

that these minimization techniques will be successful. Success will be dependent upon available budget and the necessary pre-planning strategies.

Mitigation Options

After avoidance and minimization techniques have been applied to the maximum practicable extent, remaining impacts from invasive species must be offset through mitigation. The following strategies are examples provided in the NPS strategic plan for managing invasive exotic plants (NPS 1996). Examples include early detection and rapid response efforts, inventorying and monitoring of invasive exotic plants as well as the identification of key corridors of invasion and transporters of non-native plants and animals. Based on NPS Management Guidelines, mechanical control, cultural control, biological control, and chemical control methods are possible techniques that may be used to mitigate impacts from road construction (NPS 2002c). The use of power tools and hand tools could be used for the removal of herbaceous and shallowly-rooted plants which may be effective for some invasive exotic plant species. Work crews may be required to clean equipment and clothing before traveling to another site in order to prevent the contamination of another site with invasive exotic seeds. Cultural control techniques consist of education on cleanliness of vehicles and equipment, proper disposal of plant debris, and interpretive displays and programs on the threats of invasive exotic species. Biological control is the control of a pest by disrupting their ecological status, and through the use of organisms that are natural predators, parasites, or pathogens. An example of biological control includes using the ladybird beetle (*Sasajiscymnus tsugae*) to control HWA. Chemical control measures could be used such as soil management in favor of native species. The introduction of topsoil from the undisturbed surroundings may be enough to re-introduce native seeds. A light surface application of natural litter or sawdust will cause decomposing fungi to multiply and remove excess plant available nitrogen from the soil. The use of herbicides would be considered if the alternative means of control are not feasible (NPS 2001f). The best prevention efforts will not stop all invasive species introductions. Additional coordination will be needed to develop mitigation plans. The success of mitigation efforts are uncertain and may include additional costs.

4.4.10 Protected Species

4.4.10.1 Federally Protected Endangered and Threatened Species

4.4.10.1.1 Methodology for Assessing Impacts

Impacts are assessed on the known population of bald eagles and the potential habitat for both the bald eagle and Indiana bat within or near the project study corridors. Impacts to other federally protected endangered and threatened species are negligible or discountable and are discussed in Appendix N.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Type

Impacts are either beneficial and/or adverse. Beneficial impacts are defined as having a positive effect on protected species. Adverse impacts have a negative effect on protected species.

Context

Context is defined as site-specific, local, and regional. Site-specific is the area within the construction footprint. Local is defined as the area within 2.0 miles (3.2 km) of the construction footprint or the northern shore of Fontana Lake (whichever is less). The 2.0 mile (3.2 km) radius was selected because it the guideline utilized within North Carolina when discussing known populations of threatened or endangered species. Regional is the area bounded by the northern shore of Fontana Lake, the North Carolina/Tennessee state line, Twentymile Ridge on the west, and Noland Creek on the east. This area was selected because the mountain ridges and the lake form a natural ecological boundary and for which a suitable analysis and discussion of possible impacts could be undertaken.

Duration

Short-term impacts are those that would occur for less than 1 year, typically as an episodic or temporary event. Long-term effects occur as a result of construction activities at a specific location throughout the life of construction (this is assumed to be between 1 year and 15 years), but the impact is more than that of a temporary event. Permanent impacts are considered to be anything that persists throughout the construction period. These impacts include the permanent loss of potential habitat.

Intensity

Intensity is the degree to which resources are affected and is categorized as negligible, minor, moderate, and major. The definitions for each category are based on the best available scientific information and are specific for this EIS. The definitions for intensity are based on the language for assessing impacts to protected species as stated in the ESA.

No/Negligible (No Effect)

The project would not impact a listed species or designated critical habitat. There would be no impact on potential habitat.

Minor (May Affect)

Potential impacts on listed species may occur as a direct or indirect result of the proposed action, but are expected to be discountable, insignificant, or completely beneficial. There may be loss of potential habitat, but no individuals are expected to be affected.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Moderate (May Affect)

Potential impacts may occur as a direct or indirect result of the proposed action and the effects are not discountable, insignificant or completely beneficial.

