

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter explains the methods and assumptions used for analyzing impacts of the alternatives described in Chapter 2. For each alternative, direct and indirect environmental effects are disclosed for each impact topic discussed in Chapter 3.

Methodology and Assumptions for Assessing Impacts

In order to analyze the environmental consequences of the alternatives proposed in this document, several factors must be examined for each resource: type of impact, duration of impact, and context and intensity of impact. The discussion for each impact topic includes an analysis of the impacts of each alternative, followed by an assessment of cumulative impacts, and a conclusion.

It is assumed that the Transportation Plan would be in effect for the next 5 to 10 years. During that time, it is assumed that there would be a slight to modest increase in visitation and a slight increase in traffic volumes. These assumptions are based on past visitor trends, which show relatively stable visitation numbers since 1993, even during years when the surrounding communities were experiencing a much higher growth rate. Traffic volume assumptions are tied to the visitation prediction. It is understood that several factors would affect visitation and traffic volumes, including general population growth, population growth in the states that contribute the most visitors to the park, the general state of the economy (especially the cost of gasoline), general demographics, and recreational preferences.

Type of Impact

Impacts can be beneficial or adverse, direct or indirect, or cumulative. Beneficial impacts are those that involve a positive change in the condition or appearance of a resource or a change that moves the resource toward a desired condition. Adverse impacts involve a change that moves the resource away from a desired condition or detract

from its appearance or condition. Direct impacts are caused by an action and occur at the same time and place as the action. Indirect impacts are caused by the action and occur later or farther away but are still reasonably foreseeable. Cumulative impacts are the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

Context, Intensity, Duration

Impacts are also described as to their context, intensity, and duration. Context generally refers to the geographic extent of impact (e.g., localized or widespread). Impact intensity is the magnitude or degree to which a resource would be beneficially or adversely affected. The thresholds that were used to assess the intensity of the impacts for each resource topic are presented later in this section under each impact topic heading. Impact duration refers to how long an impact would last. For the purposes of this Plan/Draft Environmental Impact Statement (DEIS), duration of the impacts is also specified separately for each impact topic.

Area of Analysis

The area of analysis for impact assessment is defined separately for each impact topic and is identified at the end of the impact thresholds definitions for each topic. The area of analysis was used as the geographic basis for assessment of impacts from the proposed actions under each alternative, as well as cumulative impacts, and includes areas surrounding the park as appropriate for the topic discussed.

Cumulative Impacts

Cumulative impacts are also considered in this analysis. A cumulative impact is described in the Council on Environmental Quality regulations (1508.7) as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reason-



ably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions.” Cumulative impacts can result from individually minor but collectively major actions taking place over a period of time.

Cumulative impacts of each alternative were addressed by considering the effects of the alternative, combined with the effects of past, present, and reasonably foreseeable future actions that were identified in and around the project area. The area of analysis for each impact topic is provided in the methodology section for each topic, and also applies to the cumulative analysis. Generally, this includes the frontcountry area of the park; for some topics, surrounding communities are also included. Projects occurring within the jurisdictional areas of the Town of Jackson and Teton Village were also identified through correspondence and phone calls with county and city governments and federal land managers. Projects include any planning or development activity that was currently being implemented or would be implemented in the reasonably foreseeable future that would contribute to cumulative impacts within the designated areas of analysis for this Plan/DEIS. A comprehensive list of such projects is provided in Appendix A.

Impairment Analysis Method

National Park Service (NPS) Management Policies (2001) require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within the park, that discretion is

limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may constitute impairment, but an impact would be more likely to constitute impairment to the extent that it has a major or severe adverse effect upon 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
- Identified as a goal in the park’s General Management Plan (GMP) or other relevant NPS planning documents.

An impact would be less likely to constitute impairment to the extent that it is an unavoidable result, which cannot be further mitigated, of an action necessary to preserve or restore the integrity of park resources or values.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. A determination on impairment is made in the Environmental Consequences section for all natural and cultural resource impact topics defined in Chapter 1, Purpose of and Need for Action. Impairment analysis and determinations are not required for visitor use and experience (unless the impact is resource-based), park operations, or socioeconomic environment (including economics, employment, housing, and land use).

Adverse impacts determined to have moderate or below (i.e., no impact, negligible, minor) intensities are not analyzed further relative to the impairment standard because of their relatively low magnitude. All major adverse impacts are evaluated using the three-bulleted criteria above. Discussion of impairment is presented at the end of the conclusion section for each impact topic.



Visual and Scenic Quality

Methods and Assumptions

Locations of proposed pathway and shoulder improvements, and locations of key viewpoints were identified and view corridors relative to these

locations were considered. Also considered was the length of time that an improvement would be seen by the viewer, based on the width of the view corridor and the speed at which the viewer would be traveling.

Impact Threshold Definitions

Negligible	Visitors would likely be unaware of any effects associated with implementation of the alternative.
Minor	Alterations in views would be slight but detectable, would affect few visitors, and would not appreciably limit or enhance visual resources identified as fundamental to the park's purpose and significance.
Moderate	Many visitors would likely be aware of the effects associated with implementation of the alternative; some changes to visual resources identified as fundamental to the park's purpose and significance would be apparent.
Major	Most visitors would be aware of the effects associated with implementation of the alternative; changes to visual resources identified as fundamental to the park's purpose and significance would be readily apparent.
Duration	Short term – effects last one year or less.
	Long term – effects last longer than one year.
Area of Analysis	Travel routes and destinations within the park boundary.

Effects of Alternative 1 – No Action Alternative

Grand Teton National Park is world renowned for its spectacular scenery and views of the Teton Range, Jackson Hole, and native wildlife. The project area is located in the frontcountry areas of the park, where some development is already present. Views of the park from within developed areas, road corridors, parking areas or other locations where development exists typically include some elements of that development; however, under Alternative 1, no additional development would be inserted into the various viewsheds.

Visitation is expected to increase slightly over the next 5 to 10 years, resulting in slight increases in the amount of motor vehicle traffic. Consequently, views from along the road corridors or parking areas could include additional vehicles, and parking areas and turnouts could also be somewhat busier.

Implementation of pilot management strategies on the Moose – Wilson Road is intended to recognize the sensitivity of the area in terms of its wildlife and scenic values, and would help to retain the existing character of the road. Currently, some foreground views are adversely affected by the ac-

cumulation of dust on vegetation. Since the pilot strategies would be designed to approximately maintain the existing traffic volumes, the amount of dust would not be likely to increase, and could be decreased through the application of dust control agents. Traffic related to any pilot transit program would change the nature of the visual impact of vehicle use along this corridor, since transit vehicles would be replacing individual vehicle use.

Overall, Alternative 1 would result in negligible to minor, long-term adverse impacts on visual quality.

Cumulative Impacts

Cumulative impacts to visual and scenic quality would include additional development and/or modification to the manmade environment undertaken to enhance visitor experience. Within the park, these projects include construction of a new visitor center at Moose, replacement of the Moose Entrance Station, construction of a new visitor facility at the JY Ranch, and reconstruction of the North Park Road between Lizard Creek Campground and the South Entrance of Yellowstone. The latter project will widen the roadway

from its current 25-foot (approximate) width to 32 feet.

These projects would result in short-term impacts on visual quality during periods of construction. Foreground views in localized areas could include construction equipment, fencing, stockpiled materials, and other intrusions into the natural setting. Construction-related visual impacts would be moderate and adverse, short-term, and localized.

Overall, impacts described under Alternative 1, combined with impacts of other actions that could affect visual and scenic quality within the park, would result in negligible to minor, long-term, adverse cumulative impacts to visual quality. Short-term, moderate adverse cumulative impacts would occur at locations of construction projects during the period of construction.

Conclusion

Alternative 1 would result in negligible to minor, long-term adverse impacts on visual quality. Cumulative impacts would be generally be long term, negligible to minor, and adverse, with moderate, short-term adverse impacts occurring during short periods during construction.

Because there would be no major, adverse impacts to visual and scenic quality whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's visual and scenic quality.

Effects of Alternative 2 – Minimal Action Alternative

In general, the effects of Alternative 2 on visual quality would be similar to those described for the No Action Alternative, with the exception that road shoulders would be widened to a 5-foot width on the Teton Park Road between Moose and Signal Mountain Lodge. In addition, variable messaging signs and informational kiosks would be installed in several locations; however, these would be designed and sited so as to minimize their visual intrusion. Limiting motorized traffic along Signal Mountain Road would eliminate

visual impacts caused by traffic along the road for the non-motorized users.

Construction of the shoulder improvements and kiosks or additional signs would result in short-term impacts on visual resources during construction. Visitors may be aware of construction equipment, fencing, stockpiled materials, and other intrusions into the natural setting. Because weather conditions in the park may preclude staging construction during less-busy seasons, and because some of these areas would be difficult to make inaccessible to visitors while construction is underway, construction-related visual impacts would be moderate and adverse, short-term, and localized, and would affect visitors and employees.

Cumulative Impacts

Cumulative impacts under Alternative 2 would be essentially the same as those described for Alternative 1. Overall, the impacts of these related actions, in conjunction with the impacts of Alternative 2, would result in negligible to minor, long-term, adverse cumulative impacts to visual quality within the park. Moderate, short-term, adverse cumulative impacts to visual resources would occur at the locations of construction projects, during the construction period, and for up to a one-year recovery period following construction.

Conclusion

Alternative 2 would result in negligible to minor, long-term, adverse impacts on visual quality, with short-term, moderate, adverse impacts during construction of improved shoulders. Cumulative impacts would generally be long term, negligible to minor, and adverse, with moderate, short-term adverse impacts occurring during periods during construction.

Because there would be no major, adverse impacts to visual and scenic quality whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's visual and scenic quality.



Effects of Alternative 3 – Preferred Alternative

Under Alternative 3, a system of multi-use pathways would be constructed, separate from the roadways but generally within approximately 50 to 150 feet of the road. The pathways would extend along U.S. Highway (U.S.) 26/89/191 from the south boundary to Moose Junction, from Moose Junction to Antelope Flats Road, and from Moose Junction to North Jenny Lake Junction. A multi-use pathway would also be constructed along the Moose – Wilson Road, extending from the Granite Canyon Entrance to the north end of the unpaved portion of the road. From that point, it would divert eastward from the road and follow the long-established alignment of the unpaved levee access road to the future (planned for 2006) location of the JY Visitor Center, at which point it would terminate. In addition to the pathways, road shoulders would be widened between North Jenny Lake Junction and Colter Bay. Short-term impacts related to construction would be moderate and adverse.

The pathways would be a new feature, intruding into the foreground views as seen from the affected road corridors and would be visible by motorists most of the time. Approximately 0.75 mile of the multi-use pathway along the Moose – Wilson Road would pass through an area of dense forest and would require the removal of a substantial number of trees, which would alter the existing character of the road corridor. Although the pathway would be designed and sited to minimize tree removal and impacts on the visual quality of the area, the new development introduced into the view corridor would be obvious to most visitors. This would result in long-term, moderate, adverse impacts on visual quality.

Other elements of Alternative 3, including the installation of variable messaging signs and informational kiosks, would have impacts on visual quality similar to that described in Alternative 2.

Cumulative Impacts

Cumulative impacts under Alternative 3 would be similar to those described for Alternative 1, but with the added impacts of the separated pathways. Overall, the impacts of these related actions, in conjunction with the impacts of Alternative 3,

would result in minor to moderate, long-term, adverse cumulative impacts to visual quality within the park. Moderate, short-term, adverse cumulative impacts to visual resources would occur at the locations of construction projects, during the construction period and for up to a one-year recovery period following construction.

Conclusion

Alternative 3 would result in moderate, long-term, adverse impacts on visual quality, primarily as a result of the introduction of multi-use pathways into the foreground views as seen from the affected road corridors. Widened shoulder between North Jenny Lake Junction and Colter Bay would also contribute to the adverse impacts, but to a lesser degree. Moderate, short-term, adverse impacts would result during construction of improved shoulders and pathways. Cumulative impacts would be minor to moderate, long term, and adverse, with short-term moderate adverse impacts during periods of construction.

Because there would be no major, adverse impacts to visual and scenic quality whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's visual and scenic quality.

Effects of Alternative 4 – Extended Pathways

Under Alternative 4, an extensive system of multi-use pathways would be constructed, separate from the roadways but generally within approximately 50 to 150 feet of the road. The pathways would extend along U.S. 26/89/191 from the south boundary to Moose Junction, from Moose Junction to Antelope Flats Road, and along the Teton Park Road from Moose Junction to Jackson Lake Junction, except for approximately two miles where a separated pathway could not be constructed and shoulder widening would be done instead. From Jackson Lake Junction, the pathway would extend as far north as Colter Bay. A multi-use pathway would also be constructed along the Moose – Wilson Road, extending from the Granite Canyon Entrance all the way to Moose, with a diversion

away from the road along the levee access road to the JY Visitor Center, as described in Alternative 3. Where portions of the Moose – Wilson Road are realigned, the pathway would follow those realignments. Short-term impacts related to construction would be moderate and adverse.

The pathways would be a new feature, intruding into the foreground views as seen from the affected road corridors and would be visible by motorists most of the time. This would result in long-term, moderate to major, adverse impacts on visual quality. Approximately 0.75 mile of the multi-use pathway along the Moose – Wilson Road would pass through an area of dense forest and would require the removal of a significant number of trees, which would alter the existing character of the road corridor. Although the pathway would be designed and sited to minimize tree removal and impacts on the visual quality of the area, the new development introduced into the view corridor and the change in character of the views would be obvious to most visitors.

Other elements of Alternative 4, including the installation of variable messaging signs and informational kiosks, would have impacts on visual quality similar to that described in Alternative 2.

Cumulative Impacts

Cumulative impacts under Alternative 4 would be essentially the same as those described for Alternative 1, but with the added adverse impacts of the more extensive separated pathway system, especially in forested areas. Overall, the impacts of these related actions, in conjunction with the impacts of Alternative 4, would result in minor to major, long-term, adverse cumulative impacts to visual quality within the park. Moderate, short-term, adverse cumulative impacts to visual resources would occur at the locations of construction projects, during the construction period and for up to a one-year recovery period following.

Conclusion

Alternative 4 would result in moderate to major, long-term adverse impacts on visual quality, largely as a result of the introduction of multi-use pathways into the foreground views as seen from the affected road corridors. Moderate, short-term, adverse impacts would result during construction.

Cumulative impacts would be minor to major, long term, and adverse, with short-term moderate adverse impacts from construction activities.

Because there would be no major, adverse impacts to visual and scenic quality whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's visual and scenic quality.

Soils

Methods and Assumptions

Three measures of soils impacts are considered in this analysis: soil removal, soil compaction, and soil restoration. Activities that may result in soil impacts include widening shoulders and constructing pathways.

Impacts to soils were assessed by examining the soils information and mapping for Grand Teton National Park described in Chapter 3. Disturbances were estimated based on the length and estimated width of the proposed pathways or shoulders in each area transected. Impacts from widened road shoulders were estimated by applying an estimated 5-foot width of permanent vegetation disturbance and a 5-foot width of temporary construction-related disturbance (i.e., extension of existing shoulders on both sides). Impacts from construction of separated multi-use pathways were estimated by applying a 14-foot width of permanent vegetation disturbance plus a 14-foot width of temporary, construction-related disturbance (i.e., heavy machinery use, grading, stockpiling) per pathway. In all cases, precise pathway locations and exact specifications have not been determined; some amount of error in disturbance estimates is expected.



Impact Threshold Definitions

Negligible	Soils would not be affected or the effects to soils would be below or at the lower levels of detection. Any effects to soil productivity or fertility would be slight.
Minor	The effects to soils would be detectable. Effects to soil productivity or fertility would be relatively small, as would the area affected. If mitigation were needed to offset adverse effects, it would be relatively simple to implement and likely successful.
Moderate	The effect on soil productivity or fertility would be readily apparent and result in a change to the soil character over a relatively wide area. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
Major	The effect on soil productivity or fertility would be readily apparent and would substantially change the character of the soils over a large area in and outside of the park. Mitigation measures to offset adverse effects would be needed and would be extensive; their success could not be guaranteed.
Duration	Short term - recovers in less than three years.
	Long term – requires more than three years to recover.
Area of Analysis	Within park boundary.

Effects of Alternative 1 – No Action Alternative

Under Alternative 1, there would be no direct impacts to soils from construction of new transportation or information kiosks/signs. However, there would be continued impacts to soils where visitors pull off roadways or parking lots onto adjacent unpaved areas or create social trails. Also, continued road maintenance may result in a small loss of soils if repairs or widening occur adjacent to the existing roadbed. These activities would result in soil compaction and associated loss of productivity along roadways and at the developed activity areas. For example, an extensive social trail network has developed at South Jenny Lake. Compaction also occurs as a result of vehicles parking on the entry drive shoulder, especially during the popular summer months. An extensive social trail network is also apparent at Colter Bay. Continued long-term, direct, adverse impacts would be negligible to minor, since these impacts would be limited to relatively small and often previously disturbed areas.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park would adversely impact soils. These projects include construction of the new Moose Visitor Center and construction of an interpretive center for the JY Ranch. Other smaller projects include the replacement of entrance stations and the construction of new housing at Moose. All of these developments would

occur in areas where human activities are already concentrated, thus minimizing impacts to soils in previously undisturbed areas. Also, all work would be done following mitigation measures that call for preservation of topsoil and reclamation of disturbed areas with native vegetation. Widening North Park Road would result in the permanent loss of approximately 33 acres of soils along an existing road corridor within the park. In addition, the Wyoming Department of Transportation (WYDOT) is planning several road projects outside the park. All of these projects would also result in the permanent loss of soils along existing road corridors, and short-term, construction-related disturbance would also occur within the areas where these projects would be implemented. However, all construction would incorporate mitigation measures to preserve soils and provide for soil and vegetation reclamation.

The impacts of these related actions, in conjunction with the impacts of Alternative 1, would result in negligible to minor, long-term, adverse cumulative impacts to soils within the park. Alternative 1 would contribute a very small increment to the overall cumulative impact.

Conclusion

Alternative 1 would result in negligible to minor, long-term, direct adverse impacts on soils due to the continued use of social trails and illegal off-road parking. Cumulative impacts would be negligible to minor, long-term, and adverse.

Because there would be no major, adverse impacts to soils whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's soil resources.

Effects of Alternative 2 – Minimal Action Alternative

Under Alternative 2, impacts to soils would occur from the same causes as described for Alternative 1: continued off-road parking and use of social trails, and occasional road maintenance, with resultant long-term negligible to minor direct adverse impacts. Alternative 2 would also include direct and adverse impacts relating to the widening of approximately 18 miles of Teton Park Road to a 5-foot width from Moose Junction to Signal Mountain Lodge. The widening of road shoulders along Teton Park Road would permanently remove approximately 11 acres of mainly gravelly loam soils and cause temporary disturbance of another 11 acres where construction equipment would be used adjacent to the main work area. Impacts would be long-term, adverse, and minor, since impacts would not affect a wide area of the park, and areas bordering the shoulders would be revegetated.

Visitor information kiosks would be installed within activity areas on existing disturbed ground, and would not result in net new disturbance. Alternative 2 would also include installation of roadside variable messaging signs at locations within and outside the park. These signs would also be located on existing disturbed grounds at roadway shoulders and major intersections, and thus would involve no additional permanent disturbance.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that would adversely impact soils under Alternative 1 would also apply to Alternative 2. Overall, impacts of these actions, in conjunction with impacts of Alternative 2, would result in long-term negligible to minor adverse impacts to soils within the park. Alterna-

tive 2 would contribute only a negligible amount to overall cumulative impacts.

Conclusion

Alternative 2 would result in long-term, negligible to minor adverse impacts to soils due to continued use of social trails, illegal off-road parking, and construction of shoulders along a portion of the Teton Park Road. Cumulative impacts would be negligible to minor, long term, and adverse.

Because there would be no major, adverse impacts to soils whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's soil resources.

Effects of Alternative 3 – Preferred Alternative

Under Alternative 3, a system of separated pathways would be constructed, separate from the roadways but generally within approximately 50 to 150 feet of the road. The pathways would extend along U.S. 26/89/191 from the south boundary to Moose Junction, from Moose Junction to Antelope Flats Road, and from Moose Junction to North Jenny Lake Junction. Shoulders would be widened along Teton Park Road and North Park Road from North Jenny Lake Junction to Colter Bay. Social trails would be improved and delineated at South Jenny Lake, Jenny Lake Lodge, Jackson Lake Lodge, and Signal Mountain. All these actions would lessen the off-road parking use or creation of social trails that have been causing negligible to minor long-term, adverse impacts to soils in localized areas around the park. The construction of road shoulders and improved social trails would result in a permanent loss of soils, but these areas have already been disturbed; therefore, new impacts would be limited.

A multi-use pathway would also be constructed along the Moose – Wilson Road, extending from the Granite Canyon Entrance to the north end of the unpaved portion of the road. From that point, the pathway would divert eastward from the road and follow the long-established alignment of the unpaved levee access road to the future (planned



for 2006) location of the JY Visitor Center, at which point it would terminate.

Widening and constructing road shoulders to a 5-foot width along approximately 16 miles of Teton Park Road and North Park Road would permanently remove approximately 10 acres of gravelly loam soils and cause temporary disturbance of another 10 acres where construction equipment would be used adjacent to the main work area. Construction of multi-use pathways along approximately 23 miles of roads would also permanently remove soils (approximately 39 acres, also mainly gravelly loam) and cause temporary disturbance to approximately 39 additional acres.

The north end of the Moose – Wilson Road would be re-aligned in two locations: from one-third mile north of Death Canyon Road to the Sawmill Pond Overlook, and in the vicinity of the junction with Teton Park Road. This would result in the restoration of approximately 5 acres of soils along the abandoned road alignment (where pavement would be removed and the area graded and reseeded). Approximately 5 acres of soils would be re-disturbed along the new alignment, which follows an old roadbed.

Visitor information kiosks would be installed within activity areas on existing disturbed ground, and would not result in net new disturbance. Alternative 3 would also include installation of roadside variable messaging signs at locations within and outside the park, and infrastructure for transit stops. These signs would also be located on existing disturbed grounds at roadway shoulders and major intersections, and thus would involve no additional permanent disturbance.

Creation of the separated pathway system would discourage social trail development, and information at kiosks and additional signs would direct visitors to stay on designated routes. However, creation of such a separated pathway system may also result in additional social trails in areas where views or wildlife are outstanding. Interpretive exhibits would be installed in these areas to call attention to the resource and remind visitors to stay on the designated pathway.

Long-term, negligible, beneficial impacts are expected to result from visitors using established

pathways. However, the creation of the paved pathways and shoulders would result in long-term, moderate, direct, adverse impacts, confined to areas of multi-use pathway development, which would be located in relatively undisturbed areas off the main roadways. Short-term, minor, adverse impacts would occur where construction disturbs soils, which would then be reclaimed and revegetated; long-term adverse impacts in these areas would be negligible.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that would adversely impact soils would be the same as for Alternative 1. The impacts of these related actions, in conjunction with the impacts of Alternative 3, would result in minor to moderate, long-term, adverse cumulative impacts to soils within the park. Alternative 3 would contribute only a small amount to overall cumulative impacts.

