructed
Trail crosswalk
Pedestrian Trail
MSE wall R2
Δ= 81° 34' 06" (RT)
R= 387.00'
T= 333.86'
L= 550.95'
S 54° 33' 14" E
361.15 FT
END PROJECT
AK PRA DENA 10(26)
13+00.00
N = 3554131.44
E = 1809008.61
El = 2067.40
NOTE:
1. See F Sheets for wall information.
Profile grade
K = 101
247' VC
+0.8920%
+3.3483%
Existing ground
11+45
2,062.20
2120
2100
2080
2060
2040
2020
2000
1980
1960
EXC. CUYD
EMB. CUYD
9+00
10+00
11+00
12+00
13+00

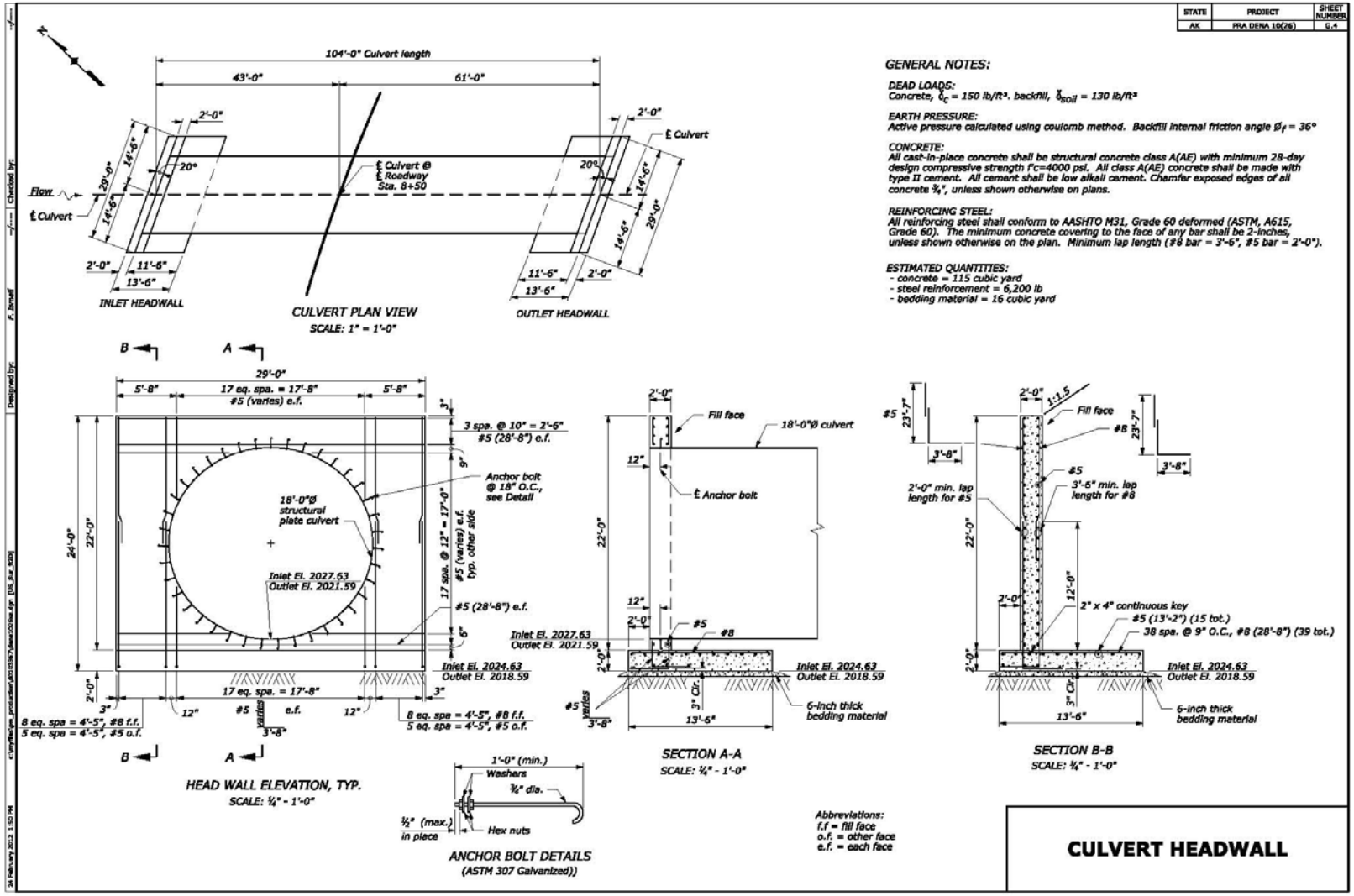

STATE
PROJECT
SHEET NUMBER
AK
PRA DENA 10(26)
F.2
Concrete headwall CL
(See details G sheets)
End MSE Wall L1
Start MSE Wall L1
Mainline Station
7+81.50
Offset -41.54'
Elevation 2048.63'
Start MSE Wall L2
End MSE Wall L2
Mainline Station
8+93.8'
Offset -36.99'
Elevation 2048.63'
18' Structural Plate Culvert
8+00
9+00
Finished grade
at centerline
Culvert Interior Treatment
Existing ground
Underdrain outlet
(1 of 2 per wall
see Details F.4-5)
Bottom of Wall
Proposed ground
at wall face
MSE WALL LEFT
PLAN AND PROFILE
Wall Stationing
1+00
1+50
2+00
2+50