Major

Potential impacts on listed species may occur as direct or indirect results of the proposed action and are expected to reduce appreciably the likelihood of survival or recovery of a listed species in the Park by reducing the reproduction, numbers, or distribution of that species.

4.4.10.1.2 Summary of Impacts

No-Action

There would be no impacts to either the Indiana bat or the bald eagle within GSMNP if the No-Action Alternative is selected.

Monetary Settlement

The Monetary Settlement Alternative would not impact bald eagles or Indiana bats within GSMNP. Potential impacts outside GSMNP resulting from the Monetary Settlement Alternative will depend on local use of funds.

Laurel Branch Picnic Area

Indiana Bat (*may affect*): Approximately 8.96 acres (3.63 ha) of habitat within GSMNP may be impacted by this construction alternative. Impacts due to direct loss of potential habitat and due to potential reduction of habitat utilization surrounding the road and facilities would be adverse, site-specific to local, permanent, and minor.

Bald Eagle (*no effect*): This alternative is greater than 1.0 mile (1.6 km) from open water. Selection of this alternative would have no impacts to the bald eagle within GSMNP.

Partial-Build Alternative to Bushnell (Primitive and Principal Park Roads)

Indiana Bat (*may affect*): Approximately 100.42 acres (40.64 ha) of habitat would likely be impacted by the Primitive Park Road. The Principal Park Road would likely impact 91.43 acres (37.02 ha) of habitat. Impacts due to direct habitat loss and potential reduction in habitat utilization surrounding the road and facilities would be adverse, site-specific to local, permanent, and minor. These impacts are the same for both

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

the Primitive and Principal Park Roads. As compared to the baseline Partial-Build Alternative to Bushnell, the impacts would likely be reduced for the Southern Option at Forney Creek Embayment.

Bald Eagle (*may affect*): Development of the Bushnell area, especially the boat ramp, would likely lead to increased boating activity in the vicinity of a known bald eagle nest. Portions of Fontana Lake in proximity to the eagle nest are within areas designated as primary and secondary management zones. Impacts on foraging activities due to increased boating associated with potential increased lake access at the proposed facility would likely be adverse, local to regional, permanent, and moderate. Three hundred linear feet (91 m) of the baseline Principal Park Road are within the secondary management zone. No portion of the Primitive Park Road is within a management zone. Impacts due to noise associated with construction activities would likely be adverse, local to regional, long-term, and minor. Impacts due to human disturbance from utilization of the road and facilities would likely be adverse, local to regional, permanent, and minor.

As compared to the baseline Partial-Build Alternative to Bushnell, the Southern Option at Forney Creek would have approximately 2,375 linear feet (725 m) of the Principal Park Road and 3,775 linear feet (1,150 m) of the Primitive Park Road within in the secondary eagle management zone. The possibilities for impacts are likely to be increased due to greater proximity to bald eagle foraging habitat.

Northern Shore Corridor (Primitive and Principal Park Roads)

Indiana Bat (*May affect*): Approximately 397.79 acres (160.98 ha) of potential habitat would likely be impacted by the Primitive Park Road. The Principal Park Road would likely impact 387.03 acres (156.63 ha). Impacts due to direct habitat loss and potential reduction in habitat utilization surrounding the road and facilities would likely be adverse, site-specific to local, permanent, and minor. The impact characterization is the same for both the Primitive and Principal Park Roads. All of the southern bridging options would likely decrease possible impacts.

Bald Eagle (*May affect*): The majority of the construction footprint for any option associated with the Northern Shore Corridor is located within 1.0 mile (1.6 km) of open water, thus is potential bald eagle habitat. The Primitive Park Road is not located within a designated management zone for bald eagles. Impacts resulting from the Primitive Park Road due to noise associated with construction activities and due to human disturbance from utilization of the road and associated facilities would likely be adverse, local to regional, long-term to permanent, and minor. Three hundred linear feet (91 km) of the baseline Principal Park Road would be within the secondary management zone. Impacts due to noise associated with construction activities would likely be adverse, local to regional, permanent, and minor. Impacts due to human disturbance from utilization of the road and facilities would likely be adverse, local to regional, permanent, and minor.