Conclusion

Alternative 3 would result in long-term, moderate, adverse impacts to soils, as well as negligible, long-term, beneficial impacts to soils, primarily as a result of the construction and eventual use of a multi-use pathways system and improved road shoulders, plus the improvements and delineation of social trails. Minor, short-term, adverse impacts would occur at locations of construction projects. Cumulative impacts would be minor to moderate, long-term, and adverse.

Because there would be no major, adverse impacts to soils whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's soil resources.

Effects of Alternative 4 – Extended Pathways

Under Alternative 4, an extended system of separated pathways would be constructed, separate from the roadways but generally within approximately 50 to 150 feet of the road. The pathways would extend along U.S. 26/89/191 from the south boundary to Moose Junction, from Moose Junc-

tion to Antelope Flats Road, and from Moose Junction to Colter Bay via the Teton Park Road. Between Signal Mountain Lodge and the Jackson Lake Dam, widened shoulders would be provided in lieu of a separate pathway due to the difficulties of constructing a pathway along that segment.

All of these actions would lessen the use of off-road parking or creation of social trails near roadways that have been causing negligible to minor, long-term, adverse impacts to soils in localized areas around the park. The construction of road shoulders and improvement of selected social trails in developed areas would result in a permanent loss of soils, but these areas have already been disturbed; therefore, new impacts would be limited.

Widening and construction of road shoulders to a 5-foot width, along approximately 2 miles of roadway between Signal Mountain Lodge and Jackson Lake Dam, would permanently remove approximately 1 acre of gravelly loam soils and cause temporary disturbance of another 1 acre where construction equipment would be used adjacent to the main work area. Construction of multi-use pathways along approximately 41 miles of roads would also permanently remove soils (approximately 70 acres, also mainly gravelly loam) and cause temporary disturbance to approximately 70 additional acres.

Similar to Alternative 3, the north end of the Moose – Wilson Road would be re-aligned in two locations: from one-third mile north of Death Canyon Road to the Sawmill Pond Overlook, and in the vicinity of the junction with Teton Park Road. This would result in the restoration of approximately 5 acres of soils along the abandoned road alignment (where pavement would be removed and the area graded and reseeded). Approximately 5 acres of soils would be re-disturbed along the new alignment, which follows an old roadbed.

Visitor information kiosks and roadside variable messaging signs would be located as in Alternative 3, and thus would involve no additional permanent disturbance. Creation of the separated pathway system would discourage social trail development, and information at kiosks and additional signs would direct visitors to stay on designated

routes. However, creation of such a separated pathway system may also result in additional social trails in areas where views or wildlife are outstanding. Interpretive exhibits would be installed in these areas to call attention to the resource and remind visitors to stay on the designated pathway.

Long-term, negligible, beneficial impacts are expected to result from visitors using established pathways. However, creation of the paved pathways and shoulders would result in long-term, moderate, direct, adverse impacts, confined to areas of multi-use pathway development, which would be located in relatively undisturbed areas off the main roadways. Short-term, minor, adverse impacts would occur where construction disturbs soils, which would then be reclaimed and revegetated; long-term adverse impacts in these areas would be negligible.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that would adversely impact soils would be the same as for Alternative 1. The impacts of these related actions, in conjunction with the impacts of Alternative 4, would result in minor to moderate, long-term, adverse cumulative impacts to soils within the park. Alternative 4 would contribute a moderate amount to overall cumulative impacts.

Conclusion

Alternative 4 would result in long-term, moderate adverse impacts to soils, and negligible long-term, beneficial impacts to soils, primarily as a result of the construction and eventual use of a multi-use pathways system and improved road shoulders, plus the improvements to and delineation of social trails. Minor, short-term, adverse impacts would occur at locations of construction projects. Cumulative impacts would be minor to moderate, long term, and adverse.

Because there would be no major, adverse impacts to soils whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's soil resources.



Vegetation (including Plant Species of Special Concern)

Methods and Assumptions

Vegetation impacts considered in this analysis include loss of native vegetation permanently removed as a result of transportation infrastructure construction and maintenance, as well as the expected expansion of weed populations and associated weed control and monitoring along new separated pathways. In addition, impacts to plant species of special concern are addressed in this section.

Impacts to vegetative cover types were assessed using the same general approach as applied to soils. Information gathered on park vegetation cover types is described in Chapter 3, including the type of vegetative cover found along the road corridors that would be disturbed under Alternatives 2 and 3. Disturbances were estimated based on the length and expected width of the proposed pathways or shoulders in each area transected. Impacts from widened road shoulders were estimated by applying an expected 5-foot width of permanent vegetation disturbance and a 5-foot width of temporary construction-related disturbance (i.e., extension of existing shoulder on both

Impact Threshold Definitions

Negligible	No native vegetation would be affected, or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. The effects would be on a small scale.
Minor	The alternative would temporarily affect some individual native plants and would also affect a relatively minor portion of that species' population. Mitigation to offset adverse effects could be required and would be effective.
Moderate	The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population over a relatively large area. Mitigation to offset adverse effects could be extensive, but would likely be successful.
Major	The alternative would have a considerable effect on native plant populations and would affect a relatively large area in and outside of the park. Mitigation measures to offset the adverse effects would be required and would be extensive; success of the mitigation measures would not be guaranteed.
Duration	Short term – recovers in less than three years.
	Long term – requires more than three years to recover.
Area of Analysis	Within park boundary.

Plant Species of Special Concern

Negligible	A small number of individual plants and/or a small amount of their respective habitat may be adversely affected via direct or indirect impacts associated with a given alternative. Populations would not be affected or the effects would be below a measurable level of detection. Mitigation measures would not be warranted.
Minor	Effects to individual plants and/or their respective habitats would be more numerous and detectable. Populations would not be affected or the effects would be below a measurable level of detection. Mitigation measures may be needed and would be successful in reducing adverse effects.
Moderate	Effects to individual plants and their habitat would be readily detectable, with consequences occurring at a local population level. Mitigation measures would likely be needed to reduce adverse effects and would likely be successful.
Major	Effects to individual plants and their habitat would be obvious and would have substantive consequences on a regional population level. Extensive mitigation measures would be needed to reduce any adverse effects and their success would not be guaranteed.
Duration	Short term: Impact lasts one to five years and can be easily reversed
	Long term: Impact lasts six or more years and cannot be easily reversed
Area of Analysis	Within park boundary

sides). Impacts from construction of separated multi-use pathways were estimated by applying a 14-foot width of permanent vegetation disturbance plus a 14-foot width of temporary, construction-related disturbance (i.e., heavy machinery use, grading, stockpiling). For estimating of trees removed, a 16-foot pathway was used (14 feet plus one-foot tree clear zone on either side). In all cases, precise pathway locations and exact specifications have not been determined; some amount of error in disturbance estimates is expected.

Effects of Alternative 1 – No Action Alternative

Under Alternative 1, there would be no direct impacts to vegetation from construction of new transportation or information kiosks/signs. Impacts to vegetation would be very limited and occur only where continued road maintenance activities would temporarily disturb vegetation near work locations and in areas where visitors pull off the road or use social trails. Maintenance activities would require revegetation and other mitigation to control dust, noxious weeds, and erosion of the soil base. Impacts to vegetation near roadways, parking lots, and along social trails would continue from localized trampling, which would result in breakage, loss of productivity, and eventual loss of vegetation in certain areas. These actions, plus the limited disturbance from road maintenance, would result in long-term, negligible to minor, localized adverse impacts to vegetation, mainly confined to areas that have already been disturbed.

Plant Species of Special Concern

No individuals or populations of federally listed plants are present in Grand Teton National Park. Three plant species of special concern may be present within the project area. *Triteleia grandiflora* grows within five feet of the Moose-Wilson Road and *Orobancha corymbosa* grows along a dirt road south of Moose. Under Alternative 1, several management strategies would be tested along the Moose-Wilson Road, such as restrictions on motorized vehicles, potential closures, etc. Before any actions are taken that could adversely affect the area bordering the road, a rare plant survey would be conducted prior to implementation of the decision. Therefore, no or negligible direct

or indirect effects to these plant species of special concern are expected to result from implementation of Alternative 1. Current use of the road and associated increased generation of dust would not adversely impact sensitive plants growing along or in the vicinity of the Moose-Wilson Road.

Another special concern plant that may occur along the streambanks of the Snake River or its tributaries on the eastern side of the project area is *Stephanomeria fluminea*. Alternative 1 would not affect this species, since no actions are proposed for these areas.

Cumulative Impacts

Several recent, current, and planned projects within the park would adversely affect vegetation. These projects include construction of the new Moose Visitor Center and construction of an interpretive center for the JY Ranch. Other, smaller projects include the replacement of entrance stations and the construction of new housing at Moose and Beaver Creek. All of these developments would occur in areas where human activities are already concentrated, thus minimizing impacts in previously undisturbed areas. Also, mitigation measures would be implemented that preserve topsoil, reclaim with native vegetation, and control erosion, noxious weeds, and possible spills of oils or other fuels used in construction equipment. Widening of North Park Road would result in the permanent loss of approximately 33 acres of vegetation along an existing road corridor within the park. All of these projects would also result in the permanent loss of vegetation along existing road corridors or on developed sites, and short-term construction-related disturbance where vegetation is disturbed, but reclamation/re-planting occurs.

The ecosystem is experiencing a long-term drought, with drier winters and wetter summers, which contributes to the establishment and survival of non-native plant species, especially in areas of high foot, horse, and vehicular traffic, as well as on lands disturbed for construction or other reasons. This park, its neighbor park, and other jurisdictions have documented a continued increase in the number and distribution of exotic or invasive plant species during the past two decades. Part of this increase is a likely result of



increased data collection and problem identification; however, there is a long-term need for exotic plant monitoring and control efforts on the part of the park and neighboring landowners and managers.

No cumulative effects to federally listed plant species are expected from implementation of Alternative 1 because none are present. No cumulative effects to plant species of special concern are expected from implementing Alternative 1 because the two species potentially present near Moose-Wilson Road would not be adversely affected, and no actions are proposed in the area preferred by the third species.

The impacts of past, present, and future actions, in conjunction with vegetation impacts resulting from Alternative 1, would result in minor, long-term, adverse cumulative impacts to vegetation in the park. Alternative 1 would contribute a very small increment to overall cumulative impacts.

Conclusion

Alternative 1 would result in negligible to minor, long-term, adverse impacts from the degradation of native vegetation in and near areas with concentrated human use and areas of social trails and off-road parking and trampling. No or negligible direct or indirect effects to plant species of special concern are expected to result from implementation of Alternative 1. Cumulative impacts to vegetation would be minor, long term, and adverse.

Because there would be no major, adverse impacts to vegetation whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's vegetation resources.

Effects of Alternative 2 – Minimal Action Alternative

Under Alternative 2, impacts to vegetation would occur from the same actions as described for Alternative 1 – continued off-road parking and use of social trails, and occasional road maintenance, with resultant negligible to minor direct adverse impacts. Alternative 2 would also include

direct, adverse impacts related to the widening of approximately 18 miles of Teton Park Road to a 5-foot width from Moose Junction to Signal Mountain Lodge. This widening would permanently remove approximately 11 acres of vegetation, immediately adjacent to existing road shoulders, which consists mostly of a low cover of grasses, forbs, and weeds. Adjacent vegetation would consist of mostly dry sagebrush shrubland with small areas of riparian shrubs and cottonwoods along creek or river crossings. Some coniferous trees and associated understory species would be affected between Jenny Lake and Signal Mountain. Areas next to the existing shoulder that would be temporarily disturbed (an estimated additional 11 acres) by the construction crews would be revegetated using native grasses and weed-free seed; therefore, impacts from these actions would be negligible to minor, long term, and adverse.

Visitor information kiosks would be installed within activity areas on existing disturbed ground, and would not result in net new disturbance. Under Alternative 2, roadside variable messaging signs would be installed at locations within and outside the park. These signs would also be located on existing disturbed grounds at roadway shoulders and major intersections, and thus would constitute no additional permanent disturbance.

All construction would be monitored for noxious weed invasion, resulting in a minor, long-term impact. Noxious weeds could spread into areas that are disturbed during construction of pathways and widening of road shoulders. This impact is expected to be minor but short-term, with prompt revegetation of disturbed areas and implementation of measures to control noxious weeds (i.e., annual monitoring and appropriate manual, chemical, or biological control). However, long-term monitoring of all travel corridors and disturbed zones would be required as part of the park's ongoing efforts to control the spread of non-native plant species.

Plant Species of Special Concern

No direct or indirect effects to federally listed plants are expected to result from implementation of Alternative 2 due to their absence in Grand Teton National Park. The plant species of special

concern reported to be present in the Moose-Wilson Road vicinity may be impacted by options tested in this area, similar to Alternative 1. A rare plant survey would be conducted prior to implementation of Alternative 2, and appropriate mitigation measures taken if these or other rare plants are found within the disturbance area. The plant species found along the Snake River and its drainages would not be affected by actions in Alternative 2. Therefore, adverse impacts to these species would be negligible.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that would adversely impact vegetation would be the same as for Alternative 1. The ecosystem is experiencing a long-term drought, with drier winters and wetter summers, which contributes to the establishment and survival of non-native plant species, especially in areas of high foot, horse, and vehicular traffic as well as on lands disturbed for construction or other reasons. This park, its neighbor park, and other jurisdictions have documented a continued increase in the number and distribution of exotic or invasive plant species during the past two decades. Part of this increase is a likely result of increased data collection and problem identification; however, there is a long-term need for exotic plant monitoring and control efforts on the part of the park and neighboring landowners and managers.

No cumulative effects to federally listed plant species are expected from implementation of Alternative 2 because none are present. No cumulative effects to plant species of special concern are expected from implementing Alternative 2 because the two species potentially present near Moose-Wilson Road would not be adversely affected. No actions are proposed in the area preferred by the third species.

Overall, impacts of past, present, and future actions, in conjunction with impacts of Alternative 2, would result in long-term, minor adverse impacts to vegetation within the park. Alternative 2 would contribute a minor amount to overall cumulative impacts.

Conclusion

Alternative 2 would result in long-term, negligible to minor, adverse impacts to vegetation due to continued use of social trails, illegal off-road parking, and construction of shoulders along a portion of the Teton Park Road, with short- and long-term, minor, adverse impacts associated with construction. Adverse impacts to plant species of special concern would be negligible. Cumulative impacts to vegetation would be minor, long-term, and adverse.

Because there would be no major, adverse impacts to vegetation whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's vegetation resources.

Effects of Alternative 3 – Preferred Alternative

Under Alternative 3, a system of separated pathways would be constructed, separate from the roadways but generally within approximately 50 to 150 feet of the road. The pathways would extend along U.S. 26/89/191 from the south boundary to Moose Junction, from Moose Junction to Antelope Flats Road, and from Moose Junction to North Jenny Lake Junction. A pathway would also be constructed along the Moose – Wilson Road, extending from the Granite Canyon Entrance to the north end of the unpaved portion of the road. From that point, it would divert eastward from the road and follow the long-established alignment of the unpaved levee access road to the future (planned for 2006) location of the JY Visitor Center, at which point it would terminate. In addition to the pathways, road shoulders would be widened between North Jenny Lake Junction and Colter Bay.

Two sections of the Moose – Wilson Road would be realigned. One of these would be the area between the Sawmill Ponds Overlook and a point approximately one-third mile north of the Death Canyon Road. This segment would be realigned to its historic location to the east of the wetland areas. The other segment would be from a point



approximately one-half mile east of the Sawmill Ponds Overlook to a junction with the Teton Park Road. This segment would be realigned so that the Moose – Wilson Road would intersect the Teton Park Road between the entrance station and the chapel access road. In both cases, the existing roadbeds would be abandoned and restored to natural conditions.

Construction of new shoulders to a 5-foot width along approximately 16 miles of Teton Park Road and North Park Road from North Jenny Lake to Colter Bay would permanently remove approximately 10 acres of vegetation and cause temporary disturbance of at least another 10 acres where construction equipment is used adjacent to the main work area. Roadside vegetation that would be affected by shoulder widening would be a low cover of mostly grasses, forbs, and weeds, as the shoulder widening would not intrude into adjacent vegetation types. Much of the area along the roads that would be affected consists of dry sagebrush shrubland; however, from Jenny Lake Junction north to Signal Mountain and Jackson Lake Dam and also closer to Colter Bay the roadway often passes through lodgepole pine forest. There are also wet meadows and some wetlands near the existing roads, especially in the Willow Flats area near Jackson Lake. Road widening in these areas would adversely affect some wetlands and associated plant species and require mitigation to ensure no net loss of park wetlands.

Construction of separated pathways along approximately 23 miles of roadways throughout the park would result in the permanent removal of approximately 39 acres of vegetation and cause temporary disturbance to at least 39 additional acres. Although specific alignments have not yet been determined, the pathways would generally be located 50 to 150 feet from the existing roadbed, and mostly within 50 feet. Vegetation impacts in the southern half of the park would include mostly sagebrush shrubland, with some cottonwood riparian cover along the Gros Ventre and Snake Rivers, and taller riparian shrubs and cottonwoods along Cottonwood Creek.

The construction of approximately 3 miles of separated pathways along the Moose – Wilson Road corridor would result in the permanent

removal of approximately 5 acres of vegetation. An additional approximately 5 acres would be temporarily impacted due to construction activities. The vegetation in this area consists of aspen forest, lodgepole pine and mixed conifer forest, and mixed aspen-conifer stands, as well as some sagebrush shrubland and tall shrub communities.

The construction of pathways along this section of the Moose – Wilson Road would be expected to result in the permanent removal of approximately 3,300 trees, although the exact number would depend on the specific alignment of the new pathway. The majority of these trees, which would consist of both conifers and aspens, would be less than 12 inches in diameter; however, it is estimated that approximately 400 would have diameters greater than 12 inches.

While every effort would be made to design and construct the Moose – Wilson pathway so as to minimize the number of trees removed, the removal of such a large number of trees would result in an obvious change in the character of the corridor and would be clearly evident to most visitors. This area contains the only lands along the foot of the Teton Range that have not experienced fire activity in the past 35 years and, where forested, the canopy cover is thus green and fairly closed and shady compared to areas north, such as in the Taggart and Jenny Lake areas. Because of the closed canopy, the topography, and the road's proximity to the mountains, views of the high peaks are extremely limited along this corridor; in contrast, the vegetation is more of an apparent foreground feature than in areas where the Tetons pose a spectacular backdrop. These mixed aspen-conifer forests with their well-developed understory also have a very high diversity compared to other forested plant communities (McCloskey, K, Ph.D. dissertation, Utah State University, in prep). Opening the overstory would result in changes to understory vegetation composition.

Relocation of a portion of the Moose-Wilson Road, between a point approximately one-third mile north of the Death Canyon Trailhead Road and the Sawmill Ponds Overlook, would result in construction activity in wet meadows and willow habitats. After the short-term disturbance associated with construction, this would result in a mi-

nor benefit to native plant communities. Although the existing national wetland inventory data does not indicate that there are significant wetlands in this area, finer-scale mapping of wetlands conducted during the planning and design phases of construction could result in identification of a small amount of wetlands that could be lost and require mitigation as a result of road relocation and construction. Attempts would be made to regenerate aspen in the area vacated by the existing road; this could restore about 3.1 acres of aspen habitat; however, as the park has not made similar efforts yet, the successful regeneration and restoration of this plant community is not assured.

Construction of approximately 20 miles of separated pathways along U.S. 26/89/191 and the Teton Park Road would result in the removal of approximately 2,300 trees, approximately 430 of which would have a diameter of 12 inches or greater (see Table 16).

Removal of large numbers of trees in the areas north of Moose toward Jenny Lake would likely be less noticeable to the average visitor, when dwarfed by the dramatic peaks of the Teton Range

in the visible background, than along a more narrow, closed-in vegetated travel corridor such as the Moose-Wilson Road. North of the Jenny Lake area, in locations where the forest comes closer to the park road, such as in the Signal Mountain area and between Jackson Lake Lodge and Colter Bay, the effects of tree removal would be more noticeable.

In areas where significant numbers of trees are removed, additional trees could succumb to root damage caused by soil movement during construction, or because opening up the tree canopy would make remaining trees more susceptible to wind throw. Construction areas would be monitored during and after construction activity for hazard trees; in subsequent years, a minor increase could occur in the number of trees needing to be removed for human safety adjacent to roads and pathways. Overall, the construction of the pathways described above and resultant removal of vegetation and trees would result in long-term, moderate adverse impacts to vegetation.

Disturbance from construction activities and off-trail visitor use would provide increased

TABLE 16
NUMBER OF TREES REMOVED BY ALTERNATIVES 3 AND 4 BY ROAD SEGMENT

Alternative 3 - Moose - Wilson Road					
		Trees Removed			
Tree Density	Linear Feet Affected	Less than 6 inches	6-12 inches	Greater than 12 inches	Total
High	2,750	1,815	83	55	1,953
Medium	1,320	356	119	53	528
Low	2,920	438	146	292	876
None	4,920				
TOTAL:	11,910	2,609	347	400	3,357
Note: 11,910 linear feet equals approximately 2.25 miles, the distance from Granite Canyon Entrance to junction with levee access road.					

Continued on next page

Alternative 3 - U.S. 26/89/191 and Teton Park Road					
		Trees Removed			
Tree Density	Linear Feet Affected	Less than 6 inches	6-12 inches	Greater than 12 inches	Total
High	1,200	792	36	24	852
Medium	860	232	77	34	344
Low	3,750	563	188	375	1,125
None	99,590				
TOTAL:	105,400	1,587	301	433	2,321
Alternative 4 – Moose – Wilson Road					
		Trees Removed			
Tree Density	Linear Feet Affected	Less than 6 inches	6-12 inches	Greater than 12 inches	Total
High	5,840	3,854	175	117	4,146
Medium	3,590	969	323	144	1,436
Low	6,240	936	312	624	1,872
None	17,510				
TOTAL:	33,180	5,760	810	884	7,454
Alternative 4 U.S. 26/89/191 and Teton Park Road					
		Trees Removed			
Tree Density	Linear Feet Affected	Less than 6 inches	6-12 inches	Greater than 12 inches	Total
High	27,030	17,840	811	541	19,191
Medium	5,680	1,534	511	227	2,272
Low	11,160	1,674	558	1,116	3,348
None	133,680				
TOTAL:	177,550	21,047	1,880	1,884	24,811

opportunities for the spread of exotic plant species, some of which (St. Johnswort, Dalmatian toadflax, yellow toadflax, houndstongue, and musk and Canada thistles) already have become established in the Moose-Wilson Road corridor and along the Teton Park Road, especially from Moose to Jenny Lake. All separated multi-use pathways would be monitored for noxious weed invasion and controlled annually, resulting in minor to moderate long-term impacts. Noxious weeds could spread into areas that are disturbed during construction of pathways and widened road shoulders. This impact is expected to be minor but short term in localized sites, with prompt revegetation of disturbed areas and implementation of measures to control noxious weeds (i.e., annual monitoring and appropriate manual, chemical, or biological control).