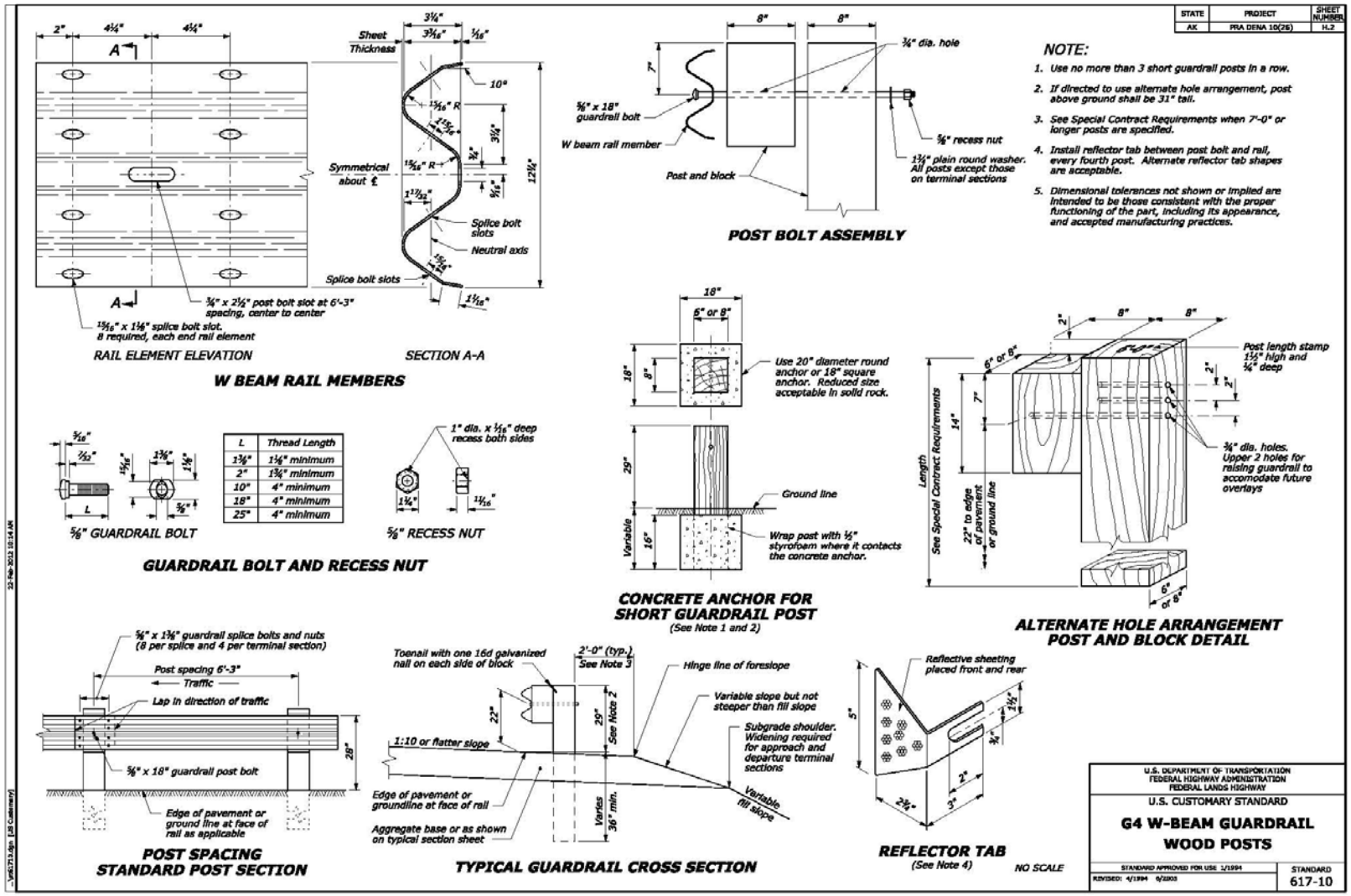

STATE
PROJECT
SHEET NUMBER
AK
PRA DENA 10(26)
F.3
N
8+00
9+00
18' Structural plate culvert
Concrete headwall CR
(See details G sheets)
Start MSE Wall R1
Mainline Station
7+95
Offset 59.41'
Elevation 2042.59'
End MSE Wall R2
Mainline Station
9+57.56
Offset 53.422'
Elevation 2042.59'
End MSE Wall R1
Start MSE Wall R2
Finished grade
at centerline of roadway
Culvert infill
Underdrain outlet
(1 of 2 per wall
See Details F.4-5)
Bottom of wall
Original ground
at face of wall
Proposed ground
at wall face
MSE WALL RIGHT
PLAN AND PROFILE
Wall Stationing
1+00
1+50
2+00
2+50
EXC. CUYD
EMB. CUYD


STATE
AK
PROJECT
PRA DENA 10(26)
SHEET NUMBER
F.4
℄ Rdwy
Varies
Roadway surface
Roadway embankment
Top of wall for wall elevations, see wall layout
1:1.5
1:2
Geotextile non-woven, type I-A
Welded wire face, see detail
Reinforcement elements
18" Between reinforcing
(H) Wall height (varies)
Wall face (vertical)
Select granular backfill
6-inch perforated pipe underdrain system (See detail Sheet F.5)
Rodent guard at underdrain outlet
Existing ground
Finished grade at face of wall
1:1
Provide level bearing surface 1/ for bottom reinforcement
Structural backfill
Min. 6" leveling pad structural backfill
Reinforcement width (B) = 1.0 (H) (min.)
MSE WALL DETAIL
Geogrid wrap min. 4'
6" min.
4" to 8"ø Select granular backfill 2/
Reinforcement
Welded wire form (see detail)
Select granular backfill
Geotextile, type 1-A
24" wrap
24" typ.
INSTALLATION DETAILS FOR WELDED WIRE FACE
8" min.
4' min. Geogrid wrap
30" Geotextile wrap
4" to 8" Select granular backfill
18"
Welded wire frame
30"
Geotextile, type 1-A
Geogrid
Select granular backfill
MSE WALL NOTE:
1. Design Data:
SELECT GRANULAR BACKFILL
Unit weight = 130 lb/ft³
Angle of internal friction = 34°
STRUCTURAL BACKFILL
Unit weight = 130 lb/ft³
Angle of internal friction = 34°
FOUNDATION MATERIAL
Unit weight = 125 lb/ft³
Angle of internal friction = 30°
NOTE:
1. Terminate the end of the top two MSE wall lifts with a 90° turn of the wall facing and backing mat a minimum of 4-feet into the backfill. The 4-foot termination sections shall not be measured for payment and are subsidiary to the wall.
FOOTNOTE:
1/ Where rock is encountered, excavate level bearing surface for entire required base width of reinforcement.
2/ Furnish select granular backfill at face of wall meeting the requirements of Subsection 704.10 with a size gradation between 4 and 8 inches.
NO SCALE
GEOSYNTHETIC REINFORCEMENT DETAILS


RIPRAP DETAIL
Placed riprap, Class 4
MSE Wall
El. 2027.6
Placed riprap, class 4, 4-feet thick (See riprap detail)
Roadway ℄ Sta. 8+50
℄ Culvert
Concrete headwall
Existing edge of water
Existing channel banks
Re-establish channel
MSE wall
Placed riprap, Class 4 4-feet thick (See riprap detail)
Backfill with riprap and conserved material
Install 216" structural plate, 104' long culvert
Effective channel width
SCALE IN FEET
Finished El. 2,062.3
Install 216" structural plate, 104' long culvert
Streambed slope = 0.0581 ft/ft
Invert El. = 2027.63
Pipe slope = 0.0581 ft/ft
Backfill using conserved streambed material, 7" deep
Concrete headwall
Existing ground
Invert El. = 2021.59
Concrete headwall footing
Concrete headwall (See details, Sheet G.9)
18' Structural plate culvert
Existing ground
Culvert interior treatment (see details Sheet G.3)
SECTION A-A
STRUCTURAL PLATE CULVERT PLAN AND PROFILE