For the Southern Option at Forney Creek, approximately 2,375 linear feet (725 m) of the Principal Park Road and 3,775 linear feet (1,150 m) of the Primitive Park Road would be located in the secondary eagle

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

management zone. This option has an increased potential for impacts due to its greater presence in the vicinity of a bald eagle nest. The remaining southern options would likely increase possible impacts due to proximity to bald eagle habitat.

Cumulative Impacts

Projects listed in Section 4.1.2 were reviewed for past and/or potential impacts to the Indiana bat and bald eagle. Impacts to the Indiana bat or its habitat resulting, or expected to result, from other actions in the study area are not documented. Minor loss of Indiana bat habitat resulting from the partial-build alternatives or the build alternatives would be in addition to any previous or future loss of habitat. These cumulative effects would occur as a result of landscape modification. Mitigation to protect, enhance, and restore habitats would minimize the potential cumulative effects on this protected species.

The presence of bald eagles is relatively new to the study area. No past actions were identified that affected bald eagle habitat in this area. Given the limited amount of privately-owned land surrounding Fontana Lake, other actions in the study area are not likely to affect bald eagle habitat. Therefore, no cumulative impacts to bald eagle habitat were identified.

4.4.10.1.3 Endangered Species Act Coordination

Section 7 of the ESA requires federal agencies to consult with the USFWS when any action that the agency carries out, funds, or authorizes may affect a listed endangered or threatened species. Whenever possible, for the partial build and build alternatives, a determination of no/negligible (no effect) was made per each federally protected species, based on known locations of populations, availability of habitat and the potential for any project related impacts. Per the *Final Endangered Species Act Consultation Handbook* (USFWS and National Marine Fisheries Service 1998), may affect is “the appropriate conclusion when a proposed action may pose **any** effects on listed species or designated critical habitat” (emphasis added). The ESA provides for an informal consultation process between the USFWS and the lead federal agency to evaluate the proposed action and determine if the effects may be adverse. Informal consultation with the USFWS is ongoing. Formal consultation will be required if the affects of the action are determined to be adverse. Future coordination and consultation, including a biological assessment (BA) (if required), with the USFWS would depend on the alternative ultimately selected. A BA would be completed if a partial-build or build alternative is selected. It may become necessary to conduct additional surveys for federally protected species dependent upon updated information about species requirements or as more refined project designs are developed. Refer to ESA Coordination, Section 5.9, for additional information relevant to Section 7 and the USFWS.

4.4.10.1.4 Options to Address Potential Impacts

NPS would employ a sequence of avoiding adverse impacts to federally protected species to the extent practicable, minimizing impacts that could not be avoided, and attempting to compensate for remaining

Clarification of the term “baseline” for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

adverse impacts. It will not be possible to avoid or mitigate for all impacts. More detailed information on mitigation techniques and strategies for federally protected species is contained in Appendix N.

Avoidance Techniques

Selection of the No-Action or Monetary Settlement Alternatives would avoid impacts to protected species and their habitats with GSMNP. Potential impacts outside of GSMNP resulting from the Monetary Settlement Alternative will depend on local use of funds.

It would not be possible to completely avoid impacts to potential habitat for the Indiana bat by selection of a build alternative in the project study corridors. Restricting clearing activities from occurring in the summer months would eliminate possible impacts to bats roosting in potential maternity trees.



Bald eagle

The Laurel Branch Picnic Area would have no impact on the bald eagle population. This alternative is greater than 1.0 mile (1.6 km) from open water and, if chosen, would avoid impacts to this species. It would not be possible to completely avoid impacts to the bald eagle by selection of either the Partial-Build Alternative to Bushnell or the Northern Shore Corridor.