Plant Species of Special Concern

No direct or indirect effects to federally listed plants are expected to result from implementation of Alternative 3 due to their absence in Grand Teton National Park. No direct or indirect effects to plant species of special concern are expected to result from implementation of Alternative 3, since a rare plant survey within the project area would be conducted before implementing any management strategies along Moose-Wilson Road or in the vicinity of streams with appropriate habitat in the Gros Ventre area.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that would adversely impact vegetation under this alternative would be the same as for Alternative 1. The ecosystem is experiencing a long-term drought, with drier winters and wetter summers, which contributes to the establishment and survival of non-native plant species, especially in areas of high foot, horse, and vehicular traffic as well as on lands disturbed for construction or other reasons. This park, its neighbor park, and other jurisdictions have documented a continued increase in the number and distribution of exotic or invasive plant species during the past two decades. Part of this increase is a likely result of increased data collection and problem identification; however, there is a long-term need for exotic plant monitoring and control

efforts on the part of the park and neighboring landowners and managers.

No cumulative effects to federally listed plant species are expected from implementation of Alternative 3 because none are present. No cumulative effects to plant species of special concern are expected from implementation of Alternative 3 because surveys would be done as needed to ensure that species would not be adversely affected.

The impacts of past, present, and future actions, in conjunction with the beneficial and adverse impacts of Alternative 3, would result in minor long-term adverse cumulative impacts to vegetation within the park. Alternative 3 would contribute a small amount to adverse cumulative impacts and would provide for negligible, long-term benefits to vegetation.

Conclusion

Alternative 3 would result in the permanent removal of approximately 54 acres of vegetation, including approximately 5,700 trees, of which approximately 830 would be over 12 inches in diameter. Actions under Alternative 3 would result in long-term, moderate, adverse impacts on vegetation, and negligible long-term beneficial impacts to vegetation, chiefly as a result of the construction and eventual use of separated pathways system and the improvements and markings of social trails. Widening road shoulders would result in minor to moderate alteration of plant communities, especially in wetland areas and in heavily forested areas. New pathways would be located in relatively undisturbed areas off the main roadways that currently exist in Grand Teton National Park.

In the short term, moderate adverse impacts would occur where construction disturbs vegetation. With proper and successful regeneration, the long-term, adverse impacts in construction areas would be negligible to minor, although long-term monitoring and control of exotic plants, if found to persist, would need to continue.

No direct or indirect effects to plant species of special concern are expected to result from implementation of Alternative 3.

Because there would be no major, adverse impacts to vegetation whose conservation is (1) necessary



to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's vegetation resources.

Effects of Alternative 4 – Extended Pathways

Under Alternative 4, an extended system of separated pathways would be constructed, separate from the roadways but generally within approximately 50 to 150 feet of the road. The pathways would extend along U.S. 26/89/191 from the south boundary to Moose Junction, from Moose Junction to Antelope Flats Road, and from Moose Junction to Colter Bay via the Teton Park Road. Between Signal Mountain Lodge and the Jackson Lake Dam, widened shoulders would be provided in lieu of a separate pathway due to the difficulties of constructing a pathway along that segment.

Two sections of the Moose–Wilson Road would be realigned. One of these would be the area between the Sawmill Ponds Overlook and a point approximately one-third mile north of the Death Canyon Road. This segment would be realigned to its historic location to the east of the wetland areas. The other segment would be from a point approximately one-half mile east of the Sawmill Ponds Overlook to a junction with the Teton Park Road. This segment would be realigned so that the Moose–Wilson Road would intersect the Teton Park Road between the entrance station and the chapel access road. In both cases, the existing roadbeds would be abandoned and restored to natural conditions.

A separated pathway would also be constructed along the Moose–Wilson Road, extending from the Granite Canyon Entrance to the north end of the unpaved portion of the road. From that point, it would divert eastward from the road and follow the long-established alignment of the unpaved levee access road to the future (planned for 2006) location of the JY Visitor Center. From that point, the pathway would run parallel to the visitor center access road for approximately one-half mile, then parallel to the Moose–Wilson Road to its junction with the Teton Park Road. Where seg-

ments of the Moose–Wilson Road are realigned, the pathway would be parallel to the new alignments.

Construction of separated pathways along approximately 34 miles of U.S. 26/89/191, the Teton Park Road, and the North Park Road would result in the permanent removal of approximately 58 acres of vegetation and cause temporary disturbance to approximately 58 additional acres. Although specific alignments have not yet been determined, the pathways would generally be located not more than 150 feet from the existing roadbed, and mostly within 50 feet. Vegetation removed would include mostly sagebrush shrubland in the southern half of the project area, but also conifer forests, some cottonwood riparian cover (mostly along the Gros Ventre and Snake Rivers and along Cottonwood Creek), and several acres each of aspen, willow, and meadows.

Construction of the separated pathways along U.S. 26/89/191, the Teton Park Road, and the North Park Road would likely result in the removal of more than 24,000 trees, of which more than 1,800 would be over 12 inches in diameter. The majority of tree removal would occur between North Jenny Lake Junction and Colter Bay, as coniferous forest becomes more predominant in the northern parts of the project area. The removal of this large number of trees would be obvious to almost all visitors and would be far more extensive than in Alternative 3. North of the Jenny Lake area in locations where the forest is denser and comes closer to the road, such as in the Signal Mountain area and between Jackson Lake Lodge and Colter Bay, the effects of tree removal due to pathway construction would be far more noticeable to almost all visitors.

The creation of separate multi-use pathways along the Moose–Wilson Road would permanently remove approximately 12 acres of vegetation and temporarily impact a minimum of 12 additional acres due to construction activities. This vegetation consists of aspen forest, lodgepole pine and mixed conifer forest, wetland meadows near the Sawmill Ponds, and mixed aspen-conifer stands, as well as some sagebrush shrubland and tall shrub communities. The creation of pathways along this section of the Moose–Wilson Road would result in the removal of a total of more than

7,000 trees, of which more than 800 would be 12 inches in diameter or greater (see Table 16).

While every effort would be made to design and construct the Moose – Wilson pathway so as to minimize the number of trees removed, the removal of such a large number of trees would result in an obvious change in the character of the corridor and would be clearly evident to most visitors. This change would be more extensive and evident than in Alternative 3 because more of the corridor would be affected by the construction of the pathway. This area contains the only lands along the foot of the Teton Range that have not experienced fire activity in the past 35 years and, where forested, the canopy cover is thus green and fairly closed and shady compared to areas north, such as in the Taggart and Jenny Lake areas. Because of the closed canopy, the topography, and the road's proximity to the mountains, views of the high peaks are extremely limited along this corridor. In contrast, the vegetation is more of an apparent foreground feature than in areas where the Tetons pose a spectacular backdrop. These mixed aspen-conifer forests with their well-developed understory also have a very high diversity compared to other forested plant communities (McCloskey, K, Ph.D. dissertation, Utah State University, in prep). Opening the overstory would result in changes to understory vegetation composition.

In areas where significant numbers of trees are removed, additional trees could succumb to root damage caused by soil movement during construction, or because opening up the tree canopy would make remaining trees more susceptible to wind throw. Construction areas would be monitored during and after construction activity for hazard trees; in subsequent years, a minor increase could occur in the number of trees needing to be removed for human safety adjacent to roads and pathways. Overall, the construction of the pathways described above and resultant removal of vegetation and trees would result in long-term, moderate adverse impacts to vegetation.

Relocation of a portion of the Moose-Wilson Road, between a point approximately one-third mile north of the Death Canyon Trailhead Road and the Sawmill Ponds Overlook, would result in construction activity in wet meadows and willow

habitats. After the short-term disturbance associated with construction, this would result in a minor benefit to native plant communities. Although the existing national wetland inventory data does not indicate that there are significant wetlands in this area, finer-scale mapping of wetlands done during the planning and design phases of construction could result in identification of a small amount of wetlands that could be lost and require mitigation as a result of road relocation and construction. Attempts would be made to regenerate aspen in the area vacated by the existing road; this could restore about 3.2 acres of aspen habitat; however, as the park has not made similar efforts yet, the successful regeneration and restoration of this plant community is not assured.

Disturbance from construction activities and off-trail visitor use would provide increased opportunities for the spread of exotic plant species, some of which (St. Johnswort, Dalmatian toadflax, yellow toadflax, houndstongue, and musk and Canada thistles) already have become established in the Moose-Wilson Road corridor and along the Teton Park Road, especially from Moose to Jenny Lake. All separated multi-use pathways would be monitored for noxious weed invasion and controlled annually, resulting in minor to moderate long-term impacts. Noxious weeds could spread into areas that are disturbed during construction of pathways and widened road shoulders. This impact is expected to be minor but short-term in localized sites, with prompt revegetation of disturbed areas and implementation of measures to control noxious weeds (i.e., annual monitoring and appropriate manual, chemical, or biological control).

Plant Species of Special Concern

No direct or indirect effects to federally listed plants are expected to result from implementation of Alternative 4 due to their absence in Grand Teton National Park. No direct or indirect effects to plant species of special concern are expected to result from implementation of Alternative 4, since a rare plant survey within the project area would be conducted before implementing any management strategies along Moose-Wilson Road or in the vicinity of streams with appropriate habitat in the Gros Ventre area.



Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that would adversely impact vegetation under this alternative would be the same as for Alternative 1. The ecosystem is experiencing a long-term drought, with drier winters and wetter summers, which contributes to the establishment and survival of non-native plant species, especially in areas of high foot, horse, and vehicular traffic, as well as on lands disturbed for construction or other reasons. This park, its neighbor park, and other jurisdictions have documented a continued increase in the number and distribution of exotic or invasive plant species during the past two decades. Part of this increase is a likely result of increased data collection and problem identification; however, actions in this alternative contribute in at least a minor way to the long-term need for exotic plant monitoring and control efforts on the part of the park and neighboring landowners and managers.

No cumulative effects to federally listed plant species are expected from implementation of Alternative 4 because none are present. No cumulative effects to plant species of special concern are expected from implementation of Alternative 4 because surveys would be done as needed to ensure that species would not be adversely affected.

The impacts of past, present, and future actions, in conjunction with the beneficial and adverse impacts of Alternative 4, would result in minor to moderate long-term adverse cumulative impacts to vegetation within the park. Alternative 4 would contribute a moderate amount to adverse cumulative impacts and would provide negligibly to the long-term benefits to vegetation.

Conclusion

The construction of the separated pathways and other actions proposed in Alternative 4 would result in long-term, moderate adverse impacts on vegetation, and negligible, long-term beneficial impacts to vegetation, chiefly as a result of the construction and eventual use of separated pathways system and the improvements and markings of social trails. Under Alternative 4, construction of the pathways would occur along approximately 41 miles of existing park roadways. This activ-

ity would permanently remove approximately 70 acres of vegetation and cause temporary disturbance to about the same number of additional acres. Vegetation removed would include an estimated 13 acres of coniferous forest, 46.8 acres of sagebrush shrubland, 4.7 acres of aspen, 1.2 acres of cottonwoods and 1.5 acres of riparian wetlands (mostly along the Gros Ventre and Snake Rivers and along Cottonwood Creek), 2 acres of meadow, and 2.3 acres of willow habitat, mostly in the area from Jackson Lake Dam to Colter Bay. The total number of trees likely to be removed would be approximately 32,000, of which more than 2,700 could be expected to be over 12 inches in diameter. Efforts would be made to restore aspen to the former location of the Moose-Wilson Road, which is to be relocated east of the Sawmill Ponds; however, the success of these efforts is not assured.

Additional short-term, moderate adverse impacts would occur where construction disturbs vegetation. With proper and successful regeneration, the long-term, adverse impacts in construction areas would be negligible, although long-term monitoring and control of exotic plants, if found to persist, would need to continue. The number of social trails could be reduced, or their locations altered, which may result in negligible, long-term beneficial impacts to vegetation that is currently receiving heavy foot traffic. Cumulative impacts would be minor to moderate, long-term, and adverse.

No direct or indirect effects to plant species of special concern are expected to result from implementation of Alternative 4.

Because there would be no major, adverse impacts to vegetation whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's vegetation resources.

Hydrology and Water Quality

Methods and Assumptions

Impacts to hydrology and water quality were assessed by examining any expected changes to channel morphology or capacity and the creation of the impervious surface that would create or increase runoff to nearby water bodies or groundwater. Alterations to channel capacity may be introduced by the construction of new bridges to support widened roadway shoulders or separated multi-use pathways. Changes in the quantity of impervious surface may be introduced by constructing new hardened shoulders or pathways into the built environment. Increasing impervious surface creates more potential for storm runoff and nonpoint source pollutants to enter park surface and groundwater systems.

Locations of proposed shoulder widening and pathway construction were examined in relation to the location of surface water features and drainageways. Areas where pathways or shoulder improvements would cross existing drainageways were identified. For the purposes of this analysis, it was assumed that most crossings could be accommodated via a cantilevered pathway or shoulder attached to the existing bridge structure, and that no modifications to existing abutments would

be required that might affect channel capacity, except in Alternative 4. During preliminary design, however, these assumptions would need to be confirmed by completing a more detailed hydraulic analysis and application of requirements for permitting. Impacts of creating impervious surfaces were addressed qualitatively, since the final design of the pathways and shoulders is not yet complete.

Effects of Alternative 1 – No Action Alternative

Under Alternative 1, there would be no direct modifications to channel capacity or levels of nonpoint source pollution. Existing bridges would remain in place along the Snake River and its tributaries. Nonpoint source pollution would continue to result from minor oil spills in parking areas or from ongoing road maintenance activities or runoff from unpaved and eroded social trails. However, any maintenance activities would include the implementation of erosion and sedimentation controls and Spill Prevention, Control, and Countermeasure (SPCC) plans, which would limit adverse effects. Impacts of these actions on water quality would be expected to be long term, negligible, and localized.

Impact Threshold Definitions

Negligible	Neither water quality nor hydrology would be affected, or changes would be either nondetectable or, if detected, would have effects that would be considered slight and local. The action would not result in degradation of water quality or impact channel morphology.
Minor	Changes in water quality or hydrology would be measurable, although the changes would be small and the effects would be localized. Impacts to water quality would be perceptible but highly localized in one or two sites. No alterations to existing channel capacity or morphology would occur. No mitigation measures associated with water quality or hydrology would be necessary.
Moderate	Changes in water quality or hydrology would be measurable, but would be relatively local. Impacts to water quality would be perceptible and/or observable in several locations within the project area. No alterations to existing channel capacity or morphology would occur. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.
Major	Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Impacts to water quality would be perceptible throughout the project area. Alterations to existing channel capacity or morphology would occur. Mitigation measures would be necessary and their success would not be guaranteed.
Duration	Short term – Following treatment, recovery would take less than one year.
	Long term – Following treatment, recovery would take longer than one year.
Area of Analysis	The Snake River and its tributaries that are adjacent to, crossed by, or downstream from proposed actions, and the Snake River Valley Aquifer.



Cumulative Impacts

Recent, current, and planned construction projects within Grand Teton National Park that may adversely impact water quality include work on the Murie Ranch, construction of the new Moose Visitor Center, and construction of an interpretive center for the JY Ranch. Other projects include the replacement of entrance stations and the construction of housing at Moose. Widening of the North Park Road may affect water quality by increasing the amount of impervious surface along an existing road corridor within the park. In addition, WYDOT is planning reconstruction of several road segments in the area. One project planned for this area would improve water quality through stabilizing approximately 150 feet of the Snake River bank near the float launch area at Moose. This project would produce negligible to minor beneficial impacts within a localized area, given its small size.

None of these facilities would be located in areas where increased recreational use of park waterways would be directly or indirectly affected by their construction. None of these facilities would involve modification of channel capacity or alignment for any of the park's waterways. Instead, the principal mechanism by which these developments might affect water quality would be by slightly increasing the amount of impervious surface and the potential for runoff and entrance into surface or subsurface waters. Additionally, roadway improvements and construction of a new parking area at Moose would increase opportunities for oil and gasoline spills to be carried into the groundwater, both during the construction process and after implementation. However, spill control and containment measures would be implemented to reduce the chances of any spills reaching surface water or groundwater.

The impacts of these actions, in conjunction with the impacts of Alternative 1, would result in negligible, long-term adverse cumulative impacts to water quality and hydrology within the park.

Conclusion

Alternative 1 would result in negligible, long-term adverse impacts on water quality and hydrology, resulting from continued road maintenance

activities, social trail use, and occasional fuel or oil spills at parking areas. Cumulative impacts would be long term, negligible, and adverse.

Because there would be no major, adverse impacts to water resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's water resources.

Effects of Alternative 2 – Minimal Action Alternative

The impacts of Alternative 2 on water quality would be very similar to those described for Alternative 1, i.e. long-term, negligible, and adverse. Alternative 2 would provide for shoulder widening along one portion of Teton Park Road, which includes the crossing of the Snake River at Moose Junction and the crossing of Cottonwood Creek and several small tributaries along the west side of Teton Park Road. However, the small amount of disturbance resulting from the construction of the shoulder would be limited to the areas immediately adjacent to the existing roadway, and it is assumed that existing abutments could accommodate the expanded shoulder with no consequences for channel capacity. During final design, a detailed hydraulic study would be undertaken as needed to assess the impacts on the stream channel.

This alternative would result in an increase in approximately 11 acres of impervious surface, but this would be a small incremental addition located immediately adjacent to the existing roadbed. Long-term, adverse impacts from increased runoff after construction would be negligible. Short-term construction impacts might produce some runoff and nonpoint source pollution. Grading and surfacing associated with shoulder widening may increase opportunities for sedimentation as well as leakage of oil and fuels from construction vehicles. Mitigation measures, including placement of erosion control silt fences and implementation of SPCC measures, would be undertaken to minimize short-term impacts. Given the small amount of shoulder widening to be done, and the

ability to use existing bridgework and abutments for the widening, construction impacts would be negligible to minor, adverse, and short term.

Cumulative Impacts

Impacts of past, current, and reasonably foreseeable future actions would be the same as those for Alternative 1. These projects are estimated to result in minimal change to hydrology or water quality. The impacts of these actions, in conjunction with the impacts of Alternative 2, would result in negligible, long-term adverse cumulative impacts to water quality and hydrology within the park.

Conclusion

Alternative 2 would result in negligible, long-term adverse impacts on water quality, principally due to a slight increase in impervious surface associated with roadway shoulder facilities and the potential for storm runoff from this area to carry pollutants (fuels, oil) into the park's water resources. Short-term impacts associated with construction activities would be negligible to minor and adverse, and with appropriate mitigation, limited to the immediate area of construction. Cumulative impacts would be long term, negligible, and adverse.

Because there would be no major, adverse impacts to water resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's water resources.

Effects of Alternative 3 – Preferred Alternative

Under Alternative 3, multi-use pathways would be constructed and would cross Ditch Creek and the Gros Ventre River along U.S. 26/89/191, and the Snake River and Cottonwood Creek along the Teton Park Road. A separated pathway would be constructed that would begin at the Granite Canyon Entrance Station (connecting to the pathway that has already been constructed by Teton County), extending north along the Moose – Wilson Road. The pathway would be generally parallel to and within 50 feet of the existing road, and would

consist of a 10-foot wide paved surface and 2-foot soft shoulders on either side. At least one foot of tree clear zone would extend on either side in addition to the shoulders, making for a total 16-foot wide clear corridor. The pathway would extend approximately two miles to the north end of the unpaved portion of the Moose – Wilson Road. At that point, the pathway would divert eastward from the road and follow the long-established alignment of the unpaved levee access road all the way to the new JY Visitor Center. The levee access road would be paved and constructed to the same standard as the rest of the separated pathway, and would allow for continued occasional use by vehicles and heavy equipment needed to maintain the levee. Also, shoulder widening would occur at the Jackson Lake Dam crossing along Willow Flats, to over the East Fork of Pilgrim Creek, along North Park Road. If possible, crossings would be accommodated via a cantilevered pathway or shoulder attached to the existing bridge structure, with no consequences for channel capacity and no need to create additional separate bridges for pathways. If cantilevered structures are not feasible, separate bridges may be necessary. During final design, a detailed hydraulic study would be undertaken to assess the impacts of proposed improvements on channel capacity and identify the need for permitting.

Construction of these widened shoulders and pathways is expected to result in approximately 49 acres of new impervious surface, with the largest share (39 acres) accounted for by separated pathway facilities. Long-term impacts from increased runoff to nearby surface drainage and into groundwater would be indirect, minor, and adverse.

Short-term construction-related activities might also produce nonpoint source pollution. Grading and surfacing associated with pathway construction in areas adjacent to creeks may increase opportunities for sedimentation, as well as leakage of oil and fuels from construction vehicles. Mitigation measures, including placement of erosion control measures, such as silt fence and use of SPCC plans, would be undertaken to minimize short-term impacts. The construction of separated pathways cantilevered from existing bridges over larger streams and Jackson Lake Dam may



necessitate placement of formwork and staging of construction activities at the edge of the channel. While construction equipment would be prohibited from the channel, additional mitigation measures, such as placing silt fence barriers and temporarily rerouting channel flows, would be employed to minimize impacts. In each location, short-term impacts would be minor, localized, and adverse.

In addition, under Alternative 3, selected social trails in certain developed areas would be paved or graveled. This would reduce erosion from these trails in the vicinity of Jenny Lake and keep visitors from disturbing new areas that could result in increased runoff and erosion into the lake, a long-term, minor, beneficial impact.

Cumulative Impacts

Impacts of past, current, and reasonably foreseeable future actions would be the same as those for Alternative 1. These projects are estimated to result in a minimal change to water quality or hydrology. The impacts of these related actions, in conjunction with the adverse and beneficial impacts of Alternative 3, would result in negligible, long-term, adverse cumulative impacts to water quality and hydrology within the park.

Conclusion

Alternative 3 would result in minor, long-term, adverse impacts on water quality, principally due to the increase in impervious surface associated with pathway and roadway shoulder facilities and the potential for storm runoff from these facilities to carry pollutants (fuels, oil) into the groundwater. Minor, long-term beneficial impacts would result from the paving and stabilization of social trails in the vicinity of Jenny Lake. Short-term impacts associated with construction activities would be minor and adverse, and with appropriate mitigation, limited to the immediate area of construction. Cumulative impacts would be long-term, negligible, and adverse.

Because there would be no major, adverse impacts to water resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's

GMP or other relevant NPS planning documents, there would be no impairment of the park's water resources.

Effects of Alternative 4 - Extended Pathways

Under Alternative 4, a separate pathway would be constructed as described in Alternative 3 to the new JY Visitor Center. Beyond this point, the separated pathway would continue, parallel to the visitor center access road until its junction with the Moose – Wilson Road, then parallel to the Moose – Wilson Road, generally staying within 50 feet of the road. As in Alternative 3, the Moose – Wilson Road would be realigned to the east side of the wetlands and at its northern end at Moose, with the abandoned sections being restored to natural condition. The separated pathway would parallel these realigned portions of the road. Separated pathways would be constructed parallel to and generally within 50 feet from Jackson Lake Junction to Colter Bay. Separate bridge crossings would be constructed at Christian Creek and Pilgrim Creek. Between Signal Mountain Lodge and the dam, shoulders would be widened to a 5-foot width.

Construction of these widened shoulders and pathways is expected to result in approximately 70 acres of new impervious surface, with the largest share (58 acres) accounted for by separated pathway facilities. Long-term impacts from increased runoff to nearby surface drainage and into groundwater would be indirect, minor, and adverse.