INFILL INFORMATIONAL QUANTITIES 5/
LOCATION | D (ft) | W (ft) | STREAMBED COBBLE GRADATION (in) | STREAMBED COBBLE (cuyd) | STREAMBED SEDIMENT (cuyd) | FISH PASSAGE BOULDER DIAMETER (in +/- 4) | HABITAT STONE (each) | BANK STONE (cuyd)
Rock Creek, 8+50 | 10 | 10 | Class E | 122 | 365 | 36 | 35 | 47
122 | 365 | 35 | 47
STATE | PROJECT | SHEET NUMBER
AK | PRA DENA 10(26) | G.3
MITIGATION QUANTITIES
ITEM | DESCRIPTION | UNIT | QUANTITY
64704-1000 | Streambed material | cuyd | 534
64703-6000 | Fish passage boulder | each | 35
PLAN
Fish passage boulder
Bank stone 2/
Streambed sediment
Culvert wall
Channel flowline
Flow
D (typ.)
½D (typ.)
SECTION A-A
Box culvert wall
Round pipe culvert wall
Pipe arch culvert wall
Pipe arch culvert
Streambed top
Round culvert
W
18" 4/
burial depth
Streambed cobble
SECTION B-B
Culvert inlet
Culvert outlet
36" min. or Length on plan sheet
NOTE:
1. Mix streambed cobbles evenly throughout streambed sediment.
2. See special contract requirements for streambed sediment, streambed cobble, and bank stone gradations.
3. Stagger in-channel fish passage boulder within the culvert span.
FOOTNOTE:
1/ Slope streambed aggregate towards flowline to ensure parabolic shape.
2/ Construct well defined banks with bank stone and streambed sediment.
3/ Embed fish passage boulders within active channel ¾ smallest dimension.
4/ 18-inches or as specified on plan sheet.
5/ Quantities included in Item 64704-1000 Mitigation, Streambed Material.
NO SCALE
SIMULATED STREAM
CULVERT INTERIOR TREATMENT


STATE
AK
PROJECT
PRA DENA 10(26)
SHEET NUMBER
G.4
104'-0" Culvert length
43'-0"
61'-0"
2'-0"
℄ Culvert
20°
℄ Culvert @ ℄ Roadway Sta. 8+50
Flow
29'-0"
14'-6"
11'-6"
13'-6"
INLET HEADWALL
OUTLET HEADWALL
CULVERT PLAN VIEW
SCALE: 1" = 1'-0"
GENERAL NOTES:
DEAD LOADS:
Concrete, γ_c = 150 lb/ft³. backfill, γ_{soil} = 130 lb/ft³
EARTH PRESSURE:
Active pressure calculated using coulomb method. Backfill internal friction angle ϕ_f = 36°
CONCRETE:
All cast-in-place concrete shall be structural concrete class A(AE) with minimum 28-day design compressive strength f'c=4000 psi. All class A(AE) concrete shall be made with type II cement. All cement shall be low alkali cement. Chamfer exposed edges of all concrete ¾", unless shown otherwise on plans.
REINFORCING STEEL:
All reinforcing steel shall conform to AASHTO M31, Grade 60 deformed (ASTM, A615, Grade 60). The minimum concrete covering to the face of any bar shall be 2-inches, unless shown otherwise on the plan. Minimum lap length (#8 bar = 3'-6", #5 bar = 2'-0").
ESTIMATED QUANTITIES:
- concrete = 115 cubic yard
- steel reinforcement = 6,200 lb
- bedding material = 16 cubic yard
B
A
5'-8"
17 eq. spa. = 17'-8"
#5 (varies) e.f.
3 spa. @ 10" = 2'-6"
#5 (28'-8") e.f.
Anchor bolt @ 18" O.C., see Detail
18'-0"Ø structural plate culvert
Inlet El. 2027.63
Outlet El. 2021.59
17 spa. @ 12" = 17'-0"
#5 (varies) e.f. typ. other side
Inlet El. 2024.63
Outlet El. 2018.59
8 eq. spa = 4'-5", #8 f.f.
5 eq. spa = 4'-5", #5 o.f.
HEAD WALL ELEVATION, TYP.
SCALE: ¼" - 1'-0"
Fill face
18'-0"Ø culvert
℄ Anchor bolt
#5
#8
6-inch thick bedding material
SECTION A-A
SCALE: ¼" - 1'-0"
1:1.5
2'-0" min. lap length for #5
3'-6" min. lap length for #8
2" x 4" continuous key
#5 (13'-2") (15 tot.)
38 spa. @ 9" O.C., #8 (28'-8") (39 tot.)
SECTION B-B
SCALE: ¼" - 1'-0"
1'-0" (min.)
Washers
¾" dia.
½" (max.) in place
Hex nuts
ANCHOR BOLT DETAILS
(ASTM 307 Galvanized))
Abbreviations:
f.f = fill face
o.f. = other face
e.f. = each face
CULVERT HEADWALL



L	Thread Length
1⅛"	1½" minimum
2"	1¾" minimum
10"	4" minimum
18"	4" minimum
25"	4" minimum