Minimization Techniques

Perpendicular crossings of stream systems would reduce impacts to riparian zones, thus minimizing the impacts to Indiana bat foraging locations. Narrowing of the construction footprint limits the amount of forest to be cleared and reduces impacts to available maternity habitat. In order to protect bats potentially roosting in the project study corridors during construction, tree-cutting moratoriums could be instituted during the roosting season. After project construction is complete, removal of trees would follow the National Park Service's Hazardous Tree Guidelines.

Minimization of impacts to bald eagles may be accomplished by designating restricted zones (no-wake areas) on Fontana Lake adjacent to known eagle nests, limiting land-disturbing activities to periods outside the nesting season, and reducing the construction footprint. Due to engineering constraints the proposed construction footprint for the Partial-Build Alternative to Bushnell or Northern Shore Corridor has already minimized direct impacts to potential bald eagle nesting sites. These birds prefer to nest on promontories, in the highest tree with a clear view to and within 1 mile (1.6 km) of open water. While the majority of road construction footprint is within 1 mile (1.6 km) of the north shore of Fontana Lake, it rarely follows a ridge line and crosses most ridges in saddles, thus leaving most potential nesting sites intact. These birds seem to adapt well to modified landscapes, often nesting in close proximity to development. However, the reactions of individual birds are unknown and may vary.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Mitigation Techniques

If a partial-build or build alternative is selected, NPS would develop a comprehensive survey plan for the Indiana bat to determine this species' status in the vicinity of the alternative. The objectives of the survey would be to evaluate potential habitat, especially the summer maternity roosting potential, and determine the actual utilization of the area. The survey would assist in identifying maternity colony sites and establishing appropriate tree-cutting moratoria. Surveys would begin prior to initiation of construction. The surveys would follow the mist-netting guidelines as specified in the Indiana Bat Revised Recovery Plan (USFWS 1999). Yearly population monitoring (as required by USFWS) would be conducted by NPS during and following any construction time frame. Coordination with USFWS would be ongoing to determine the need for additional recommendations to protect or mitigate for impacts to the Indiana Bat.

If an alternative involving construction, other than the Laurel Branch Picnic Area, is implemented, NPS would develop a comprehensive survey and monitoring plan for the bald eagle to determine this species' status in the Park. This plan would be developed in cooperation with property managers of lands adjacent to GSMNP. Monitoring of known eagle nests would follow the *Bald Eagle Monitoring Guidelines* (USFWS 2002a) and the *Habitat Management Guidelines for the Bald Eagle in the Southeast Region* (USFWS 1987). Surveys would begin prior to initiation of construction. Yearly population monitoring (as required by USFWS) would be conducted by NPS during and following any construction time frame. Coordination with USFWS would be ongoing to determine the need for additional recommendations to protect or mitigate for impacts to the bald eagle.

Enhancement Techniques

Enhancement measures may be used to offset the impacts to protected species that result from any of the alternatives. Enhancement measures may be used in cooperation with mitigation techniques to offset impacts. Funding of educational programs and of research that target the relationship between transportation systems and federally protected species may enhance our ability to preserve and protect natural resources. For Indiana bats, suggested enhancement techniques include gating of existing mines and caves within the Park known to harbor Indiana bats and utilizing prescribed fire to improve habitat.

4.4.10.1.5 Impairment Evaluation

Impairment of federally protected endangered and threatened species in GSMNP and along the AT would not occur under the No-Action Alternative, Monetary Settlement Alternative, Laurel Branch Picnic Area, and the Partial-Build Alternative to Bushnell. The Northern Shore Corridor is not likely to impair federally protected endangered and threatened species in GSMNP or along the AT based on the information obtained to date. Due to the magnitude of this alternative, it is likely that additional NEPA documentation would be required to address site specific impacts not currently known and to determine detailed mitigation measures as they relate to final design. The impairment determination related to federally protected endangered and threatened species would be re-evaluated in such documentation.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

4.4.10.2 Federal Species of Concern (FSC), Candidate, and State Protected Species

4.4.10.2.1 Methodology for Assessing Impacts

All of the FSC, candidate, and state protected species applicable to the project study are discussed in Appendix N. Only the species that have been found within the project study corridors are included in this section. Direct impacts to known populations of FSC, candidate, and state protected species may occur from loss of habitat and individuals within the construction footprint. Indirect impacts to these species may occur as a result of changes in daily and seasonal migration patterns, behavior, mortality (road related) and edge effect due to ecosystem fragmentation.