Short-term construction-related activities might also produce nonpoint source pollution. Grading and surfacing associated with pathway construction in areas adjacent to creeks may increase opportunities for sedimentation as well as leakage of oil and fuels from construction vehicles. Mitigation measures, including placement of erosion control measures, such as silt fence and use of SPCC plans, would be undertaken to minimize short-term impacts. The construction of separated pathways cantilevered from existing bridges over larger streams and Jackson Lake Dam may necessitate placement of formwork and staging of construction activities at the edge of the channel. Separate bridge crossings at Christian Creek, and

particularly at Pilgrim Creek, have the potential to impact existing channel capacity or morphology. While construction equipment would be prohibited from the channel, additional mitigation measures, such as placing silt fence barriers and temporarily rerouting channel flows, would be employed to minimize impacts. In each location, short-term impacts would be minor, localized, and adverse.

In addition, under Alternative 4, selected social trails in certain developed areas would be paved or graveled. This would reduce erosion from these trails in the vicinity of Jenny Lake and keep visitors from disturbing new areas that could result in increased runoff and erosion into the lake, a long-term, minor, beneficial impact.

Cumulative Impacts

Impacts of past, current, and reasonably foreseeable future actions would be the same as those for Alternative 1. These projects are estimated to result in a minimal change to water quality or hydrology. The impacts of these related actions, in conjunction with the adverse and beneficial impacts of Alternative 4, would result in minor, long-term, adverse cumulative impacts to water quality and hydrology within the park.

Conclusion

Alternative 4 would result in minor, long-term, adverse impacts on water quality, principally due to the construction of separate bridges over Christian and Pilgrim Creeks; the increase in impervious surface associated with pathway and roadway shoulder facilities; and the potential for storm runoff from these facilities to carry pollutants (fuels, oil) into the groundwater. Minor, long-term beneficial impacts would result from the paving and stabilization of social trails in the vicinity of Jenny Lake. Short-term impacts associated with construction activities would be minor and adverse, and with appropriate mitigation, limited to the immediate area of construction. Cumulative impacts would be long term, negligible, and adverse.

Because there would be no major, adverse impacts to water resources whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National

Park; (2) key to the natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's water resources.

Wetlands

Methods and Assumptions

Wetland presence within the project area was estimated using aerial photography, 1990 National Wetland Inventory (NWI) mapping, 1982 soil survey mapping, 1985 land cover type classification, and several historic wetland delineations, as described in Chapter 3. Temporary and permanent wetland impacts were calculated by correlating wetland locations with locations of proposed actions. However, because precise wetland locations, pathway locations, and engineering specifications have not been determined at this time, wetland impacts described should be considered to be professional estimates.

Table 17 provides a summary of direct impacts (acres) to potential wetland areas by alternative and road segment. The table was derived using a Geographic Information System (GIS) analysis, which overlaid alternatives onto habitat classifications of cottonwood, pond, stream, wet meadow and willow (all of which have the potential to be wetlands). The GIS was designed to calculate the number of potential wetland acres directly affected by each road/pathway segment within each alternative.



Impact Threshold Definitions

Negligible	Wetlands area or function would not be affected, or changes would be either nondetectable or if detected, would have effects that would be considered slight, local, and would likely be short-term.
Minor	Wetlands function would not be affected, but effects to a few individual plant or wildlife species would be measurable. Changes would be small, localized, and short-term. No mitigation measures would be necessary.
Moderate	Wetlands function would be affected. Changes would be measurable and long-term, but localized, with all species remaining indefinitely viable within the park. Mitigation measures would be necessary and likely successful.
Major	Wetlands function would be affected permanently. Changes would be readily measurable, long-term, and have consequences on a regional scale. Wetland species dynamics would be upset and species would be at risk of expiration from the park. Mitigation measures would be necessary and their success would not be guaranteed.
Duration	Short term - Recovers in less than three years. Long term - Takes more than three years to recover.
Area of Analysis	Within park boundary.

Effects of Alternative 1 – No Action Alternative

Under Alternative 1, there would be no actions that would result in impacts to wetlands other than routine road maintenance conducted in the vicinity of wetlands crossed by roads. With the application of appropriate mitigation, including avoidance, erosion and sedimentation control, noxious weed control, and use of construction, as needed, no new loss of wetlands would result from the implementation of Alternative 1, and long-term adverse impacts (direct or indirect) would be negligible and localized.

Cumulative Impacts

Historic and current park management philosophies emphasize wetland protection, and no existing and future development activities occurring within Grand Teton National Park are expected to adversely impact wetlands to any large degree. Some wetlands have been historically altered or lost as a result of past activities, but the extent of these impacts is unknown. For example, several springs and associated wetlands located along the toe of the Beaver Creek Bench on the Moose

TABLE 17
SUMMARY OF DIRECT LOSS OF POTENTIAL WETLANDS¹ (ACRES) FROM LINEAR ROAD FEATURES AND SEPARATED PATHWAYS BY ALTERNATIVE

Road segment	Alternatives							
	Road Features				Separated Pathways			
	1	2	3	4	1	2	3	4
Granite Entrance to JY Visitor Center	0	0	0	0	0	0	0.22	0.22
JY Visitor Center to Moose	0	0	0.05	0.05	0	0	0	0.86
South Boundary to Antelope Flats Road	0	0	0	0	0	0	1.10	1.10
Moose to North Jenny Lake Junction	0	0.11	0	0	0	0	0.66	0.66
North Jenny Lake Junction to Signal Mountain Lodge	0	0	0	0	0	0	0	0
Signal Mountain Lodge to Jackson Lake Dam	0	0	0.05	0.05	0	0	0	0
Jackson Lake Dam to Jackson Lake Junction	0	0	0.27	0	0	0	0	1.86
Jackson Lake Junction to Colter Bay	0	0	0.06	0	0	0	0	0.54
Total	0	0.11	0.43	0.10	0	0	1.88	5.24

¹Figures represent net difference from existing condition

– Wilson Road appear to have been historically filled and modified as a result of road construction. Similarly, the flood control levee located along Snake River east of the Moose – Wilson Road also appears to have filled wetlands and has altered the hydrology of the area sufficiently to adversely affect adjacent and vicinity wetlands. GIS analysis indicates that approximately 9.24 acres of potential wetlands may have been impacted by the present road configuration.

Ongoing and recently completed projects in Grand Teton National Park that would impact wetlands include the widening and reconstruction of 10.5 miles of North Park Road (0.92 acre of wetland impacts, 3.22 acres of wetland mitigation), the widening and rehabilitation of 7.7 miles of U.S. 26/89/191 (0.3 acre of wetland impacts, no mitigation), the Spread Creek Material Source and Staging Area project (0.01 acre of wetland impacts), and the Snake River Pit Rehabilitation project, which may intentionally and unintentionally create wetlands. Environmental Assessments and Findings of No Significant Impact associated with these projects addressed impacts to wetlands. Road reconstruction projects also impact wetlands. WYDOT is planning reconstruction of several roads; wetlands would be impacted by each of these projects, but the extent is presently unknown.

The wetland impacts of these other actions, when combined with the negligible wetland impacts resulting from Alternative 1, would result in long-term, negligible to minor adverse impacts to wetlands, mainly associated with maintaining small but permanent wetland fills along existing roads that contribute negligibly to wetland cumulative impacts.

Conclusion

Alternative 1 would result in long-term, negligible, and localized adverse impacts to wetlands, with no new or measurable net wetland losses. Cumulative impacts would be long-term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to wetlands whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2)

key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wetlands.

Effects of Alternative 2 – Minimal Action Alternative

Alternative 2 would have similar impacts to wetlands as described for Alternative 1 relating to continued road maintenance, with a slight addition to adverse effects from the shoulder widening along Teton Park Road in the vicinity of Cottonwood Creek and Snake River, where palustrine scrub-shrub and emergent wetlands are present. Wetland impacts would primarily be associated with wetland fills that may be required to construct widened shoulders along this portion of the road. Approximately 0.11 acres of potential wetlands may be affected (see Table 17). However, these should be avoidable or minimal, since shoulder construction would occur without any expansion of the current bridges. No impacts would result from transit facilities or separated pathways. Actions under Alternative 2 would result in negligible to minor, adverse, long-term impacts to wetlands.

Cumulative Impacts

Cumulative impacts to wetlands associated with Alternative 2 would be generally the same as those identified in Alternative 1, since wetlands would be avoided during shoulder construction along existing roadways. If any wetlands were disturbed, wetland mitigation requirements would ultimately result in total replacement and a possible net increase in park wetlands that are similar in type and function to impacted wetlands. Human uses of linear facilities resulting from implementing Alternative 2, including vehicles, are not expected to contribute to cumulative impacts in any measurable way.

The wetland impacts of other actions (described in Alternative 1), when combined with wetland impacts resulting from Alternative 2, would result in negligible to minor, long-term, adverse impacts to wetlands, mainly associated with the small but permanent wetland fills that contribute negligibly to wetland cumulative impacts.

Conclusion



Alternative 2 would result in negligible to minor, long-term adverse impacts on Grand Teton National Park wetlands. Permanent losses of wetlands would be avoided, minimized, and if necessary, compensated for at a minimum ratio of 1:1. Construction activities would employ best management practices (BMPs) to reduce or largely eliminate any adverse effects to adjacent and nearby wetlands. Cumulative impacts to wetlands would be long term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to wetlands whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wetlands.

Effects of Alternative 3 – Preferred Alternative

Alternative 3 may affect a small portion of palustrine scrub-shrub, emergent, and aquatic bed wetlands within the project area if wetlands cannot be totally avoided during construction in certain areas, such as Willow Flats. Wetland impacts would primarily be associated the widened shoulders planned for north of Jenny Lake to Colter Bay, which would involve crossing Willow Flats and the Pilgrim Creek area. No impacts would result from transit facilities. Construction of the multi-use pathways through or adjacent to wetlands could affect wetlands by altering or obstructing groundwater and surface water regimes, altering wetland connectivity, and changing chemical and biological characteristics. Potential impacts would be minimized or eliminated by using cantilevered additions to existing bridges, if feasible, and by placing multiple culverts through a separated pathway if needed. Any long-term impacts following mitigation would be minor and localized.

The majority of wetland impacts that could occur under Alternative 3 would affect palustrine scrub-shrub wetlands and palustrine emergent wetlands. Approximately 2.31 acres of potential wetlands may be affected (see Table 17). Wetland impacts would be greatest in the area from Jackson Lake Dam to Jackson lake Junction. Additional wetland

impacts would be located in small, localized areas adjacent to Jackson Lake and Cottonwood Creek, and along the Moose-Wilson Road realignment.. Wetland impacts would occur mainly along existing transportation corridors, but the exact alignment of the multi-use pathways has not yet been determined. In all areas where wetlands may need to be affected to complete construction, mitigation measures would be implemented to result in replacement of wetland functions and values, as well as to control erosion, noxious weeds, and spills of any construction-related fuels. Impacts would be minor, long-term, and adverse.

Improvements to several social trails in the vicinity of Jenny Lake would have no direct impacts on wetlands, since these trails are not located in wetlands. There would be indirect negligible beneficial impacts to wetlands by eliminating runoff from eroded trails into nearby wetlands that border Jenny Lake.

Cumulative Impacts

Cumulative impacts to wetlands associated with Alternative 3 would be generally the same as those identified in Alternative 1, with only a small incremental effect expected from construction of multi-use pathways in certain areas. Wetland mitigation requirements would ultimately result in total replacement and a possible net increase in park wetlands that are similar in type and function to impacted wetlands. Human uses of linear facilities resulting from implementing Alternative 3, including vehicles, are not expected to contribute to cumulative impacts in any measurable way.

The wetland impacts of other actions (described in Alternative 1), when combined with wetland impacts resulting from Alternative 3, would result in negligible to minor adverse, long-term impacts to wetlands, associated mostly with the small but permanent wetland fills that contribute negligibly to wetland cumulative impacts.

Conclusion

Alternative 3 may result in minor, long-term adverse impacts on Grand Teton National Park wetlands, mainly in the vicinity of Cottonwood Creek and Willow Flats, with negligible beneficial impacts due to improving social trails. Permanent losses of wetlands would be avoided, minimized,

and if necessary, compensated for at a minimum ratio of 1:1. Construction activities would employ BMPs to reduce or largely eliminate any adverse effects to adjacent and nearby wetlands. Cumulative impacts would be long-term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to wetlands whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wetlands.

Effects of Alternative 4 - Extended Pathways

Alternative 4 may affect a small portion of palustrine scrub-shrub, emergent, and aquatic bed wetlands within the project area if wetlands cannot be totally avoided during construction in certain areas, such as Willow Flats. Wetland impacts would primarily be associated the creation of separated pathways from the JY Visitor Center to Moose; the south boundary to Antelope Flats Road; and Jackson Lake Dam to Jackson Lake Junction. Construction of the multi-use pathways through or adjacent to wetlands could affect wetlands by altering or obstructing groundwater and surface water regimes, altering wetland connectivity, and changing chemical and biological characteristics. Potential impacts would be minimized or eliminated by using cantilevered additions to existing bridges, if feasible, and by placing multiple culverts through a separated pathway if needed. Any long-term impacts following mitigation would be minor and localized.

Approximately 5.34 acres of potential wetlands may be affected (see Table 17). The majority of wetland impacts that could occur under Alternative 4 would affect palustrine scrub-shrub wetlands and palustrine emergent wetlands. Wetland impacts would be greatest in the section from Jackson Lake Dam to Jackson Lake Junction. Additional wetland impacts would be located in small, localized areas adjacent to Jackson Lake and Cottonwood Creek, and along the Moose-Wilson Road realignment. Wetland impacts would occur mostly along existing transportation cor-

ridors, but the exact alignment of the multi-use pathways has not yet been determined. In all areas where wetlands may need to be affected to complete construction, mitigation measures would be implemented to result in replacement of wetland functions and values, as well as to control erosion, noxious weeds, and spills of any construction-related fuels. Impacts would be minor, long-term, and adverse.

Improvements to several social trails in the vicinity of Jenny Lake would have no direct impacts on wetlands, since these trails are not located in wetlands. There would be indirect negligible beneficial impacts to wetlands by eliminating runoff from eroded trails into nearby wetlands that border Jenny Lake.

Cumulative Impacts

Cumulative impacts to wetlands associated with Alternative 4 would be generally the same as those identified in Alternative 3, with an increased effect expected from construction of separated pathways from the JY Visitor Center to Moose; Jackson Lake Dam to Jackson Lake Junction; and Jackson Lake Junction to Colter Bay. Wetland mitigation requirements would ultimately result in total replacement and a possible net increase in park wetlands that are similar in type and function to impacted wetlands. Human uses of linear facilities resulting from implementing Alternative 4, including vehicles, are not expected to contribute to cumulative impacts in any measurable way.

The wetland impacts of other actions (described in Alternative 1), when combined with wetland impacts resulting from Alternative 4, would result in negligible to minor, adverse, long-term impacts to wetlands, associated mostly with the small but permanent wetland fills that contribute negligibly to wetland cumulative impacts.

Conclusion

Alternative 4 may result in minor, long-term adverse impacts to Grand Teton National Park wetlands, mainly in the vicinity of Cottonwood Creek and the area from Jackson Lake Dam to Jackson Lake Junction, with negligible beneficial impacts due to improving social trails. Permanent losses of wetlands would be avoided, minimized, and if necessary, compensated for at a minimum ratio of



1:1. Construction activities would employ BMPs to reduce or largely eliminate any adverse effects to adjacent and nearby wetlands. Cumulative impacts would be long-term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to wetlands whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wetlands.

Threatened and Endangered Species, Species of Special Concern, and General Wildlife

Methods and Assumptions

This section addresses impacts to endangered and threatened animal species, bird species of special concern, and general wildlife (mammals, reptiles, and amphibians). Impacts to plant species of special concern are addressed under the Vegetation section.

Effects of transportation routes, features, and improvements on terrestrial wildlife (including threatened and endangered species) have been documented (Trombulak and Frissell 2000; Foreman 2002) and include such impacts as mortality from collisions, modification of animal behavior, disruption of the physical environment, spread of exotic species, and changes in human use of the lands and water. Specific examples include habitat loss and fragmentation, reduced animal use of habitats because of noise and/or the presence of humans, loss of forage, interference with wildlife life-history functions (e.g., courtship, nesting, and migration), spread of non-native species carried by vehicles, and increased levels of recreation.

The level of impact is related in part to the density of transportation features, the physical footprint and effect zone of the transportation network, availability of secure habitat areas, and traffic volume. Grand Teton National Park is approximately 484 square miles in size, and there are roughly 350 miles of transportation routes within the park. This represents an average transportation route

density of 0.7 mile per square mile for the entire park. Road density is scale-dependent and may be higher or lower than the average figure reported here in some portions of the park. The approximate physical footprint of the road system is 0.8 square mile, which is less than 1 percent of the total park area.

The following sources of information were used to assess project impacts to wildlife, including threatened, endangered, and sensitive species:

- Scientific literature on species life histories, distributions, habitat selection, and responses to human activities.
- Site-specific information on wildlife distribution and use patterns within Grand Teton National Park and its vicinity, including complete and ongoing studies (when available), and the professional judgment of park or state biologists familiar with the status and management concerns related to individual species.

The impact analyses were based on a variety of factors, primarily known or likely presence of the species in the areas that would be affected by actions under each alternative and presence of the species' preferred habitat. Factors considered included habitat loss or disturbance, direct mortality, human-caused disturbance (e.g., noise), and habitat fragmentation. Additional factors such as traffic volumes or human use patterns were also considered. Impact threshold definitions are presented below.

For purposes of Section 7 Consultation with the U.S. Fish and Wildlife Service (USFWS), the impact assessments for federally listed species also include a concluding statement as to whether the alternative would have "no effect," "may affect but is not likely to adversely affect," or "may affect and is likely to adversely affect" any federally listed species. Review of this document and the impact analysis is intended to serve as the Biological Assessment in support of the Section 7 consultation process.

Linear developments (e.g. roads, trails, and pathways) have been shown to affect wildlife through direct habitat loss, disturbance and creation of barriers to movement, habitat avoidance, social disruption, and direct or indirect mortality

Impact Threshold Definitions

Threatened and Endangered Species (Federally Listed Species)	
No Effect	A federally listed species would not be affected.
Negligible or Minor	Analogous to a "May Affect But Not Likely To Adversely Affect" determination used by the U.S. Fish and Wildlife Service. Implementing the alternative could possibly affect but is not likely to adversely affect a listed species or its critical habitat. Mitigation measures may be needed in order to attain the not likely to adversely affect determination.
Moderate	Analogous to a "May Affect But Not Likely To Adversely Affect" determination used by the U.S. Fish and Wildlife Service, or to a "May Affect and Likely To Adversely Affect" determination when an action could affect one or more individual members of a listed species and/or its critical habitat, but when the action would not threaten the survival of the species. Mitigation measures would likely be required to reduce impacts.
Major	Analogous to a "May Affect and Likely To Adversely Affect" determination used by the U.S. Fish and Wildlife Service, when an action could affect one or more individual members of a listed species and/or its critical habitat; and when the action could threaten the survival of the species and/or its critical habitat. Mitigation measures would likely be required to reduce impacts, or the action could result in a "Jeopardy Opinion" given by the U.S. Fish and Wildlife Service.
Duration	Short term – recovers in less than one year.
	Long term – requires more than one year to recover.
Area of Analysis	Within the park and surrounding Greater Yellowstone Area.
Species of Special Concern and General Wildlife	
Negligible	A small number of individual animals and/or a small amount of their respective habitat may be adversely affected via direct or indirect impacts associated with a given alternative. Populations would not be affected or the effects would be below a measurable level of detection. Mitigation measures would not be warranted.
Minor	Effects to individual animals and/or their respective habitats would be more numerous and detectable. Populations would not be affected or the effects would be below a measurable level of detection. Mitigation measures may be needed and would be successful in reducing adverse effects.
Moderate	Effects to individual animals and their habitat would be readily detectable, with consequences occurring at a local population level. Mitigation measures would likely be needed to reduce adverse effects and would likely be successful.
Major	Effects to individual animals and their habitat would be obvious and would have substantive consequences on a regional population level. Extensive mitigation measures would be needed to reduce any adverse effects and their success would not be guaranteed.
Duration	Short term: Impact has a duration less than or equal to three years following implementation.
	Long term: Impact has a duration greater than three years following implementation.
Area of Analysis	Within park boundary and surrounding greater Yellowstone area

(Jalkotzy et al. 1997, Forman and Alexander 1998, Trombulak and Frissell 2000, Gucinski et al. 2001, Forman et al. 2003, and Gaines et al. 2003). The level of impact depends on the nature of the corridor (e.g. length, width, type of use, use levels, etc.), the habitats it traverses, species present, and whether the linear development occurs in previously disturbed or relatively pristine areas.

Construction of new linear features or expansion of existing features directly impacts the habitat it displaces, as vegetation removed in the process

of construction is no longer available for use by wildlife. Once built, the mere presence of linear features can also influence the local environment and site conditions, and thus habitat conditions. Noise and human activity associated with the construction phase may cause individual animals to avoid the areas of activity in the short term. Activities (e.g. motorized vehicle traffic, biking, hiking etc.) associated with the linear corridors can disturb wildlife, causing them to leave the area, alter use patterns, or experience a stress response. These responses carry costs in terms of energy



expenditures and possibly lost opportunities (Jalkotzy et al. 1997). Some responses are unique to certain wildlife species and differ depending upon an animal's sensitivity, age or sex, and may change according to season, group size, and habitat security. Behavioral responses may be short in duration (temporary displacement) or long-term, such as abandonment of preferred foraging areas. Animal density may be increased in the remaining habitat which can impact the ability of individual animals to survive. In general, impacts to wildlife from human disturbance are influenced by characteristics of the disturbance itself and may vary depending upon type of activity, distance away, direction of movement, speed, predictability, frequency, and magnitude.

The ecological impacts of linear developments generally expand beyond the actual physical linear footprint. The width of this *zone of influence* (ZOI) varies and is influenced by individual species' sensitivity, landscape and topographic features, and the patterns of human use (e.g. type, timing, and frequency of human use). For this analysis, two zones of influence along linear features were identified and used to compare and analyze potential impacts among the alternatives considered from the proposed project on wildlife. These zones were created by buffering the linear features (both existing and proposed) by either 75 or 400 meters (Figure 19). The resulting buffers depict areas where wildlife would be affected by disturbance from use of the road or biking and hiking along the pathway. Separated pathways were buffered from an alignment 50 feet from the roadside, assuming their location would generally be within this distance. Where pathways diverge more than 50 feet from the road, impacts would be greater.

The ZOI may actually vary depending on the topography on the area, vegetation types present, and species concerned. For example, a ZOI for a nesting passerine is significantly smaller than the zone for a grizzly bear. Grizzly bear zones of influence from roads have ranged from 100 to over 900 meters (Puchlerz and Servheen 1994), whereas those for songbirds have been reported as 10 to 100 meters (Miller et al. 1998); therefore, both a small and larger zones of influence were used for analysis to account for these differences.