Investigations undertaken for this study have discovered species new to the Park, new records for rare species known from the Park, and species new to science. These investigations did not constitute a comprehensive survey of the project study corridors and they covered less than one percent of the total land contained within the Park.

Type

Impacts are either beneficial and/or adverse. Beneficial impacts are defined as having a positive effect on protected species. Adverse impacts have a negative effect on protected species.

Context

Context is defined as site-specific, local, and regional. Site-specific is the area within the construction footprint. Local is defined as the area within 2.0 miles (3.2 km) of the construction footprint or the northern shore of Fontana Lake (whichever is less). The 2.0-mile (3.2-km) radius was selected because it is the guideline used within North Carolina when discussing a known population of threatened or endangered species. Regional is the area bounded by the northern shore of Fontana Lake, the North Carolina/Tennessee state line, Twentymile Ridge on the west, and Noland Creek on the east. This area was selected because the mountain ridges and lake form a natural ecological boundary and for which a suitable analysis and discussion of possible impacts could be undertaken.

Duration

Short-term impacts are those that would occur for less than 1 year, typically as an episodic or temporary event. Long-term effects occur as a result of construction activities at a specific location throughout the life of construction (this is assumed to be between 1 year and 15 years), but the impact is more than that of a temporary event. Permanent impacts are considered to be anything that persists throughout the construction period. These impacts include the permanent loss of potential habitat.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Intensity

Intensity is the degree to which resources are affected and are categorized as negligible, minor, moderate, and major. The following definitions characterize the intensity of potential impacts to FSC and state protected species.

No/Negligible

The project would have no discernable impacts on species of concern or on their potential habitat.

Minor

Potential impacts on species of concern may occur as a direct or indirect result of the proposed action and are expected to be discountable, insignificant, or completely beneficial. There may be loss of potential habitat, but no individuals are expected to be affected.

Moderate

Potential impacts may occur as a direct or indirect result of the proposed action, and the effects are not discountable, insignificant or completely beneficial. There may be a loss of potential habitat and it is likely that individuals may be lost, but the overall population in the Park would survive.

Major

Potential impacts on listed species may occur as a direct or indirect result of the proposed action and are expected to reduce appreciably the likelihood of survival of the species of concern in the Park by reducing the reproduction, numbers, or distribution of that species.

4.4.10.2.2 Summary of Impacts

Of the FSC, candidate, and state protected species analyzed for this project, one species, the olive darter, is anticipated to have adverse impacts expected to reach the “major” category of intensity from study alternatives. Within GSMNP, there are two confirmed populations of the olive darter; one each in Forney and Hazel creeks. There is also a potential population in Noland Creek; however, this population has not been observed within the last 15 years.

No-Action

There would be no impacts to either FSC or state listed species if the No-Action alternative is selected.

Clarification of the term “baseline” for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Monetary Settlement

While impacts to FSC, candidate, and state listed species would not be anticipated from the Monetary Settlement Alternative, potential impacts from actions outside GSMNP would depend on local use of funds.

Laurel Branch Picnic Area

Vertebrates: Impacts to 11 of the 14 FSC, candidate, or state protected vertebrate species found within the project study corridors would be minor, adverse, site-specific to local, and permanent. They are Rafinesque's big-eared bat, northern long-eared bat, Southern Appalachian woodrat, long-tailed shrew, southern water shrew, northern pine snake, cerulean warbler, hellbender, Junaluska salamander, seepage salamander, and smoky dace. The timber rattlesnake would likely encounter moderate, adverse, site-specific to local, permanent impacts. Impacts to the sicklefin redhorse and olive darter would be negligible, adverse, site-specific to local and permanent because habitat is not present within the Laurel Branch Picnic Area. However, the olive darter is thought to occur in nearby Noland Creek.

Invertebrates: Impacts to all five FSC or state protected invertebrate species found within the project study corridors would be minor, adverse, site-specific to local, and permanent. These species are the queen crater, dark glyph, fringed coil, dwarf proud globe, and Diana fritillary.

Plants: Impacts to the three vascular plants found within the project study corridors would be minor, adverse, site-specific to local, and permanent. These species are the butternut, sweet pinesap, and Carolina saxifrage.

Partial-Build Alternative to Bushnell (Primitive and Principal Park Roads)

Vertebrates: Impacts to six of the 14 FSC, candidate, or state protected vertebrate species found within the project study corridors would have minor, adverse, site-specific to local and permanent impacts from the baseline Partial-Build Alternative to Bushnell. These species are Rafinesque's big-eared bat, southern water shrew, northern pine snake, cerulean warbler, Junaluska salamander, and seepage salamander. Due to the habitat that would be impacted by this alternative, five species in addition to the timber rattlesnake would encounter moderate, adverse, site-specific to local, permanent impacts for both road types. They are the northern long-eared bat, Southern Appalachian woodrat, hellbender, and smoky dace. The long-tailed shrew would encounter minor impacts from the Principal Park Road and moderate impacts from the Primitive Park Road. The olive darter would encounter minor impacts from the Principal Park Road and major, adverse, site-specific to local, and long-term to permanent impacts from the Primitive Park Road. The Primitive Park Road could lead to a reduction in one population of the olive darter (at Hazel Creek).

Invertebrates: Impacts to the dark glyph and the fringed coil would be moderate, adverse, site-specific to local, and permanent due to potential loss of habitat for the baseline Partial-Build Alternative to Bushnell.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Impacts to the remaining three species of invertebrates found within this area would be minor, adverse, site-specific to local, and permanent. These species are the queen crater, dwarf proud globe, and Diana fritillary.

Plants: The baseline Partial-Build Alternative to Bushnell would impact the three vascular plants: butternut, sweet pinesap, and Carolina saxifrage. The impacts would be minor, adverse, site-specific to local, and permanent.

Southern Option at Forney Creek Embayment (Primitive and Principal Park Roads)

Impacts due to direct habitat loss would be reduced from the baseline Partial-Build Alternative to Bushnell because the construction footprints for both the Primitive and Principal Park Roads would impact less area. This option would avoid known populations of olive darter and hellbender in Forney Creek and northern long-eared bat, Southern Appalachian woodrat, and long-tailed shrew found in the vicinity of Forney Creek.

Northern Shore Corridor (Primitive and Principal Park Roads)

Vertebrates: Impacts to the northern pine snake are anticipated to be minor, adverse, site-specific to local, and permanent. Impacts to 11 vertebrates found within the baseline Northern Shore Corridor are anticipated to be moderate, adverse, site-specific to local, and permanent. These species are Rafinesque's big-eared bat, northern long-eared bat, Southern Appalachian woodrat, southern water shrew, cerulean warbler, timber rattlesnake, hellbender, Junaluska salamander, seepage salamander, sicklefin redhorse, and smoky dace. The long-tailed shrew would encounter minor impacts from the Principal Park Road and moderate impacts from the Primitive Park Road. The olive darter would encounter major, adverse, site-specific to local, and long-term to permanent impacts. While both road types for the baseline Northern Shore Corridor would have major adverse impacts to the olive darter due to potential loss of individuals, habitat loss, and negative changes in water quality, they differ in the number of creeks and associated populations affected. Impacts from the Primitive Park Road could lead to a reduction in two populations of the olive darter (at both Forney and Hazel creeks) while impacts from the Principal Park Road could lead to a reduction in one population of this fish (at Hazel Creek).

Invertebrates: Impacts to the five invertebrate species would be moderate, adverse, site-specific to local, and permanent. These species are dark glyph, queen crater, fringed coil, dwarf proud globe, and Diana fritillary.