Predictable and localized activities, such as motorized activities that are confined to specific routes where vehicles seldom stop, may have less impact to wildlife species than activities that are unpredictable and/or widespread. The response of wildlife to a road or pathway may be short-term. But with increasing levels of use and changes in the type of use, there may be enough disturbance that some wildlife may move away permanently. Predictability can be a factor in how much disturbance a trail user causes. For example, some wildlife may become habituated to high-use roads where vehicles seldom stop or stop mostly in predictable locations (e.g. pullouts). In these situations wildlife would utilize habitat closer to the road than they would otherwise. Generally, the level of predictability along a linear corridor declines as human activities change from 1) vehicles passing through a linear corridor, to 2) vehicles stopping only at established pullouts along the corridor, to 3) vehicles stopping randomly along the corridor, to 4) people exiting vehicles at random points along the corridor, to 5) people approaching wildlife from random points along a corridor. Because pathways would allow users to easily stop and approach wildlife at any point along the corridor (Figure 19), the ability of wildlife to predict human responses would be low. This off trail use is likely to increase the average zone of influence for the corridor (Figure 19).

FIGURE 19
AN EXAMPLE OF THE APPLICATION OF 75 AND 400 METER BUFFERS APPLIED TO
REPRESENT A PATHWAY'S ZONE OF INFLUENCE ON ADJACENT HABITATS, AND HOW
UNPREDICTABLE OFF-TRAIL USE CAN EXTEND THIS INFLUENCE.

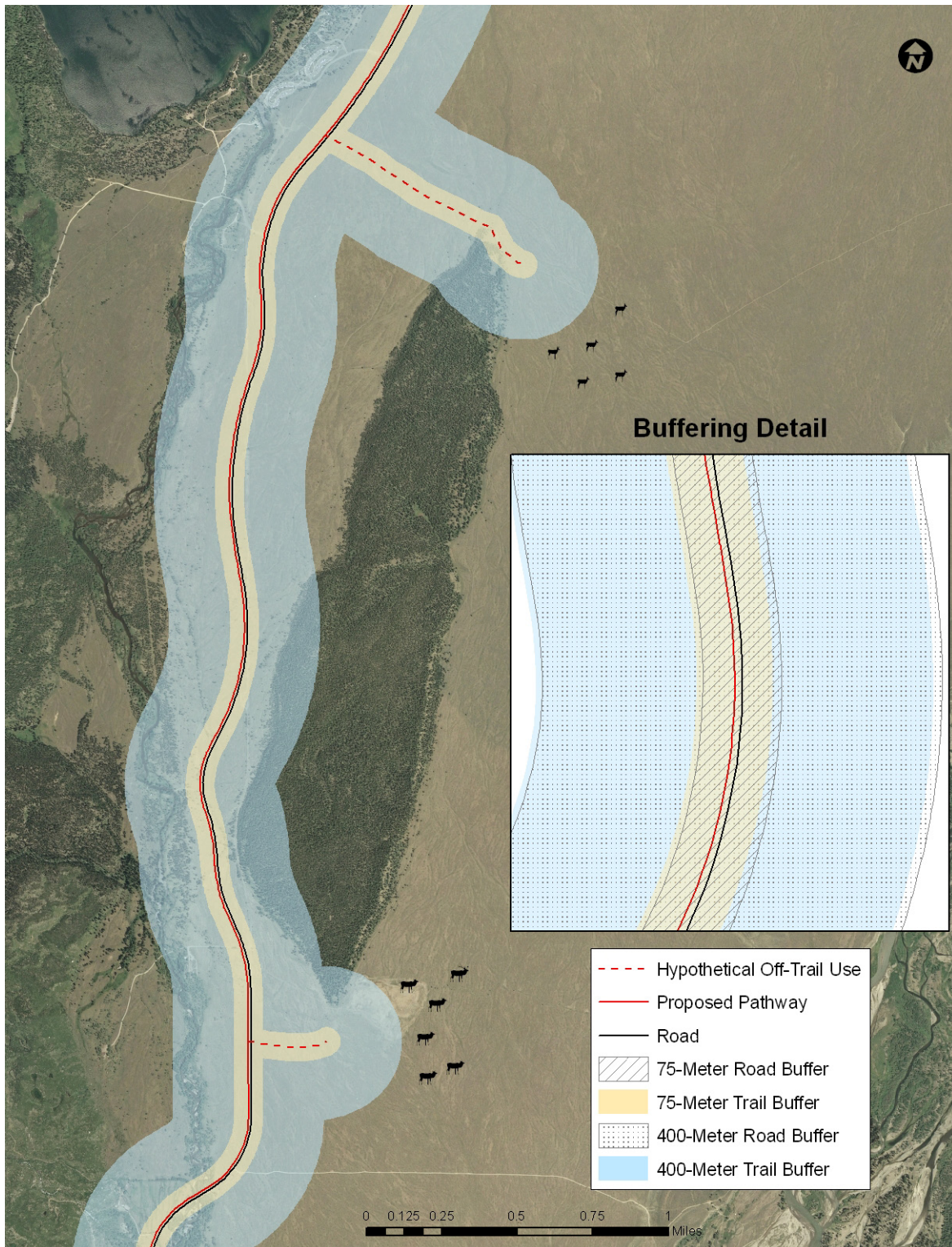


TABLE 18
ESTIMATES OF DIRECT HABITAT LOSS¹ (ACRES) FROM LINEAR FEATURES
BY HABITAT TYPE AND ALTERNATIVE

Linear Feature	Habitat Type	Alternative 1 (No Action)	Alternative 2 (Minimal Action)	Alternative 3 (Preferred Alternative)	Alternative 4
Separated Pathway	All veg types	0	0	39.3	69
	Conifer forest	0	0	1.8	12.9
	Cottonwood	0	0	1.2	1.2
	Aspen	0	0	1.2	1.5
	Sagebrush	0	0	32.2	46.8
	Meadow	0	0	1.9	2.0
	Willow	0	0	0.1	2.3
	Riparian wetland	0	0	0.7	1.5
	Ag. Lands/other	0	0	0.3	0.7
Roadway (includes widened shoulder)	All veg types	0	4.3	3.4	0
	Conifer forest	0	0.8	1.9	0.5
	Cottonwood	0	0.1	0	0
	Aspen	0	0.1	-3.1	-3.2
	Sagebrush	0	3.4	4.2	2.7
	Meadow	0	0	0.1	0
	Willow	0	0	0	0.1
	Riparian wetland	0	0	0.2	0
	Ag. Lands/other	0	0	0	0

¹Figures represent net difference from existing condition; therefore, positive numbers represent a net loss, while negative numbers represent a net gain.

TABLE 19
SUMMARY OF DIRECT HABITAT LOSS¹ (ACRES) FROM LINEAR ROAD
FEATURES AND SEPARATED PATHWAYS BY ALTERNATIVE

Road Segment	Alternatives							
	Road Features				Separated Pathways			
	1	2	3	4	1	2	3	4
Granite entrance to JY Visitor Center	0	0	0	0	0	0	5.4	5.4
JY Visitor Center to Moose	0	0	-0.4	-0.4	0	0	0	6.8
South Boundary to Antelope Flats Road	0	0	0	0	0	0	15.6	15.6
Moose to north Jenny Lake Junction	0	2.7	0	0	0	0	18.3	18.3
North Jenny Lake Junction to Signal Mountain Lodge	0	1.7	1.7	0	0	0	0	11.9
Signal Mountain Lodge to Jackson Lake Dam	0	0	0.4	0.4	0	0	0	0
Jackson Lake Dam to Jackson Lake Junction	0	0	0.2	0	0	0	0	1.9
Jackson Lake Junction to Colter Bay	0	0	1.3	0	0	0	0	9.3
Total	0	4.3	3.2	0	0	0	39.3	69.2

¹Figures represent net difference from existing condition

TABLE 20
AREA (ACRES) WITHIN 75 AND 400 METER ZONE OF INFLUENCE BUFFERS
ALONG ROADWAYS BY ALTERNATIVE AND SECTION

Segment	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	75 m	400 m	75 m	400 m	75 m	400 m	75 m	400 m
Granite entrance to JY Visitor Center	204.7	1,027.8	204.7	1,027.8	204.7	1027.8	204.7	1,027.8
JY Visitor Center to Moose	228	1,046.6	228	1,046.5	215.3	1048.3	215.3	1,048.3
South Boundary to Antelope Flats Road	591.4	3,069.1	591.4	3,069.1	591.4	3,069.1	591.4	3,069.1
Moose to north Jenny Lake Junction	677.8	3,382.8	680.4	3,385.3	678.2	3,382.8	678.2	3,382.8
North Jenny Lake Junction to Signal Mountain Lodge	445.8	2,263.2	447.5	2,265.5	447.5	2,265.5	445.8	2,263.8
Signal Mountain Lodge to Jackson Lake Dam	119.4	605.2	119.4	604.6	119.9	605	119.9	605
Jackson Lake Dam to Jackson Lake Junction	72.5	366.7	72.5	366.7	72.7	367	72.5	366.7
Jackson Lake Junction to Colter Bay	348.7	1,821.6	348.7	1,821.6	350.1	1,823.1	348.7	1,821.6
Total	2,688.3	13,583	2,692.6	13,587.2	2,679.7	13,588.6	2,676.4	13,585.2

TABLE 21
ESTIMATED ZONE OF INFLUENCE (LOSS OF HABITAT EFFECTIVENES IN ACRES)
FROM LINEAR FEATURES BY ALTERNATIVE

Linear Feature	ZOI	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Separated pathway	75 m zone	0	0	1,424	2,506.4
	400 m zone	0	0	7,495.6	13,108
Roadway	75 m zone ¹	0	4.3	-8.6	-11.9
	400 m zone ²	0	4.1	5.5	2.1
Net loss ³	75 m zone	0	0	166	281
	400 m zone	0	0	310	414

¹75 m ZOI for existing roads is 2,688.3 ac

²400 m ZOI for existing roads is 13,583.1 ac

³Additional contribution of separated pathway to ZOI beyond that of existing road system

General Measures of Habitat Loss For All Alternatives

Direct habitat loss from construction of widened shoulders, separated pathways, and road realignments among 8 vegetation classes ranges from zero for Alternative 1 to 69 acres for Alternative 4 (Tables 18 and 19). Appendix B includes a more detailed table of estimated direct habitat loss by road segment for separated pathways. Indirect habitat loss from ZOIs associated with roads in the project area is presented in Table 20 and is similar among all alternatives. Additional (net)

habitat loss associated with linear feature ZOI's ranges from zero for Alternative 1 to more than 400 acres for Alternative 4 (Table 21). Indirect habitat loss for pathways proposed in Alternatives 3 and 4 by pathway segment is presented in Table 22. Appendix B includes a more detailed table of estimated indirect habitat loss by road segment. These tables and appendices will be referred to as needed in the context of subsequent topical impact sections.

Grand Teton National Park is a large, natural area that supports robust populations of several



TABLE 22
AREA (ACRES) WITHIN 75 AND 400 METER ZONE OF INFLUENCE BUFFERS
ALONG SEPARATED PATHWAYS BY ALTERNATIVE¹ AND SECTION

Segment	Alternative 3		Alternative 4	
	75 m	400 m	75 m	400 m
Granite entrance to JY Visitor Center	66.9	211.5	64.7	166.4
JY Visitor Center to Moose	0	0	46.9	79.5
South Boundary to Antelope Flats Road	44.8	45.7	44.8	45.7
Moose to north Jenny Lake Junction	54.6	53.3	54.5	53.1
North Jenny Lake Junction to Signal Mountain Lodge	0	0	35.8	35.4
Signal Mountain Lodge to Jackson Lake Dam	0	0	0	0
Jackson Lake Dam to Jackson Lake Junction	0	0	27.9	28
Jackson Lake Junction to Colter Bay	0	0	5.7	5.6
Total	166	311	281	414

¹No separated pathways are proposed under Alternatives 1 or 2; therefore, there is no indirect habitat loss

large, potentially dangerous species of mammals. Existing forms of park transportation – vehicles, cyclists, and pedestrians on several classes of roads, pedestrians on and off trails, equestrians, and both motorized and non-motorized watercraft – each have certain wildlife hazards that are reasonably well understood. For the most part, vehicles are subject to potentially dangerous collisions with wildlife, while non-motorized users are concerned with undesirably close encounters with potentially dangerous wildlife.

Providing separated pathways in this context presents new human safety challenges for park managers and the public. Wildlife hazards associated with separated pathways would be similar to those associated with trails, with one important exception: bicycles and other wheeled vehicles, which are not permitted on trails but would be permitted on pathways, would be able to move quickly and quietly through the landscape. This would greatly increase the probability of sudden, surprise encounters with and aggressive responses from wildlife, because two important mitigating factors – the slow speed of hikers and loud noise of motorized vehicles – would be absent. Areas near noisy streams or where sight distances are minimized by terrain, daylight, or vegetation would have increased hazards, as would using any portion of a pathway after dark.

Encounters with bears (especially grizzly bears), moose, and bison are of particular concern because of their propensity to respond with aggression that can result in serious human injuries or death. Higher frequencies of encounters can be expected in higher quality habitats for each of the species concerned. Pathway alignments that stay as close to the road as possible, maximize sight distances, and avoid high quality habitat can help mitigate, but not eliminate, these hazards (e.g., Herrero et al. 1986). Signage and other forms of education may also mitigate risk. Not surprisingly, few data exist from which to base predictions of encounter rates, however, because precedents for combining pathways with large protected areas and high densities of large, dangerous mammals are rare.

Bears

Some information on cyclist encounters with grizzly bears is available from Herrero and Herrero (2000), from which the following information was taken. In North America, 33 records were found for cyclist encounters with grizzly bears in which the bear responded aggressively. Five of these occurred on roads used by cars and the remaining occurred on trails or nearby. In most cases grizzly bears charged or chased cyclists. In 12% (4 of 33) of encounters, cyclists were injured by grizzly bears; in 75% of these cases (3 of 4),

injuries were serious (requiring more than 24 hours in a hospital). The majority (22 of 33) of encounters occurred in Banff and Jasper National Parks, where mountain biking is allowed on some trails. Ninety-five percent of encounters in which distance was estimated, the cyclist first became aware of the bear at less than 50 meters, which Herrero (1985) defined as a “sudden encounter.” Importantly, while not conclusive, the data suggest that rates of sudden encounters with bears are much higher among cyclists than hikers. Indeed, in Canada’s Kluane National Park, park managers state that “Mountain bikers travel quickly and quietly on the trails. As a result, they are much more likely to have surprise encounters with bears and other wildlife, than hikers, and horses” (Kluane National Park 1997).

Most of the encounters documented by Herrero and Herrero (2000) and discussed above occurred on dirt trails, where bicycles would be expected to travel slower and make more noise than they would on a paved pathway.

Bison

Many records are available for human-bison encounters in which aggressive reactions by bison occurred. In Grand Teton, several people have been charged by bison, but only one human injury has been documented to date. In this case a man was seriously gored in the thigh after approaching a bull bison too closely.

In Yellowstone National Park, however, bison have charged and made contact with humans at least 81 times from 1978-1999(?). Many victims received serious injuries, and two visitors died from their injuries. In each case, bison appeared to be reacting defensively to people who approached them too closely. By contrast, grizzly bears injured 30 and killed two humans during the same period, making bison the most dangerous animal in the park.

Moose

Moose have a long-standing but perhaps downplayed reputation of aggressive encounters with humans. Stories of fishermen being treed by moose are common, as are chases by moose cows protecting calves. In rare cases, moose have killed humans (Chuck Schwartz, pers. comm.). Cow moose protecting calves are perhaps the most

dangerous, and approaching too closely or having sudden, surprise encounters seems to be a common denominator in aggressive responses. In Grand Teton, several such encounters have been reported to date, but none are known to have caused human injury.

Cougars

From 1991-2003, 71 cougar attacks resulting in 10 human deaths were recorded in North America (<http://cougarinfo.com/attacks.htm>). None were reported for Wyoming. Details of these accounts indicate that children are more vulnerable than adults, and at least four attacks involved cyclists, including one mountain biker fatality in California. Cougar attacks are too rare to make valid comparisons among user groups, but most victims shared the common trait of recreating in cougar habitat when attacks occurred. While risk of cougar attacks would increase if pathways attract more visitors into cougar habitat, no evidence could be found to suggest that user attributes associated with pathways would increase risk above that experienced by other outdoor recreationists.

Effects of Alternative 1 – No Action Alternative

Endangered and Threatened Species (Federally Listed Species)

Bald Eagle

Under Alternative 1, the presence and ongoing maintenance of existing park roads would not directly affect bald eagles or their habitat. Road maintenance activities would not occur within 0.5 mile of bald eagle nests, and no eagle habitat would be removed during routine road maintenance.

Indirect effects from road use and maintenance or from the new road management strategies on Moose-Wilson Road would include a reduction in habitat effectiveness within a zone of influence from the road. Based on nesting habitat management guidelines (GYBEMP 1995), it was assumed that bald eagles would avoid suitable habitat within a 400-meter buffer from the road. The amount of habitat within this zone of influence that would be impacted by Alternative 1 would be the same as the amount impacted under existing conditions (Table 22). Disturbance from human presence, noise, and recreation within the zone of influence



could displace eagles or occasionally flush birds from perches in areas that contain suitable eagle habitat, such as near the Moose Bridge, Cottonwood Creek, and at the Jackson Lake Dam. Other indirect effects from human disturbance would include modifications of behavior, habitat avoidance, and possibly changes in reproductive success. Activities associated with road maintenance or vehicle use of the road would be short-term and would not be expected to measurably change bald eagle use of the area.

Cumulative Effects

Activities occurring within bald eagle habitat that may adversely affect bald eagles are limited and, for public land management actions, are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect bald eagle populations include private land development, vegetation management, human recreation, contaminants, and illegal killing of individuals.

Residential development on private lands adjacent to the Snake River outside of Grand Teton National Park has increased dramatically, and this trend is expected to continue into the foreseeable future. However, the number of bald eagles nesting and producing young within the Snake Population Unit, including Grand Teton National Park, has increased. The development thresholds at which the Snake Population Unit eagle productivity would decline is unknown, but is not expected to occur as a result of Alternative 1 or other projects proposed at this time.

Recreational activities such as floating, fishing, hiking, horseback riding, snow-shoeing, and skiing within bald eagle nesting and foraging areas could adversely impact nest occupancy and productivity if these activities occur in proximity to active nests. However, the park has been successful at minimizing human intrusion into the 0.5-mile spatial buffer around active bald eagle nests during the nesting season, thus minimizing disturbance to nesting eagles. There is no evidence that suggests that current levels of recreational use within Grand Teton National Park or elsewhere in Jackson Hole has adversely affected bald eagle nesting. It is likely, however, that human recreational use of the Snake River, for example, may

sometimes conflict with bald eagle foraging and may cause individual birds to be displaced from certain foraging areas when humans are present. In places of heavy recreational use, such as in the Snake River Canyon south of the park, bald eagles appear to adapt to human presence and human-related disturbances by spatially and/or temporally adjusting their foraging activities and apparently do so without adversely affecting reproductive success. Bald eagles that are not habituated to human-related disturbances may abandon nests and/or alter their behavior resulting in nest failure and low productivity (MBAMP 1994).

An “Incidental Take” Statement for 18 bald eagles was given to the Canyon Club development project within the Snake River Canyon in southern Jackson Hole in 2002, but this potential “Take” was determined by the USFWS not to jeopardize the continued existence of the species. After 2 years of golf course construction, no incidental take of eagles has occurred as a result of construction-related activities on the Canyon Club project.

These activities cumulatively contribute to increased mortality risks to bald eagles and reduce the availability of secure eagle habitat. However, the total cumulative impact of the above listed activities, as well as other unidentified actions occurring within bald eagle habitat, does not appear to have adversely affected population recovery as evidenced by current population numbers in the Greater Yellowstone Area. Actions under Alternative 1 are not expected to increase, in the long-term, human presence within or improve access to bald eagle habitat that would cumulatively reduce habitat security.

Overall, long-term adverse cumulative impacts to the bald eagle would be minor. Adverse impacts resulting from Alternative 1 would be expected to contribute only slightly to cumulative impacts affecting bald eagles.

Effects Determination and Summary of Rationale

Under Alternative 1, individual bald eagles may be displaced by human presence, noise, and activities associated with road maintenance and vehicular use of roads, but given that the project area is outside of bald eagle nest territories, these effects are expected to be negligible. No actions are

proposed in this alternative that would affect important bald eagle wintering or foraging habitats. Overall, impacts to local and ecosystem bald eagle populations under Alternative 1 are expected to be negligible. Therefore this alternative may affect but is not likely to adversely affect bald eagles.

Canada Lynx

Under Alternative 1, the existing transportation infrastructure would remain in use and routine maintenance of existing roadways would continue to occur. New road management strategies would be tested on the Moose-Wilson Road. The presence and ongoing maintenance of existing park roads that are within or adjacent to lynx habitat, could have minor adverse effects on lynx. Direct effects to lynx could include permanent loss of a small amount of habitat (likely less than 5 acres) caused by road and pull-out paving in forested habitats or secondary habitats important for connectivity. Potential lynx habitat occurs adjacent to the Moose-Wilson Road, along the Teton Park Road between Signal Mountain and Jackson Lake dam and along the North Park Road between Jackson Lake Junction and Colter Bay. In the Wyoming Range of northwestern Wyoming, lynx were documented using non-forested habitats where they were intermingled with or immediately adjacent to primary habitat (Squires and Laurion 2000, Ruediger et al. 2000). Thus the sagebrush habitats adjacent to the Teton Park Road may provide lynx travel habitat linking habitats and populations both within the park and between more southern and northern areas of the Greater Yellowstone Area. These habitats are part of an identified linkage area connecting the Granite LAU with the Berry and Two Ocean LAUs.

Direct mortality could also result from collisions with vehicles. There are few records of lynx being killed by collisions with vehicles, but they have been documented (Ruediger et al. 2000). No lynx have been reported killed by vehicles in the park. The risk of mortality is related to the type of roadway, traffic volume, and lynx density. The risk of roadway mortality and the degree of habitat fragmentation increases as highways are upgraded and/or speeds are increased (Ruediger et al. 2000). No roadway upgrades or changes to speed limits are proposed; therefore the risk of roadway mortality for lynx is anticipated to be low

TABLE 23
MILES OF ROAD IN GRAND TETON
NATIONAL PARK
BY ROAD CLASS INSIDE AND OUTSIDE OF
THE GRIZZLY BEAR RECOVERY ZONE
(PRIMARY CONSERVATION AREA), 2004

Road Class	Inside Recovery Zone	Outside Recovery Zone
Heavy Duty	13.98	26.86
Medium Duty	1.25	52.83
Light Duty	38.4	121.04
Unimproved Dirt	16.08	79.59

and adverse impacts negligible to minor.

Indirect effects from road use and maintenance or from the new road management strategies on Moose-Wilson Road would include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually lost to the road. Other indirect effects to lynx may include human-caused displacement of animals from areas adjacent to roads or other behavior modifications. There is little information on the disturbance effects of linear corridors on medium-sized mammals, such as lynx. They may be less tolerant of human activities in the southern part of their range where suitable habitats are naturally more fragmented (Jalkotzy et al. 1997). However, some anecdotal information suggests that lynx may be relatively tolerant of humans (Ruediger et al. 2000), with the exception of human activity near den sites (Ruggiero et al. 2000). Whether they avoid habitats adjacent to linear features or are displaced by human activities along these corridors and the threshold at which this may occur is unknown (Ruediger et al. 2000). For the purposes of this analysis, it was assumed that lynx would avoid coniferous habitats within 400 meters of linear features. Approximately 4,021 acres of coniferous forest habitat occurs within the 400 meter ZOI of the existing transportation system. No lynx den sites are known in the park, but given that they are generally located in mature subalpine forests with abundant coarse woody debris (Squires and Laurion 2000), it is unlikely that any den sites are close to the main transportation system. The threshold where hu-



man activity precludes use of an area by lynx is unknown (Ruediger et al. 2000).