Plants: Impacts to the Carolina saxifrage are anticipated to be minor, adverse, site-specific to local, and permanent for the baseline Northern Shore Corridor. Impacts to the remaining two vascular plant species, butternut and sweet pinesap, would be moderate, adverse, site-specific to local, and permanent.

Southern Option at Forney Creek Embayment (Primitive and Principal Park Roads)

Impacts due to direct habitat loss would be reduced from the baseline since the construction footprint for both the Primitive and Principal Park Roads would impact less area than the baseline Northern Shore

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

Corridor. This option would avoid known populations of olive darter and hellbender in Forney Creek and northern long-eared bat, Southern Appalachian woodrat, and long-tailed shrew found in the vicinity of Forney Creek. There would be no change from the baseline Northern Shore Corridor in potential impacts to other species.

Southern Option at Hazel and Eagle Creek Embayments (Primitive and Principal Park Roads)

Impacts due to direct habitat loss would be reduced from the baseline Northern Shore Corridor because the construction footprints for both the Primitive and Principal Park Roads would impact less area. This option would avoid known populations of the northern long-eared bat, Southern Appalachian woodrat, hellbender, seepage salamander, smoky dace, and the olive darter. There would be no change from baseline in potential impacts to other species.

Southern Option Crossing Fontana Dam (Primitive and Principal Park Roads)

Impacts due to direct habitat loss would be reduced from the baseline Northern Shore Corridor since the construction footprint for both the Primitive and Principal Park Roads would impact less area. No known populations of FSC or state protected species would be avoided by selecting this option.

Cumulative Impacts

Past actions in the study area, described in Section 4.1.2, affected both terrestrial and aquatic FSC, candidate, and state protected species. Aquatic species within the study area have been affected by decreased water quality from timber and mining activities and by Fontana Dam. Fontana Lake and other impoundments on the Tennessee River have limited habitat and isolated certain fish such as the olive darter and mussels that require habitat of large to medium sized streams. The impoundments form a barrier that prevents the natural migration to existing streams. Future projects in the area including NCDOT TIP projects, construction on the Ravensford site, and completion of Foothills Parkway could affect other populations of these species.

FSC and state protected terrestrial species are rare due to present or threatened destruction, modification, or limitation of its habitat or range (Stein et al. 2000). In the past, historically forested landscapes in the study area vicinity have been divided by roads and reduced by commercial and residential development. Future projects including NCDOT TIP projects, construction on the Ravensford site, and completion of Foothills Parkway, would result in habitat loss, habitat fragmentation, and reduced habitat quality in the study area.

When added to those projects, it is possible that the impacts to FSC and state protected species to be caused by the partial-build alternatives and the build alternatives could constitute cumulative impacts on the terrestrial resources of the region. These cumulative effects have occurred and will continue to occur as a result of landscape modification. Mitigation to protect, enhance, and restore sensitive habitats would minimize the potential cumulative effects on the region's protected species.

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

4.4.10.2.3 Options to Address Potential Impacts

NPS would employ the sequence of avoiding adverse impacts to FSC and state protected species to the extent practicable, minimizing impacts that could not be avoided, and attempting to compensate for remaining adverse impacts. It will not be possible to avoid or mitigate for all impacts. More detailed information on mitigation techniques and strategies for FSC and state protected species is contained in Appendix N.

Avoidance Techniques

Selection of the No-Action or Monetary Settlement Alternatives would avoid impacts to FSC and state protected species and their habitats within GSMNP. It would not be possible to completely avoid impacts to these species by selection of a partial-build or build alternative.