Routine snowplowing operations on northern Grand Teton National Park roads would include the periodic (spatially and temporally) laying back of plowed snow banks and creating plowed openings in snow banks to allow lynx and other wildlife to easily negotiate these obstacles.

Cumulative Effects

Other activities occurring in the Greater Yellowstone Area that may affect lynx or their habitat include timber management, wildland fire management (including prescribed burns both inside and outside the park), grazing (outside and within the park), winter recreation (including grooming for OSVs) and trapping of other furbearers. With the exception of trapping, all of these activities have the potential to affect forest successional stages, and consequently, snowshoe hares and lynx. Continued use and maintenance of the existing park roadways within the project area are expected to add minor cumulative impacts to lynx.

Impact Determination and Summary of Rationale

Under Alternative 1, individual lynx may be displaced by human presence and noise associated with routine maintenance and continued use of the transportation system, but given that most of the project area is outside of mapped lynx habitat, these effects are expected to be negligible to minor. No actions are proposed in this alternative that would affect important lynx linkage areas. The likelihood of a lynx being hit and killed by a vehicle is anticipated to be low given that lynx likely occur in the park at low densities, if at all, and to date no vehicle mortalities have been reported. Based on the above assumptions and conclusions, it is in the opinion of the NPS that Alternative 1 **may affect but is not likely to adversely affect** Canada lynx.

Grizzly Bear

Under Alternative 1, the presence, use, and ongoing maintenance of existing park within or adjacent to bear habitat roads (Table 23) would adversely affect grizzly bears, both directly and indirectly. Direct effects include permanent loss of habitat caused by road and pull-out paving and the potential for vehicle-caused mortality. Indirect

effects from road use and maintenance or from the new road management strategies on Moose-Wilson Road include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually paved by the road. Using a buffer of 400 meters on each side of the road as an average ZOI for grizzly bears, and focusing on areas from Jenny Lake Junction and to the north that currently support grizzlies, it is estimated that 5,057 acres of habitat in the project area would be affected (Table 20). A reduction in habitat effectiveness could potentially result in slightly lower reproductive fitness of some individual bears within home ranges adjacent to the road corridor. However, range and population increases of grizzly bears in Grand Teton National Park suggest that impacts associated with roads have not yet reached a threshold impact level that jeopardizes the survival of grizzly bears in the park. Other indirect effects to grizzly bears include human-caused displacement of bears from areas adjacent to roads, habituation to humans, and other potential behavior modifications.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality could be considered moderate, since this could affect one or more bears, but would not threaten the survival of the species. To date, no grizzly bears have been reported killed by vehicles in Grand Teton National Park. However, existing road conditions and grizzly bear distribution suggest it is only a matter of time before this occurs. In the past 25 years, 13 grizzly bears have been killed by vehicles in the Greater Yellowstone Area (Gunther et al. 2004, IGBST, unpublished data).

Cumulative Effects

Actions occurring on public lands within the recovery zone that may adversely affect grizzly bears or their habitat, such as oil and gas exploration and development, logging, and mining, are limited by the Endangered Species Act (ESA) (USFWS 1982) and are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect grizzly bears in the recovery zone include:

- Livestock grazing, which may impact grizzly bears through management actions

- Private land development
- Firewood cutting
- Road use/management
- Timber harvest (past)
- Recreation activities, especially big game hunting, that lead to human-bear conflicts
- Vegetation management
- Wildland fire and prescribed fires
- Loss or decline of important food sources (e.g., whitebark pine seeds due to fire suppression)
- Potential reduction in elk and bison populations

These activities would cumulatively contribute to increased mortality risks, reduce availability of secure habitat, and diminish habitat effectiveness for grizzly bears. The total cumulative impact of the above-listed activities, as well as other unidentified actions occurring within the grizzly bear recovery zone, does not appear to be adversely affecting population recovery, as evidenced by the expanding grizzly bear population in the Greater Yellowstone Area (Eberhardt and Knight 1996; Schwartz et al. 2002; Pyare et al. 2004).

Cumulative impacts to grizzly bears in the Greater Yellowstone Area specific to this Plan/DEIS include road kills, recreation use, management removals, and road or project construction. As previously mentioned, to date, no grizzly bears have been reported killed by vehicles in Grand Teton National Park. However, existing road conditions and grizzly bear distribution suggest it is only a matter of time before this occurs. In the past 25 years, 13 grizzly bears have been killed by vehicles in the Greater Yellowstone Area (Gunther et al. 2004, IGBST, unpublished data). The cumulative impacts of these actual losses and possible future road kills are likely to be minor, because road kills are not a significant source of mortality to the population in the Greater Yellowstone Area.

Increases in backcountry recreation by humans in and around Grand Teton National Park may negatively affect grizzly bears if human-bear encounters increase. Hunting of elk during the park's

annual elk reduction occurs on approximately 66,600 acres of the park's backcountry, 29,100 of which is in the recovery zone. Hunting of elk and other big game also occurs outside of and adjacent to the park's boundaries. Conflicts between grizzly bears and hunters appear to be increasing (Gunther et al. 2004), and these encounters are a potential source of bear mortality. In 2004, 7 of 19 (37 percent) human-caused grizzly bear mortalities in the Yellowstone ecosystem were attributed to hunter conflicts (M. Haroldson, IGBST, pers. comm.), and for the first time in many years, female grizzly recovery mortality limits were exceeded. However, unless hunter-related conflicts increase substantially, the cumulative adverse effects of these conflicts at current grizzly bear population levels are likely to be minor. Land and wildlife management agencies, including Grand Teton National Park, have active programs designed to educate backcountry users about grizzly bears and requirements designed to reduce human-bear conflicts.

Several privately owned and State of Wyoming-owned in-holdings are present in Grand Teton National Park; depending upon future human activities occurring on these properties, grizzly bears may be negatively affected. Grand Teton National Park has, for many years, attempted to secure these in-holdings with lifetime leases and out-right purchases and has been quite successful in doing so. No large-scale developments or land-based projects have been proposed for these in-holdings. The JY Ranch (approximately 1,100 acres in southern Grand Teton National Park) will be conveyed to the federal government in 2006 to be administered as part of the park. Although most of the development that has been present on the ranch will be removed, an interpretive facility and trail system will be developed by the current owners prior to the conveyance. Recently, efforts have been made by the federal government to secure several parcels of state-owned land within Grand Teton National Park. The cumulative adverse effects of possible future development occurring on these in-holdings are likely to be minor.

In the past 20 years, two grizzly bears have been removed from Grand Teton National Park for management reasons: one for cattle depredations



and one because of human habituation and food conditioning. The latter bear came to Grand Teton National Park as a nuisance bear after being relocated from the northern to the southern part of the ecosystem. An additional bear that had broken into a cabin at the AMK Ranch in Grand Teton National Park was killed after being relocated from Grand Teton National Park to Montana and continuing its nuisance behavior there. Management removals within the primary conservation area (PCA) and a 10-mile buffer around it are counted against recovery parameters (USFWS 2003). The existing transportation system increases the potential for management removals because of the access to grizzly bear habitat it provides, adding cumulatively to removals throughout the ecosystem.

Overall, the contribution of this alternative to long-term cumulative impacts to grizzly bears in the Greater Yellowstone Area would be negligible to minor.

Mitigation Measures

- “Bearwise” education will be conducted with all personnel involved in road and reconstruction and maintenance projects.
- All food and other attractants will be properly stored at all times, and all food materials, garbage, and other attractants will be packed out on a daily basis if it cannot be stored in bear-resistant containers.
- Project crews other than law enforcement personnel will not carry firearms.
- Project crews will carry bear pepper spray when conducting project activities and will be trained in bear safety.
- All project crews working in grizzly bear habitat will meet standards for sanitation, attractant storage, and access.
- All grizzly bear/human confrontations would be reported to Science and Resource management personnel.

Effects Determination and Summary of Rationale

Alternative 1 is not expected to have substantial adverse population level impacts on grizzly bears, nor would it jeopardize the recovery of grizzly

bears within the Greater Yellowstone Area. However, it is reasonable to expect that one or more grizzly bears could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone grizzly bear population under Alternative 1 would be long-term and moderate, since one or more individual bears are **likely to be adversely affected** by this alternative.

Gray Wolf

Under Alternative 1, the presence, use, and ongoing maintenance of existing park roads within or adjacent to wolf habitat would continue to adversely affect wolves, both directly and indirectly. Direct effects include permanent loss of habitat caused by road and pull-out paving and potential for vehicle-caused mortality. Radio-telemetry data have shown that the Teton pack regularly crosses U.S. 89/191 between Moran and the Triangle X Dude Ranch, and between Moran and the park’s east boundary. Other wolves from unknown pack affiliations have been observed crossing park roads on many occasions (S. Cain, Grand Teton National Park, per. comm.). Indirect effects from road use and maintenance would include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually paved by the road. The loss of habitat associated with existing primary roads is estimated to be 13,583 acres (Table 20). Other indirect effects to wolves include human-caused displacement of wolves from areas adjacent to roads, and possibly other behavior modifications. Under this alternative, no activities would occur within 1 mile of known wolf dens or rendezvous sites.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality could be considered moderate, since this could affect one or more individual wolves, but would not threaten the survival of the species. Between 1995 and 2001, 13 wolves were killed by vehicles in the Greater Yellowstone Area. Existing road conditions and future road reconstruction may result in the death of additional wolves.

Cumulative Effects

Activities occurring within wolf habitat that may adversely affect wolves in the Greater Yellowstone Area are limited and, for public land manage-

ment agencies, are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect wolves occurring within the recovery zone include livestock grazing, private land development, vegetation management, potential reduction in elk and bison populations, and control actions.

These activities would cumulatively contribute to increased mortality risks and reduce the availability of secure habitat. However, the total cumulative impact of the above-listed activities, as well as other unidentified actions occurring within the wolf habitat, does not appear to have adversely affected population recovery, as evidenced by the quick expansion of the wolf population following reintroduction and the continued expansion into areas outside of Yellowstone National Park. In the long term, the proposed action is not expected to increase human presence within or improved access to wolf habitat that would cumulatively reduce habitat security.

Cumulative impacts to the gray wolf specific to this Plan/DEIS also include road kills, recreational use, and road reconstruction in the area. Between 1995 and 2001, 13 wolves were killed by vehicles in the Greater Yellowstone Area. Existing road conditions and future road reconstruction may result in the death of additional wolves. However, the cumulative impacts of these actual losses and possible future road kills on the Greater Yellowstone population are likely to be negligible to minor.

Several privately owned and State of Wyoming-owned in-holdings are present in Grand Teton National Park; depending upon future human activities occurring on these properties, wolves may be negatively affected. Grand Teton National Park has, for many years, attempted to secure these in-holdings with lifetime leases and out-right purchases and has been quite successful in doing so. No large-scale developments or land-based projects have been proposed for these in-holdings. The JY Ranch (approximately 1,100 acres in southern Grand Teton National Park) will be conveyed to the federal government in 2006 to be administered as part of the park. Although most of the development that has been present on the ranch will be removed, an interpretive facility and

trail system will be developed by the current owners prior to the conveyance. Recently, efforts have been made by the federal government to secure several parcels of state-owned land within Grand Teton National Park. The cumulative impacts of existing residential activities and possible future development occurring on these in-holdings are likely to be minor.

Overall, long-term adverse cumulative impacts to the gray wolf would be minor. Adverse impacts to gray wolves resulting from Alternative 1 would be expected to contribute only slightly to cumulative impacts to wolves.

Effects Determination and Summary of Rationale

Alternative 1 is not expected to have substantial adverse population level impacts on wolves, nor would it jeopardize the recovery of wolves within the Greater Yellowstone Area. However, it is reasonable to expect that one or more wolves could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone wolf population under Alternative 1 would be long-term and moderate, since one or more individual wolves are likely to be adversely affected by this alternative.

Yellow-billed Cuckoo

Under Alternative 1, the presence, use, and ongoing maintenance of existing park roads would not directly affect the yellow-billed cuckoo or its habitat. No known cuckoo nests are within or adjacent to the project area, and no potential nesting habitat would be removed during road maintenance.

Indirect effects from road use and maintenance or from the new road management strategies on Moose-Wilson Road would include a reduction in habitat effectiveness within a zone of influence from the road. Based on findings reported in Miller et al. (1998) for other passerine species, it was assumed that cuckoos would avoid suitable habitat within a 75-meter buffer from the road. The amount of habitat within this zone of influence that would be impacted by Alternative 1 would be the same as the amount impacted under existing conditions (Table 21). Studies have shown that passerine bird species respond to human dis-



turbance in several ways and that these responses vary depending upon the species, sex, and age of an individual, as well as on the time of year and quality and foraging potential of adjacent habitat (Knight and Temple 1995, Gutzwiller et al. 1998). How cuckoos would respond to and be impacted by noise and human presence from road maintenance is relatively unknown, but may include habitat avoidance, nest abandonment, behavior modifications, or reproductive failure as observed by other passerine bird species (Boyle and Samson 1985, Knight and Gutzwiller 1995, Miller et al. 1998). Because no cuckoos have been reported in the project area and activities associated with road maintenance would be short-term, impacts from Alternative 1 would not be expected to measurably change yellow-billed cuckoo use of the area, and adverse impacts would be none to negligible.

Cumulative Effects

Activities occurring within yellow-billed cuckoo habitat that may adversely affect yellow-billed cuckoo are limited and, for public land management actions, are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect yellow-billed cuckoo populations include private land development, loss of riparian habitat, human recreation, and nest predation.

These activities would cumulatively contribute to increased mortality risks to cuckoos and reduce the availability of secure cuckoo habitat. Overall, long-term adverse cumulative impacts to cuckoos would be minor. Adverse impacts resulting from Alternative 1 would be expected to contribute only slightly to cumulative impacts affecting yellow-billed cuckoos.

Effects Determination and Summary of Rationale

Under Alternative 1, individual cuckoos may be displaced by human presence, noise, and associated activities with road maintenance, but given that no cuckoos are known to nest in the park, these effects are expected to be none to negligible. No actions are proposed in this alternative that would affect potential cuckoo breeding or nesting habitats. Overall, impacts to yellow-billed cuckoo populations under Alternative 1 are expected to be none to negligible. Therefore this alternative may

affect but is not likely to adversely affect yellow-billed cuckoos.

Bird Species of Special Concern (Not Federally Listed) and Neotropical Migratory Birds

Neotropical Migratory Birds/ Bird Species of Special Concern

Activities occurring under Alternative 1 would have the lowest impact of those alternatives considered in this document on bird species of special concern and other migratory bird species that may breed or use areas within the project area. Under Alternative 1, maintenance of existing roads and associated activities would be confined to roadways. No vegetation or bird habitat would be removed.

Indirect effects from road use and maintenance or from the new road management strategies on Moose-Wilson Road would include a reduction in habitat effectiveness within a zone of influence from the road. Based on findings reported in Miller et al. (1998) for a variety of songbirds, it was assumed that many bird species of special concern and neotropical migratory birds in the project area would avoid suitable habitat within a 75-meter buffer from the road although for some raptor species this zone of influence may be greater (Dubois and Hazelwood 1987). The amount of habitat within this zone of influence that would be impacted by Alternative 1 would be the same as the amount impacted under existing conditions (Table 21).

The effects disturbance would have on birds within the zone of influence would be variable and difficult to quantify. Factors such as species, sex, and age of individuals, as well as the time of year, magnitude, type and duration of human activities, affects response (Knight and Temple 1995, Gutzwiller et al. 1998, Postovit and Postovit 1987). Studies have found that birds may respond to human disturbance by avoiding habitat, abandoning nests, and modifying behavior (Boyle and Samson 1985, Knight and Gutzwiller 1995, Miller et al. 1998). Disturbance to diurnal raptors has also been shown to disrupt behavior when it deters foraging or flushes birds from foraging perches and roosts (Holmes et al. 1993). Maintenance activities associated with Alternative 1 would be limited in time and space; therefore, disturbance

to birds would be short-term and negligible. No long-term adverse effects are anticipated for bird species of special concern and/or other neotropical migratory birds as a result from Alternative 1.

Cumulative Effects

Neotropical migratory birds are of particular interest to wildlife managers because they have been experiencing severe population declines throughout their North American range. Habitat fragmentation and loss of winter range are at least two factors believed responsible for these declines. Bird species of special concern may be vulnerable to extirpation at the global or state level due to inherent rarity, significant loss of habitat, or sensitivity to human-caused mortality or habitat disturbances (Fertig and Beauvais 1999). These factors cumulatively contribute to reduced reproductive success, increased mortality risks, and reduced availability of secure habitat to bird species of special concern. Residential development in Jackson Hole has been responsible for both habitat loss (or at least habitat alterations and conversion) and increased mortality as a result of predation by domestic pets (especially cats) and collisions with windows. Future residential development in the valley can be expected to continue this negative trend. Alternative 1 is not expected to increase, in the long-term, loss of habitat to birds or human presence within important breeding bird habitat that would cumulatively reduce habitat security. Therefore, Alternative 1 would have negligible and short-term cumulative impacts to bird species of special concern.

Greater Sage-Grouse

Under Alternative 1, the routine maintenance of existing park roads would not directly affect grouse and their habitat. No leks are within the project area. Although known nesting, brood-rearing and wintering habitat are adjacent to roadways in the southern portion of the project area, no vegetation in these habitats would be removed under Alternative 1. Direct mortality of grouse could result from collisions with vehicles. Grouse have been killed by vehicles along the outside park highway and the Teton Park Road (S. Wolff, Grand Teton National Park, pers. comm.). Road use and maintenance under Alternative 1 would not be expected to increase mortality to

grouse along roadways or measurable change sage-grouse use of the area.

Indirect effects from road use and maintenance or from the new road management strategies on Moose-Wilson Road would include a reduction in habitat effectiveness within a zone of influence from the road. For the purposes of this analysis, it was assumed that sage-grouse would be affected by a zone of influence 75 meters from the roadway. The amount of habitat within this zone of influence that would be impacted by Alternative 1 would be the same as the amount impacted under existing conditions (Table 21). Potential indirect effects to sage-grouse due to human presence and noise associated with project activities include displacement of individuals, habitat avoidance, and modifications in behavior. Human activity along roadways and dispersed use beyond the roadway could cause occasional flushing of birds from nests or brood-rearing areas. Under this alternative, these impacts would occur infrequently and only during the duration of road maintenance; therefore, it is in the opinion of the NPS that Alternative 1 would have short-term negligible adverse effects on the greater sage-grouse.

Cumulative Effects

Actions occurring on public and private lands within greater sage-grouse suitable habitat that may adversely affect grouse or their habitat include but are not limited to:

- Oil and gas exploration and development
- Livestock grazing and sagebrush removal
- Private land development
- Road use/management
- Vegetation management
- Wildland fire and prescribed fires
- Recreation near leks, such as bird-watching
- Increase in predator populations and in turn, increased predation rates

In the Jackson Hole area, the condition and extent of wintering habitat may be limiting sage-grouse population growth (Holloran and Anderson 2004). Wintering habitat is characterized by dense, tall sagebrush stands on relatively flat south



to west facing slopes and includes areas south of Blacktail Butte, Wolff Ridge, and the northern portions of the National Elk Refuge. The extent of historical wintering habitats in the Jackson Hole region is difficult to quantify, but it appears that areas have been eliminated through development, large ungulate grazing of these habitats, and/or prescribed and natural fires (Holloran and Anderson 2004).

The activities listed above cumulatively contribute to increased mortality risks and reduced availability of secure habitat to sage-grouse and may potentially limit sage-grouse population growth in the Jackson Hole region. Alternative 1 is not expected to increase, in the long-term, loss of habitat to sage-grouse or to human presence within sage-grouse habitat that would cumulatively reduce habitat security. Therefore, Alternative 1 would have negligible and short-term cumulative impacts to the greater sage-grouse.

General Wildlife

Mammals

The continued use and maintenance of existing park roads would have both direct and indirect minor adverse effects on mammals whose habitats the roads intersect. Under Alternative 1, adverse impacts to mammals would be primarily associated with the risk of vehicle collisions, reduced habitat effectiveness, and fragmentation of habitats.

Direct effects to mammals include vehicle caused mortality and permanent loss of habitat due to road and/or pull-out paving. Ungulates residing in and migrating through Grand Teton National Park frequently cross roads and these crossings sometimes result in wildlife-vehicle collisions (WVC). Park records have documented an average of 25 deer, 20 elk, 8 moose, 3 bison, and 1 pronghorn killed each year based on data from 1992-2001. There was no apparent trend in the number of WVCs occurring in Grand Teton National Park over the 10 year period 1992 and 2001. However, WVCs in Teton County appear to have increased over a similar time period and are strongly correlated with increases in traffic levels (Biota 2003). Annual recreational visitation in Grand Teton National Park has been relatively flat over the last decade and is expected to increase

only slightly over the next 5-10 years. If WVCs in the park follow a pattern similar to Teton County as a whole then ungulate road related mortalities could also increase slightly over the life of this transportation plan.

Other mammals are also killed by vehicles on park roads, but to a far lesser extent than ungulates. Black bears appear to be the most susceptible non-ungulate species to vehicle collisions. Park records documented an average of 2 black bears and 1 coyote killed per year for the period 1992-2001. Overall, the number of ungulates and black bears hit by vehicles on park roads is low and current numbers represent a minor mortality source to park mammals on an annual basis.

Existing roads, trails, and human uses of these linear facilities can displace wildlife and reduce roadside habitat use. The extent to which mammals may be displaced by the existing road system or any road management strategies implemented on Moose-Wilson Road is unknown. Studies of ungulates suggest that they may habituate to situations when predictable and consistent stimuli are associated by the animal with harmless outcomes (Knight and Gutzwiller 1995). Elk in protected areas like national parks sometimes adapt to vehicle traffic along roads when their experiences with these disturbances are benign. Winter is the most critical time for wildlife. With the exception of moose, ungulate wintering areas are generally outside of the park or away from project area roads. For other mammals present in the park during the winter this period coincides with the lowest levels of park use by humans.

Roads and the human developments along them may in some cases be an attractant for some species (e.g., coyotes, bears, etc.) especially if use of these areas has been reinforced by food reward. Carnivores searching for both natural and unnatural food sources in and adjacent to road corridors may be more susceptible to road mortality.

Linear features may also cause some degree of wildlife habitat fragmentation, but this is one of the least understood impacts in road ecology. Traffic volume and speed, road width and whether or not fencing is used influence the extent to which a roadway and system may impede connectivity. The current road system has a relatively

low posted speed (45 mph on the Teton Park and North Park Road and 55 mph on US 26/89/191), regular patrols to enforce speed limits, a two lane road surface, and limited use of fencing – characteristics that reduce the likelihood that existing road corridors limit wildlife movements.

Overall, Alternative 1 would have long-term, minor adverse impacts to mammals.

Amphibians and Reptiles

Activities occurring under Alternative 1 would have the lowest impact of those considered in this document on amphibians and reptiles. Under Alternative 1, maintenance of existing roads would occur and be confined to roadways. No vegetation or suitable breeding habitat would be removed. Direct mortality of adult amphibians or reptiles that occupy areas within the project area could result due to human activities and operation of equipment but these effects would be negligible and short-term. Overall, activities associated with Alternative 1 would have no to negligible adverse impacts to amphibians and reptiles in the park.