Avoidance of some known hellbender, olive darter and smoky dace populations may be accomplished by selection of the southern options for both the Partial-Build Alternative to Bushnell and Northern Shore Corridor. Additional information concerning avoidance of impacts to aquatic organisms is located in Aquatic Ecology, Section 4.4.4. Alignment adjustments that move the construction footprint away from important habitats such as boulder fields, talus slopes, and rare vegetation communities may avoid impacts to some known locations of species such as timber rattlesnake, Rafinesque's big-eared bat, northern long-eared bat, Southern Appalachian woodrat, cerulean warbler, Junaluska salamander, seepage salamander, invertebrates, and plants. Additional information for these species is located in Vegetation Communities, Section 4.4.5; Terrestrial Wildlife, Section 4.4.6; and Migratory Birds, Section 4.4.8. Avoiding impacts to one species may result in additional impacts to other species or resources. The potential benefits of avoidance for one resource will need to be weighed against the potential to impact other resources on a case-by-case basis.

Minimization Techniques

Impacts to rare species may be reduced by incorporating bridging of wetland systems and retaining walls to limit footprint impacts into the roadway design. Road alignments designed to cross stream systems at right angles would minimize impacts to forested zones along waterways and would reduce potential degradation of stream systems from erosion and sedimentation. Well-planned placement of wildlife crossing structures for rare species of terrestrial vertebrates could provide safe passage options for daily and seasonal migrations.

Mitigation Techniques

Rehabilitation of degraded wetlands, streams, and vegetation communities in GSMNP could restore natural habitat for rare terrestrial and aquatic species. Impacts to populations of FSC and state protected plants and aquatic organisms that cannot be avoided or minimized may be mitigated by relocation of these organisms to

Clarification of the term "baseline" for this project:

The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.

appropriate habitats found in GSMNP. This would be possible with some vegetative and aquatic animal species that could be collected and relocated such as the smoky dace, olive darter, and sweet pinesap. Monitoring of these relocated populations would likely be required. The possibility exists that, following construction, conditions would be favorable for reintroduction of some rare populations to their original locations. Monitoring the condition of these reintroduced populations would likely be required. However, this technique would have high cost and limited success and would only be implemented if impacts were imminent.

Enhancement Techniques

Enhancement measures may be used to offset the impacts to FSC, candidate, and state protected species that result from any of the partial-build or build alternatives. The immediate reestablishment of natural vegetation following construction activities may decrease the potential for impacts to adjacent populations of FSC, candidate, and state protected species. Funding of educational programs and research that targets the relationship between transportation systems and rare species may enhance our ability to preserve and protect natural resources.

4.4.10.2.4 Impairment Evaluation

Impairment of FSC, candidate, and state protected species in GSMNP and along the AT would not occur under the No-Action Alternative, Monetary Settlement Alternative, Laurel Branch Picnic Area, and the Partial-Build Alternative to Bushnell. The Northern Shore Corridor is not likely to impair FSC, candidate, and state protected species in GSMNP or along the AT based on the information obtained to date. Due to the magnitude of this alternative, it is likely that additional NEPA documentation would be required to address site specific impacts not currently known and to determine detailed mitigation measures as they relate to final design. The impairment determination related to FSC, candidate, and state protected species would be re-evaluated in such documentation.

4.5 Impacts to Aesthetics and Visual Resources

Several of the alternatives would impact visual resources in the study area. Impacts were evaluated by assessing views from the 14 viewpoints described in Aesthetics and Visual Resources, Section 3.5. It was determined that views of portions of the alternatives were possible from 11 of the 14 viewpoints due to the direction of the view, the steep topography of the area, and vegetation. Impacts to visual resources include changes to the existing views from the 14 viewpoints that would occur as a direct result of the construction of the alternatives, as well as impacts to visual resources as a result of the alternatives that would occur later in time.

The following sections present impacts to aesthetic and visual resources by alternatives. The existing and anticipated views from each of the viewpoints are included as Figures 5-33 of the Aesthetic and Visual Resources Technical Report (Appendix O). Also, the worksheets describing the impact assessment at each

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The Partial-Build Alternative to Bushnell and the Northern Shore Corridor include a baseline route, as well as options to that route. Baseline routes and options are detailed in Section 2.5 and shown on Figure 2-8. Baseline routes have been compared to existing conditions. Impact analyses for the options are shown as a difference from the associated baseline route.