Cumulative Impacts (General Wildlife)

Cumulative impacts to wildlife could result from other developments and use of the park, such as construction of new facilities and recreational intrusion into habitats. Historic and current park management emphasizes natural ecosystem processes, so that development has been minimized and much of the historical development in the park has been removed and reclaimed. Existing and future development within Grand Teton National Park is not expected to adversely impact wildlife populations. Traffic and recreational use and the associated noise and human presence within Grand Teton National Park could adversely impact individual animals, but are not likely to adversely affect populations.

Cumulative impacts of other past, present, and future projects in and around the park have the potential of adversely affecting wildlife. These impacts primarily involve the loss or degradation of habitat. Residential development on private land has increased dramatically in recent years, and this trend is expected to continue into the foreseeable future. Despite these residential and recreational increases, mammal populations within

Jackson Hole, including Grand Teton National Park, are believed to have stayed relatively stable or increased. Regarding reptiles and amphibians, riparian areas have been developed and wetlands have been filled to accommodate development. However, wetland protection administered by the U.S. Army Corps of Engineers and by county government is believed to be sufficient to protect the integrity of amphibian and reptiles on private land in Jackson Hole.

Declining amphibian populations have been documented worldwide and are thought to be particularly acute in western North America. These declines have been attributed to habitat disturbance including pollution, fish introduction, and habitat degradation. There is also growing interest in infectious diseases and their role in global amphibian declines (Daszak et al. 1999). In particular, chytrid fungus, a contagious disease found in various frogs, toads, and salamanders, has been thought to be the cause of heightened mortality leading to mass amphibian die-offs in six continents, including North America. Montane and pristine areas in the Western U.S. have not been immune to the fungus; in fact, two toad species once common in the Rocky Mountains, including boreal toads in Rocky Mountain National Park, have likely been decimated by the disease (Muths et al. 2003). Cases of chytrid-infected amphibians in Wyoming and Montana, as well as in Colorado, have indicated the distribution of the disease is throughout the Rocky Mountains and has the potential to be detrimental to amphibian populations in these areas. A pilot project conducted in Grand Teton National Park during the summer of 2004 identified chytrid fungus on the skin of boreal toads and spotted frogs but it did not appear to affect the health or survival of infected animals.

Overall, the impacts from past, present, and future actions, in conjunction with the effects of Alternative 1, would result in long-term, minor to moderate cumulative impacts to general wildlife. Alternative 1 would contribute only negligibly to these cumulative impacts.



Conclusion (Threatened and Endangered (Federally Listed) Species, Bird Species of Special Concern, and General Wildlife)

Threatened and Endangered (Federally Listed)

Species - Alternative 1 may affect but is not likely to adversely affect the bald eagle, Canada Lynx, or yellow-billed cuckoo. Alternative 1 is likely to adversely affect the grizzly bear and gray wolf, because vehicle collisions may occur that would adversely affect one or more individuals, but the alternative would not threaten the survival of either species.

Bird Species of Special Concern - Alternative 1 would have no to negligible adverse impacts on bird species of special concern, neotropical migratory birds, or greater sage-grouse. Cumulative impacts would be negligible and adverse.

General Wildlife - Alternative 1 would result in negligible to minor, long-term adverse impacts to mammals, reptiles, and amphibians from continued use of park roads and trails due to displacement from and/or avoidance of habitats adjacent to existing roads. Direct mortality levels are not expected to increase under this alternative, but it is likely that individual mammals would continue to be struck and killed by vehicles using park roads. Cumulative impacts would be long term, minor to moderate, with Alternative 1 adding a small amount to overall cumulative impacts.

Because there would be no major, adverse impacts to wildlife resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wildlife resources, including any listed species or species of special concern.

Effects of Alternative 2 – Minimal Action Alternative

Endangered and Threatened Species (Federally Listed Species)

Bald Eagle

Similar to Alternative 1, no direct adverse impacts to bald eagles would result from implementing Alternative 2. The proposed shoulder widening

along the Teton Park Road would not directly affect bald eagle nesting, foraging, or wintering habitat. Construction of widened shoulders would not occur within 0.5 mile of known bald eagle nests. Road widening in the vicinity of the Snake River near the Moose Bridge and near Cottonwood Creek would be confined to the existing roadway.

Indirect effects from construction activities and increases in road use by pedestrians and cyclists would cause a reduction in habitat effectiveness within a 400-meter zone of influence (see Alternative 1 analysis for discussion on bald eagle zone of influence). The amount of habitat within this zone of influence that would be impacted by Alternative 2 would be the same as the amount impacted from existing conditions (Table 21). Disturbance from human presence, noise, and recreation along the roadway and from dispersed use off of the roadway could displace eagles or occasionally flush birds from perches in areas that contain suitable eagle habitat such as near the Moose Bridge, Cottonwood Creek, and at the Jackson Lake Dam. Other indirect effects from human disturbance would include modifications of behavior, habitat avoidance, and possibly changes in reproductive success. Activities associated with shoulder construction would be short-term; however, pedestrian and cyclist use along roadways would be long-term. It is the opinion of the NPS that impacts from Alternative 2 would be greater than those from Alternative 1, and that Alternative 2 would have long-term, negligible effects on bald eagles.

Cumulative Effects

Cumulative impacts to bald eagles associated with Alternative 2 would be generally the same as those identified in Alternative 1. Any disturbances to bald eagles from road shoulder construction would contribute only negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and cyclist use of proposed improved shoulders, would contribute only negligibly to cumulative impacts. Overall long-term cumulative impacts to bald eagle populations would be negligible.

Impact Determination and Summary of Rationale

Under Alternative 2, individual bald eagles may be displaced by human presence, noise, vehicular road use, and associated activities with road shoulder widening but given that the project area is outside of bald eagle nest territories, these effects are expected to be negligible. No actions are proposed in this alternative that would affect important bald eagle wintering or foraging habitats. Overall, adverse impacts to local and ecosystem bald eagle populations under Alternative 2 are expected to be negligible. Therefore this alternative **may affect but is not likely to adversely affect** bald eagles.

Canada Lynx

Direct and indirect effects to lynx resulting from Alternative 2 would be similar to those described for Alternative 1, i.e., negligible to minor and adverse. In addition to the effects from existing conditions, Alternative 2 includes widening of roadway shoulders along approximately 18 miles of the Teton Park Road between Moose and Signal Mountain. Approximately 5 acres of vegetation would be removed permanently in the project area. A 1-mile section of road from the Signal Mountain turnoff to Signal Mountain Lodge is within the Two Ocean LAU and mapped lynx habitat occurs adjacent to the roadway in this area. A small amount (less than 2 acres) of lynx habitat would be lost. However, this loss would occur adjacent to the existing road and large patches of forested cover would remain intact nearby; therefore, the direct loss of habitat would be negligible. Indirect impacts associated with construction of widened shoulders and use of the roadside by more pedestrians and cyclists would include human-caused displacement and possibly other behavior modifications. Approximately 4,024 acres of coniferous forest habitat would be affected by the 400 meter ZOI. This represents an increase of 3 acres compared to alternative 1. How lynx respond to increased recreation use is likely to depend upon the activities that people are involved in. Activities that are predictable may allow animals to habituate to them. Those that are noisier (allows the animal to detect the recreationist), short in duration, and where the recreationist does not directly approach the animal are least impactful. Because of the increased recreation

use anticipated and a slightly larger transportation footprint expected under this alternative, the loss in habitat effectiveness in the road corridors zone of influence is expected to be greater than that under Alternative 1.

Anticipated vehicle traffic levels on roads in park would be similar to Alternative 1 and represent a negligible to minor potential source of mortality for Canada lynx.

Cumulative Effects

Other activities occurring in the Greater Yellowstone Area that may affect lynx or their habitat include timber management, wildland fire management (including prescribed burns both inside and outside the park), grazing (outside the park and within the park), winter recreation, and trapping of other furbearers. With the exception of trapping, all of these activities have the potential to affect forest successional stages, and consequently, snowshoe hares and lynx.

Cumulative impacts to Canada lynx associated with Alternative 2 would be generally the same as those identified in Alternative 1. Road density within the park would not increase as a result of the proposal, although the physical footprint and the effect zone would increase slightly. Any disturbances to lynx from road shoulder construction would represent a negligible to minor contribution to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of proposed improved shoulders, would contribute only minor cumulative impacts.

Impact Determination and Summary of Rationale

Under Alternative 2, individual lynx may be displaced by human presence and noise associated with routine maintenance and continued use of the transportation system, but because most of the project area is outside of mapped lynx habitat, these effects are expected to be negligible to minor. No actions are proposed in this alternative that would affect important lynx linkage areas. The likelihood of a lynx being hit and killed by a vehicle is anticipated to be low, because lynx likely occur in the park at low densities, if at all, and to date no vehicle mortalities have been reported. Impacts to lynx or lynx habitat are expected to be greater than those described under Alternatives 1 and 2.



tive 1, but are still expected to be negligible to minor. Therefore, it is in the opinion of the NPS that Alternative 2 **may affect but is not likely** to adversely affect Canada lynx.

Grizzly Bear

Direct and indirect effects to grizzly bears resulting from Alternative 2 would be similar to those resulting from Alternative 1, with the following exceptions. Direct impacts associated with the proposed approximately 18 miles of widened road shoulder along Teton Park Road would involve removing a small amount of vegetation and thus direct habitat loss (Tables 18 and 19). However, this loss would occur adjacent to the existing road, and because bears tend to avoid road corridors (Mace et al. 1996, McLellan et al. 1988), the loss in habitat effectiveness would be negligible. Indirect impacts associated with construction of widened shoulders and use of the roadside by more pedestrians and cyclists would include human-caused displacement of bears from areas adjacent to widened roads, habituation to humans, and possibly other behavior modifications. However, use of the roadsides by more people may make it more difficult for bears to habituate to this less predictable activity; thus, the loss in habitat effectiveness in the roads' zone of influence could be expected to be greater than under Alternative 1. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20).

The creation of non-motorized corridors – expanded road shoulders in this alternative is expected to result in an increase in non-motorized use of these areas. Bear-human encounters in these areas would probably increase, both because of increased human use and because of the added surprise factor that quiet, non-motorized use represents (see Pathways and Wildlife Hazard discussion). This is particularly true where roads and pathways traverse habitats where terrain and/or vegetation limit sight distances, or where noise from streams can cover noise of approaching humans. The risk of serious human injuries from such encounters would increase, but their frequency of occurrence cannot be predicted.

Increasing access in grizzly bear habitat for large

numbers of the public, potentially carrying food, also creates additional opportunities for bears to become conditioned (Herrero 1985) to human foods. Experience in the park has shown that food storage regulation compliance is poorest and hardest to enforce among dispersed recreationists. Therefore, while education efforts would help mitigate this potential, some bears may become conditioned to human foods. Bears that become conditioned to human foods usually become a threat to human safety and ultimately need to be destroyed. Because this alternative would provide more non-motorized access (through expanded road shoulders) in grizzly bear habitat than Alternative 1, it would result in higher potential for bear mortality associated with human food conditioning.

Improving social trails in and near campgrounds may keep visitors from straying to less developed areas that bears could inhabit, but otherwise would have no effect.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality and from potential mortality from human conditioning could be considered moderate, since this could affect one or more bears, but would not threaten the survival of the species.

Cumulative Effects

Cumulative impacts to grizzly bears associated with Alternative 2 would be generally the same as those identified in Alternative 1. Any disturbances to grizzly bears from road shoulder construction would contribute only negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of proposed improved shoulders, would contribute only negligibly to cumulative impacts. Overall long-term cumulative impacts to grizzly bears in the Greater Yellowstone Area population would be negligible to minor.

Mitigation Measures

- “Bearwise” education will be conducted with all personnel involved in road and pathway construction and maintenance projects.
- All food and other attractants will be properly stored at all times, and all food materials, gar-

bage, and other attractants will be packed out on a daily basis if it cannot be stored in bear-resistant containers.

- Project crews other than law enforcement personnel will not carry firearms.
- Project crews will carry bear pepper spray when conducting project activities and will be trained in bear safety.
- All project crews working in grizzly bear habitat will meet standards for sanitation, attractant storage, and access.
- All grizzly bear/human confrontations would be reported to Science and Resource management personnel.

Effects Determination and Summary of Rationale

Alternative 2 is not expected to have substantial adverse population level impacts on grizzly bears, nor would it jeopardize the recovery of grizzly bears within the Greater Yellowstone Area. However, the inclusion of expanded road shoulders in grizzly bear habitat, some of which has limited sight distances, would reduce habitat effectiveness, increase potential for habituation and/or food conditioning by some bears, and increase potential for bear mortalities associated with management removals. It is also reasonable to expect that one or more grizzly bears could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone grizzly bear population under Alternative 2 would be long-term and moderate, since one or more individual bears are likely to be adversely affected by this alternative.

Gray Wolf

Direct and indirect effects to wolves resulting from Alternative 2 would be similar to those resulting from Alternative 1, with the following exceptions. Direct impacts associated with the proposed approximately 18 miles of widened road shoulder along Teton Park Road would involve removing a small amount of vegetation and thus direct habitat loss for some potential wolf prey species. However, this loss would occur adjacent to the existing road, and because both ungulates and wolves largely avoid the road corridor, the

loss in habitat effectiveness would be negligible.

Indirect impacts associated with use of the roadside by more pedestrians, cyclists, and transit vehicles would include human-caused displacement of wolves from areas adjacent to widened roads, habituation to humans, and possibly other behavior modifications. However, use of the roadsides by more people may make it more difficult for wolves to habituate to this less predictable activity; thus, the loss in habitat effectiveness in the roads' zone of influence could be expected to be greater than under Alternative 1. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown, but perhaps moderate amount at times (Figure 20). Improving social trails in and near campgrounds would have no effect on wolves.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality could be considered moderate, since this could affect one or more wolves, but would not threaten the survival of the species.

Cumulative Effects

Cumulative impacts to gray wolves associated with Alternative 2 are expected to be similar to those identified in Alternative 1. Vehicle use of existing Grand Teton National Park roads and bicyclist and pedestrian use of new improved shoulders along Teton Park Road are not expected to contribute to cumulative impacts on wolves. The cumulative impacts of existing residential activities and possible future development occurring on park in-holdings and properties in the vicinity of Grand Teton National Park are likely to be minor. Overall, long-term impacts to gray wolves would be negligible to minor, and the contribution of impacts resulting from Alternative 2 to gray wolf cumulative impacts would be very small.

Effects Determination and Summary of Rationale

Alternative 2 is not expected to have substantial adverse population level impacts on wolves, nor would it jeopardize the recovery of wolves within the Greater Yellowstone Area. However, habitat security would be reduced, and it is reasonable to expect that one or more wolves could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to



the park and Greater Yellowstone wolf population under Alternative 2 would be long-term and moderate, since one or more individual wolves are **likely to be adversely affected** by this alternative.

Yellow-billed Cuckoo

Similar to Alternative 1, no direct adverse impacts to yellow-billed cuckoo would result from implementing Alternative 2. The proposed shoulder widening along the Teton Park Road would not occur near any known cuckoo nesting or foraging habitats, but a small amount of potential cuckoo habitat would be permanently removed (0.1 acres; Appendix B). Road shoulder widening in the vicinity of the Snake River near the Moose Bridge and near Cottonwood Creek would be confined to the existing roadway.

Indirect effects from construction activities and increases in road use by pedestrians and cyclists would cause a reduction in habitat effectiveness within a 75-meter zone of influence (see Alternative 1 analysis for discussion on cuckoo zone of influence). Approximately 0.2 acres of cottonwood forest (Appendix B) would be potentially impacted within this zone of influence; however the amount of habitat impacted by Alternative 2 would be the same as existing conditions (Table 21). The effects from construction, human presence, noise, and recreation along the roadway and from dispersed use off of the road would have on cuckoos within the zone of influence are relatively unknown but may include displacement of individuals, changes in behavior, reduction in breeding and reproduction success, and movement to less desirable habitats. Impacts from Alternative 2 would be expected to be greater than under Alternative 1 and have long-term, no to negligible effects on yellow-billed cuckoos, although no cuckoos have been reported in the project area.

Cumulative Effects

Cumulative impacts to yellow-billed cuckoos associated with Alternative 2 would be generally the same as those identified in Alternative 1. The amount of habitat removed would be small and would be along the existing road corridor; therefore, the loss of this habitat would not significantly contribute to habitat fragmentation. Any disturbances to yellow-billed cuckoos from road shoulder construction would contribute only

negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and cyclist use of proposed improved shoulders, would contribute only negligibly to cumulative impacts. Overall long-term cumulative impacts to yellow-billed cuckoo populations would be none to negligible.

Impact Determination and Summary of Rationale

Under Alternative 2, individual yellow-billed cuckoos could be displaced by human presence, noise, and activities associated with road shoulder widening, but because no known cuckoo breeding or nesting territories are located within the project area, these effects are expected to be none to negligible. No actions are proposed in this alternative that would affect important yellow-billed cuckoos nesting or foraging habitats. Overall, impacts to yellow-billed cuckoo populations under Alternative 2 are expected to be none to negligible. Therefore this alternative **may affect but is not likely to adversely affect** yellow-billed cuckoos.

Bird Species of Special Concern (Not Federally Listed) and Neotropical Migratory Birds

Neotropical Migratory Birds/Birds Species of Special Concern

Direct and indirect effects to bird species of special concern and/or neotropical migratory birds resulting from Alternative 2 would be similar to those described in Alternative 1. In addition to the effects from existing conditions, Alternative 2 includes widening roadway shoulders along approximately 18 miles of the Teton Park Road between Moose and Signal Mountain. A direct loss of approximately 5 acres of vegetation would occur due to shoulder widening in habitats such as sagebrush, cottonwood, aspen, and conifer forests (Appendix B). The removal of these habitats would impact breeding, nesting, brood-rearing, and year-round foraging habitat of several bird species that depend on these habitat types; however, because the amount of direct habitat loss is small, these impacts would be negligible. Nests, eggs or young could be destroyed if construction of road shoulders occurs during the breeding season (mid-May through mid-July); therefore, mitigation measures to reduce these losses would be implemented (see below).

Indirect impacts associated with the construction of road shoulders and their use by pedestrians and cyclists would include a reduction in habitat effectiveness within a 75-meter zone of influence from the road (see Alternative 1 discussion on bird species of concern and neotropical migratory bird species zone of influence). A variety of habitats and therefore several different bird species would be affected within this zone of influence (Appendix B); however, no net loss of habitat from existing conditions would occur (Table 21). The effects that this disturbance would have on birds within the zone of influence would be variable and difficult to quantify. Studies have shown that individual songbirds respond differently to human disturbance and that responses depend on species, sex, and age of the individual and on the time of year and quality of adjacent habitat (Knight and Temple 1995, Gutzwiller et al. 1998). Potential response to human disturbance by passerine birds includes habitat avoidance, nest abandonment, reproductive failure, and modifications in behavior (Boyle and Samson 1985, Knight and Gutzwiller 1995, Miller et al. 1998, Page and Ritter 1999). Recreational disturbance to diurnal raptors has also been shown to disrupt behavior when it deters foraging or flushes birds from foraging perches and roosts (Holmes et al. 1993). In addition to impacts associated with recreational use along the roadway, dispersed use off the road could further reduce habitat effectiveness by an unknown, but perhaps moderate, amount at times (Figure 20). Although human disturbances may be brief in time, repeated encounters would be long-term. Overall, impacts from Alternative 2 would be negligible and long-term to bird species of special concern and/or other neotropical migratory birds.

Cumulative Effects

Cumulative impacts to birds under Alternative 2 would be generally the same as those described in Alternative 1. Alternative 2 would contribute to the loss of habitat but would be confined to the areas along the Teton Park Road. Any disturbances to birds from road shoulder construction would contribute negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of proposed improved shoulders, would contribute negligibly to

cumulative impacts. Overall long-term cumulative impacts to bird species of special concern and/or other neotropical migratory bird populations would be negligible.

Mitigation Measures

To minimize the potential for “taking” a nest or egg of a migratory bird species, either 1) any activity that would destroy a nest or egg would occur after July 15, a timeframe outside of the primary nesting season, or 2) a survey for any nests in the project area would be conducted prior to these activities.

Greater Sage-Grouse

Direct and indirect effects to greater sage-grouse resulting from Alternative 2 would be similar to those described for Alternative 1. In addition to the effects from existing conditions, Alternative 2 includes widening of roadway shoulders along approximately 18 miles of the Teton Park Road between Moose and Signal Mountain. Direct impacts from Alternative 2 would include permanent loss of 2.4 acres of sagebrush habitat from Moose to North Jenny Lake Junction, although this loss would occur adjacent to the existing road. An additional one-acre sagebrush habitat would be removed along the road from North Jenny Lake Junction to Signal Mountain, an area where no sage-grouse have been recorded (Appendix B). No direct effects would occur to known sage-grouse lekking, nesting, brood-rearing, or wintering areas under Alternative 2.

Indirect impacts associated with the construction of road shoulders and their use by pedestrians and cyclists include a reduction in habitat effectiveness within a zone of influence (see Alternative 1 for discussion on sage-grouse zone of influence). An estimated 2.3 acres of sagebrush habitat would be impacted within this zone of influence along the Inner Park Road from Moose to North Jenny Lake Junction (Appendix B), beyond which is already impacted by existing conditions (Table 21). An additional 0.9 acres of sagebrush would be within this zone of influence from North Jenny Lake Junction to Signal Mountain, although no grouse have been reported in this area. Sagebrush habitat along the Teton Park Road is considered potential sage-grouse nesting and brood-rearing habitats, and could therefore be impacted by



activities associated with Alternative 2. Indirect effects to sage-grouse due to human presence and noise associated with project activities include displacement of individuals, habitat avoidance, and modifications in behavior. Human activity along roadways and dispersed use beyond the roadway could cause occasional flushing of birds from nests or brood-rearing areas. Although impacts during construction would be short-term, repeated human disturbance from recreational use along widened shoulders would be long-term. As a result, impacts from Alternative 2 would have long-term and negligible to minor impacts to the greater sage-grouse.

Cumulative Effects

Cumulative impacts to greater sage-grouse associated with Alternative 2 would be generally the same as those identified in Alternative 1. Alternative 2 would contribute to the loss of sagebrush habitat, but this loss would be confined to the areas along the Teton Park Road. Any disturbances to sage-grouse from road shoulder construction would contribute negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of proposed improved shoulders, would contribute negligibly to cumulative impacts. Overall long-term, cumulative impacts to greater sage-grouse in the Jackson Hole population would be negligible.

General Wildlife

Mammals

In addition to the effects from continued use and maintenance of existing roadways, Alternative 2 includes widening of roadway shoulders along approximately 18 miles of the Teton Park Road between Moose and Signal Mountain. Approximately 5 acres of native vegetation, mainly sagebrush, would be removed permanently. Sagebrush habitats are important to a wide range of mammals, including all the native ungulates and a number of carnivores and small mammals. The actual amount of habitat lost would be small, and the loss would occur immediately adjacent to the existing road corridor, but because the corridor would increase in width edge effects would increase. This would enhance habitat for generalist species (e.g., coyotes, black bears), but would further degrade habitats for specialist species

(e.g., forest dwelling species). It is likely that any mammals present would, in the short-term, be temporarily displaced from habitat adjacent to the road due to construction-related activity for the duration of the project, but may use some of these areas once reclamation activities have been completed and vegetation has become established.

The primary additional impact to mammals under Alternative 2 would be disturbance due to the increased level of recreation (mainly bicyclists) on the roadway. Widening of the road shoulder would increase the footprint of the roadway and thus its zone of influence on adjacent habitats. The construction of widened shoulders is expected to result in an increase in non-motorized recreation use, which could result in increased disturbance impacts, as well as increased potential for conflicts with wildlife.

Responses of wildlife to human activities vary by individual and species. An individual animal's response may vary according to the season, age and sex, body size, group size, behavioral response of cohorts or habitat security (Knight and Gutzwiller 1995). Behavioral responses are influenced by the characteristics of the disturbance itself (type, distance away, direction of movement, speed, predictability, and frequency) and location (in open habitat areas versus those screened by topography or vegetation), as well as the tolerance of the species or individual to disturbance. Recent experimental measurement of the effects of off-road recreation on mule deer and elk and found that elk displayed pronounced reactions to ATVs and mountain bikers, over horseback riders or hikers (Wisdom et al. 2004). In general, recreational activities had a substantial effect on elk behavior, but it is unclear what the energetic costs associated with these disturbances may be. Mule deer showed little response (in terms of movement rates), but may respond to off-road activity by seeking denser cover, which could result in reduced foraging opportunities (Wisdom et al. 2004). Taylor and Knight (2003) observed that mule deer, bison and pronghorn antelope exhibited a high probability of flushing from on-trail recreationists when encountered at close range (within 100 meters). They identified a 200 meter area of influence along trails. Zones of influence up to 1300 meters have been identified for elk along roads (Gaines et al. 2003).

Areas adjacent to the Teton Park Road from Moose to north Jenny Lake Junction are important to elk for feeding and as rutting sites, and to bison, pronghorn, and mule deer for feeding. Under this alternative, both the 75-and 400-meter ZOI's would increase by approximately 4 acres (Table 21). However, given that recreationists could stop at any point along the pathway and approach wildlife or enter occupied habitats, disturbance levels within the zone of influence are expected to be higher than under Alternative 1. An increase in off-trail use associated with increased levels of recreation users in the road corridor would further reduce habitat effectiveness by an unknown, but perhaps moderate, amount at times (Figure 20). Although, some studies suggest that ungulates and other wildlife may habituate to the presence of humans, it is unknown how they may respond to relatively unpredictable activities. In addition, habituation can lead to an increase in wildlife-human conflicts (e.g. elk in the Banff, Canada townsite,) and an escalation of management actions (e.g. removals, hazing, relocation, etc.) to improve human safety. Alternative 2 is not expected to have significant population level impacts on mammals, although it is likely that individuals and groups of individuals in specific areas would be influenced by disturbance impacts.

Motor vehicle traffic levels on roads in Grand Teton National Park are expected to be similar to Alternative 1 and represent a minor potential source of mortality to mammals. Although wildlife-vehicle collisions usually cause the death of an animal, they occur relatively infrequently and do not adversely affect mammals at a population level.

Overall, Alternative 2 would have long-term, minor adverse impacts to mammals.

Amphibians and Reptiles

Direct and indirect effects to amphibians and reptiles resulting from Alternative 2 would be similar to those described in Alternative 1. In addition to the effects from existing conditions, Alternative 2 includes widening of roadway shoulders along approximately 18 miles of the Teton Park Road between Moose and Signal Mountain, and removing an estimated 5 acres of vegetation (Table 19). No direct loss to riparian habitats would occur from the proposed shoulder widening. Although no

known amphibian or reptile breeding sites occur within the project area, if construction does occur near a wetland that may be a potential amphibian breeding area, measures would be taken to prevent damage caused by construction equipment, erosion, siltation, or other activities. The removal of vegetation for shoulder widening could cause direct impacts to amphibians or reptiles that use these areas to forage or for cover. Direct and indirect mortality of adult amphibians or reptiles due to human activities and operation of equipment could occur. Overall, impacts to reptiles and amphibians from Alternative 2 would be negligible and short-term.

Cumulative Impacts (General Wildlife)

Cumulative impacts to general wildlife under Alternative 2 would be about the same as those identified in Alternative 1 (i.e., long term, minor to moderate, and adverse). The contribution of impacts resulting from Alternative 2 to cumulative impacts would be very small.

Conclusion (Threatened and Endangered (Federally Listed) Species, Bird Species of Special Concern, and General Wildlife)

Threatened and Endangered (Federally Listed) Species - Alternative 2 may affect but is not likely to adversely affect the bald eagle, Canada Lynx, or yellow-billed cuckoo. Alternative 2 is likely to adversely affect the grizzly bear and gray wolf, because vehicle collisions or mortality related to human conditioning (for bears) may occur that would adversely affect one or more individuals, but the alternative would not threaten the survival of either species.

Bird Species of Special Concern - Alternative 2 would have no to negligible adverse impacts on bird species of special concern and neotropical migratory birds, and negligible to minor adverse effects on the greater sage-grouse. Cumulative impacts would be negligible and adverse.

General Wildlife - Alternative 2 would result in negligible to minor, long-term adverse impacts to mammals, reptiles and amphibians from continued use of park roads and pathways and construction of shoulder widening along a portion of Teton Park Road. Although the amount of direct habitat loss is least under this alternative, the



construction of widened shoulders to accommodate bicycle traffic is likely to lead to an increase in recreation use and consequently levels of disturbance. The potential for human-wildlife conflicts and associated management actions would be higher than under Alternative 1 again due to increased recreation use levels. Direct mortality levels are not expected to increase under this alternative, but it is likely that individual mammals would continue to be struck and killed by vehicles using park roads. Although no adverse population level impacts to mammals, reptiles, or amphibians are anticipated, effects to local species distributions and habitat use patterns are likely, but to a lesser degree than in Alternatives 3 or 4. Cumulative impacts would be long term, minor to moderate, and adverse, with Alternative 2 adding little to overall cumulative impacts.

Because there would be no major, adverse impacts to wildlife resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wildlife resources, including any listed species or species of special concern.

Effects of Alternative 3 – Preferred Alternative

Endangered and Threatened Species (Federally Listed Species)

Bald Eagle

No direct adverse impacts to bald eagles would result from implementing Alternative 3. The proposed road shoulder and pathway would not directly affect bald eagle nesting, foraging, or wintering habitat. Construction of widened shoulders and pathways would not occur within 0.5 mile of known bald eagle nests. The development of pathways in the vicinity of the Snake River near the Moose Bridge and along Cottonwood Creek would be confined to the existing roadway. The proposed pathway along the Moose-Wilson Road from the Granite Entrance to Moose, including the road re-route, would not be constructed within bald eagle habitat.

Indirect effects from construction activities, pedestrians and cyclist use along pathways and widened shoulders, and transit vehicle use, would cause a reduction in habitat effectiveness within the zone of influence (see Alternative 1 analysis for the definition of zone of influence for bald eagles). Disturbance from human presence, noise, and recreation along the roadway and pathways, as well as from dispersed use off the pathways, could displace eagles or occasionally flush birds from perches in areas that contain suitable eagle habitat such as near the Moose Bridge, Cottonwood Creek, and at the Jackson Lake Dam. Other indirect effects from human disturbance would include modifications of behavior, habitat avoidance, and possibly changes in reproductive success. Activities associated with shoulder and pathway construction would be short-term; however, pedestrian and cyclist use along roadways and pathways would be long-term. It is therefore the opinion of the NPS that impacts from Alternative 3 would be greater than those from Alternative 1 and similar to those from Alternative 2. These impacts would have long-term, minor effects on bald eagles.

Cumulative Effects

Cumulative impacts to bald eagles associated with Alternative 3 would be generally the same as those identified in Alternatives 1 and 2. Any disturbances to bald eagles from pathway construction would contribute only negligibly to cumulative impacts. Transit and other vehicle use of Grand Teton National Park roads and pedestrian and cyclist use of proposed pathways would contribute only negligibly to cumulative impacts. Overall long-term cumulative impacts to bald eagle populations would be negligible.

Impact Determination and Summary of Rationale

Under Alternative 3, individual bald eagles may be displaced by human presence, noise, and associated activities with pathway construction but given that the project area is outside of bald eagle nest territories, these effects are expected to be minor. No actions are proposed in this alternative that would affect important bald eagle wintering or foraging habitats. Overall, impacts to local and ecosystem bald eagle populations under Alternative 3 are expected to be minor. Therefore this al-

ternative **may affect but is not likely to adversely affect** bald eagles.

Canada Lynx

Direct and indirect effects to lynx resulting from Alternative 3 would be similar to those described for Alternative 1, including direct mortality and direct and indirect impacts to lynx habitat. Overall impacts would be negligible to minor and adverse.

In addition to effects resulting from continued use and maintenance of the existing transportation system, Alternative 3 involves construction of approximately 16 miles of widened shoulders along the Teton Park Road and the North Park Road. A portion of the Moose-Wilson Road would be realigned and the old road alignment restored. Three separated pathway segments totaling approximately 23 miles are also proposed along U.S. 26/287/191 from the south boundary to the Antelope Flats Road, along the Moose-Wilson Road from the Granite Entrance Station to the JY Visitor Center and along the Teton Park Road from Moose to North Jenny Lake Junction. Shoulder widening and road realignment would result in a direct loss of 1.9 acres (Table 18) of conifer forest vegetation types. This loss would occur between the Signal Mountain turnoff and Colter Bay within the Two Ocean and Steamboat LAUs. An additional 1.8 acres (Table 18) of conifer forest would be lost due to construction of the pathway in the Granite LAU. Conifer habitats represent potential habitat for lynx. This amount of habitat loss (3.9 acres total) would be minor given the large amount of coniferous forest remaining that would not be impacted.

Disturbance impacts to lynx could occur from noise and human presence associated with construction of the shoulders and the pathway and its use. Of the pathway segments proposed under this alternative, the Moose-Wilson segment would traverse relatively contiguous conifer habitat, which is mapped as lynx habitat. The width of the linear corridor in this area would increase from 18' to a maximum of 82' (assuming pathway is 50 feet from the road) along this segment, with an attendant increase in the ZOI. The separated pathway would affect an additional 113 acres of coniferous forest habitat beyond the existing 400-

meter ZOI. Lynx are generally crepuscular animals (active at twilight or before sunrise), and may rest in secure habitat during the day and emerge at night to use areas where human activity has stopped or decreased. Consequently, if pathway use occurs primarily during daylight hours, disturbance impacts to lynx habitats adjacent to the road and pathway corridors would be minimal.

Motor vehicle traffic levels under this alternative, including transit vehicles under the pilot program that would displace individual vehicles, are expected to be similar to those predicted under the other action alternatives and represent a negligible to minor potential source of mortality for lynx. The overall risk of direct mortality is not expected to increase from pathway construction and use.

Routine snow-plowing operations on northern Grand Teton National Park roads would include the periodic (spatially and temporally) laying back of plowed snow banks and creating plowed openings in snow banks to allow lynx and other wildlife to easily negotiate these obstacles.

Cumulative Effects

Other activities occurring in the Greater Yellowstone Area that may affect lynx or their habitat include timber management, wildland fire management (including prescribed burns both inside and outside the park), grazing (outside and within Grand Teton National Park), winter recreation, and trapping of other furbearers. With the exception of trapping, all of these activities have the potential to affect forest successional stages, and consequently, snowshoe hares and lynx.

Cumulative impacts to Canada lynx associated with Alternative 3 would be generally the same as those identified in Alternatives 1 and 2. Although road density would not increase under this alternative, the overall density of linear features would increase with an addition of 23 miles of separated pathway. The physical footprint of the road would increase slightly, and construction of the separated pathway would result in additional direct habitat loss and reduced habitat effectiveness. Disturbances to lynx from road shoulder construction would represent a negligible to minor contribution to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian



and bicyclist use of proposed improved shoulders, would contribute only minor cumulative impacts.

Effects Determination and Summary of Rationale

Under Alternative 3, individual lynx may be displaced by human presence and noise associated with routine maintenance and continued use of the transportation system; but because most of the project area is outside of mapped lynx habitat, these effects are expected to be negligible to minor. No actions are proposed in this alternative are likely to significantly affect important lynx linkage areas. The likelihood of a lynx being hit and killed by a vehicle is anticipated to be low given that lynx likely occur in the park at low densities, if at all, and to date, no vehicle mortalities have been reported. Impacts to lynx or lynx habitat are expected to be greater than those described under Alternatives 1 or 2, but are still expected to be minor in scale. Based on the above assumptions and conclusions, it is in the opinion of the NPS that Alternative 3 **may affect but is not likely to adversely affect** Canada lynx.

Grizzly Bear

Direct and indirect effects to grizzly bears resulting from Alternative 3 would include those resulting from road use and maintenance, as described under Alternative 1. The presence and ongoing maintenance of existing park roads within or adjacent to bear habitat adversely affects grizzly bears, both directly and indirectly. Direct effects include permanent loss of habitat caused by road and pull-out paving and the potential for vehicle-caused mortality. Indirect effects from road use and maintenance and transit system vehicle use would include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually paved by the road. In the project area, the loss of habitat associated with existing primary roads is estimated to be 5,057 acres. A reduction in habitat effectiveness could potentially result in slightly lower reproductive fitness of some individual bears within home ranges adjacent to the road corridor. However, range and population increases of grizzly bears in Grand Teton National Park suggest that impacts associated with roads have not yet reached a threshold impact level that jeopardize the survival of grizzly bears in the park. Other indirect effects to griz-

zly bears include human-caused displacement of bears from areas adjacent to roads, habituation to humans, and possibly other behavior modifications.

In addition to the effects resulting from existing conditions, Alternative 3 includes the construction of approximately 23 miles of multi-use pathways and 16 miles of widened shoulders along the main park roads, which would have additional impacts. Direct impacts associated with the proposed action would include the permanent loss of approximately 49 acres of native vegetation, and an equal additional temporary loss during construction and revegetation phases (Tables 18 and 19). Most of this habitat alteration would occur immediately adjacent to existing roads (16 miles) or within 50 meters of the road (23 miles). Additional indirect habitat loss from extending the zone of influence associated with roads and separated pathways under this alternative would equal 310 acres (Tables 20 and 21).

By maintaining separated pathways mostly within 50 feet of the road, much of the habitat loss associated with this alternative would occur adjacent to or within the zone of influence of existing roads. And because bears tend to avoid road corridors (Mace et al. 1996, McLellan et al. 1988), the additional loss in long-term habitat effectiveness would be minor. In small areas where pathways would diverge as much as 150 feet from roadsides, impacts would be increased. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown, but potentially moderate, amount at times (Figure 20). Indirect impacts associated with construction and use of the roadsides and separated pathways by more pedestrians and cyclists would include human-caused displacement of bears from adjacent areas, potential habituation (Herrero 1985) to humans, and possibly other behavior modifications. Mattson et al. (1992) reported that habituated bears in the Greater Yellowstone Area were killed from a variety of causes 3.1 times more often than wary bears. Use of the roadsides by more people may make it more difficult for most bears to habituate to this less predictable activity, however, and thus the loss in habitat effectiveness in the road's zone of influence could be expected to be greater than under Alternatives 1 or 2.

The creation of non-motorized corridors – both expanded road shoulders and separated pathways – is expected to result in an increase in non-motorized use of these areas. Bear-human encounters in these areas would increase both because of increased human use and because of the added surprise factor that quiet, non-motorized use represents (see Pathways and Wildlife Hazards discussion). This is particularly true where roads and pathways traverse habitats where terrain and/or vegetation limit sight distances, or where noise from streams can cover noise of approaching humans. Serious human injuries from such encounters may occur, but their frequency cannot be predicted.

Adding pathways in grizzly bear habitat that are easily utilized by large numbers of the public, potentially carrying food, also creates additional opportunities for bears to become conditioned (Herrero 1985) to human foods. Experience in the park has shown that food storage regulation compliance is poorest and hardest to enforce among dispersed recreationists. Therefore, while education efforts would help mitigate this potential, some bears may become conditioned to human foods. Bears that become conditioned to human foods usually become a threat to human safety and ultimately need to be destroyed. Because this alternative would have more pathways in grizzly bear habitat than Alternatives 1 or 2, it would result in higher potential for bear mortality associated with human food conditioning.

In this alternative, none of the proposed separated pathways occur within the grizzly bear recovery zone (USFWS 1993), or PCA identified in the final conservation strategy for the grizzly bear in the Yellowstone ecosystem (USFWS 2003). However, the 5.5-mile section of expanded road shoulder proposed between Jackson Lake Junction and Colter Bay borders the PCA through willow, sage/grass, and mixed lodgepole, spruce-fir cover types where grizzlies are common. The grizzly bear recovery zone was delineated to define an area within which to focus grizzly bear recovery efforts after the species was listed in 1975. At the time the boundary was delineated, grizzly bears were uncommon in Grand Teton National Park. Currently, however, grizzly bears are established in large areas outside of the PCA in Grand Teton

National Park (Schwartz et al. 2002), and the line has little relevance in terms of grizzly bear distribution.

The final conservation strategy for the grizzly bear in the Yellowstone ecosystem (USFWS 2003) was developed to guide grizzly bear management after the species is delisted. It includes a “no-net-loss” of secure habitat standard for all of the PCA. Thus, while the loss of secure habitat from expanded road shoulders, the zone of influence from pathway users, and the effects of off-trail use adjacent to the PCA would be technically allowable, considering the current distribution of bears it would be contrary to the goals of the conservation strategy, of which Grand Teton National Park is a signatory.

Currently grizzly bears are uncommon in the area of proposed separated pathways on the Teton Park Road south of north Jenny Lake Junction. The probability of human-bear encounters in this area is further reduced because habitat cover types are predominately open with long sight distances. However, it is likely that grizzly bears would become more common in this area in the future. While grizzly bears are also currently uncommon along the Moose-Wilson Road corridor, individuals have been known to travel through the area. Adding separated pathways in this area, along with varied terrain, heavy cover, and several noisy stream crossings, would escalate the probability of human-grizzly bear encounters and associated human injuries.

Paving of social trails in and near campgrounds would perhaps help to keep visitors from straying into bear habitat, but otherwise would have no effect on bears.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality and from potential mortality from human conditioning could be considered moderate, since this could affect one or more individual bears, but would not threaten the survival of the species.

Cumulative Effects

Actions occurring on public lands within the recovery zone that may adversely affect grizzly bears or their habitat, such as oil and gas exploration and development, logging, and mining, are lim-



ited by the ESA (USFWS 1982) and are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect grizzly bears in the recovery zone include:

- Livestock grazing, which may impact grizzly bears through management actions
- Private land development
- Firewood cutting
- Road use/management
- Timber harvest (past)
- Recreation activities, especially big game hunting, that leads to human-bear conflicts
- Vegetation management
- Wildland fire and prescribed fires
- Loss or decline of important food sources (e.g., whitebark pine seeds due to fire suppression)
- Potential reduction in elk and bison populations

These activities and issues cumulatively contribute to increased mortality risks, reduce availability of secure habitat, and diminish habitat effectiveness for grizzly bears. The total cumulative impact of the above-listed activities, as well as other unidentified actions occurring within the grizzly bear recovery zone, does not appear to be adversely affecting population recovery as evidenced by the expanding grizzly bear population in the Greater Yellowstone Area (Eberhardt and Knight 1996, Schwartz et al. 2002, Pyare et al. 2004).

Cumulative impacts to grizzly bears in the Greater Yellowstone Area specific to this alternative would be similar to those under Alternatives 1 and 2 and include road kills, recreation use, management removals, and road or project construction. To date, no grizzly bears have been reported killed by vehicles in Grand Teton National Park. However, existing road conditions and grizzly bear distribution suggest it is only a matter of time before this occurs. Thirteen grizzly bears have been killed by vehicles in the GYE in the past 25 years. The cumulative effects of these actual losses and possible

future roadkills are likely to be minor, because road kills are not a significant source of mortality to the population in the Greater Yellowstone Area.

Increases in backcountry recreation by humans in and around Grand Teton National Park may negatively affect grizzly bears if human-bear encounters increase. Hunting of elk during the Park's annual elk reduction occurs in approximately 66,600 acres of the park's backcountry, 29,100 of which is in the recovery zone or PCA. Hunting of elk and other big game also occurs outside of and adjacent to the park's boundaries. Conflicts between grizzly bears and hunters appear to be increasing (Gunther et al. 2004), and these encounters are a potential source of bear mortality. In fact, in 2004, 7 of 19 (37%) human-caused grizzly bear mortalities in the Yellowstone ecosystem were attributed to hunter conflicts (M. Haroldson, IGBST, pers. comm.), and for the first time in many years grizzly recovery mortality limits were exceeded. However, unless hunter-related conflicts increase substantially, the cumulative adverse effects of these conflicts at current grizzly bear population levels are likely to be minor. Land and wildlife management agencies, including Grand Teton National Park, have active programs designed to educate backcountry users about grizzly bears and requirements designed to reduce human-bear conflicts.

Several privately owned and State of Wyoming owned in-holdings are present in Grand Teton National Park; depending upon future human activities occurring on these properties, grizzly bears may be negatively affected. Grand Teton National Park has, for many years, attempted to secure these in-holdings with lifetime leases and out-right purchases and has been quite successful in doing so. No large-scale developments or land-based projects have been proposed for these in-holdings. The JY Ranch (about 1,100 acres in southern Grand Teton National Park) is being converted into an interpretive center and much of the existing development is being removed and reclaimed. In addition, management of this in-holding will eventually be handed over to Grand Teton National Park. Recently, efforts have been made by the Federal government to secure several parcels of state-owned land within Grand Teton National Park. The cumulative adverse effects of

possible future development occurring on these in-holdings are likely to be minor.

In the past 20 years, two grizzly bears have been removed from Grand Teton National Park for management reasons: one for cattle depredations and one because of human habituation and food conditioning. The latter bear came to Grand Teton National Park as a nuisance bear after being relocated from the northern to the southern part of the ecosystem. An additional bear that had broken into a cabin at the AMK Ranch in Grand Teton National Park was killed after being relocated from Grand Teton National Park to Montana and continuing its nuisance behavior there. Management removals within the PCA and a 10 mile buffer around it are counted against recovery parameters (USFWS 2003). Implementation of this alternative would increase the potential for management removals, adding cumulatively to removals throughout the ecosystem.

In summary, losses of habitat effectiveness and potential lowering of reproductive fitness of some individual bears resulting from existing roads and approximately 16 miles of expanded road shoulders and 23 miles of new paved, separated pathways would contribute only negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, pedestrian and bicyclist use of proposed pathways, and potential management removals associated with this use, are also expected to have negligible to minor cumulative impacts. Thus, overall, long-term cumulative impacts to grizzly bears in the Greater Yellowstone Area as a result of this alternative would be negligible to minor.

Mitigation Measures

- “Bearwise” education will be conducted with all personnel involved in road and pathway construction and maintenance projects.
- All food and other attractants will be properly stored at all times, and all food materials, garbage, and other attractants will be packed out on a daily basis if it cannot be stored in bear resistant-containers.
- All road-killed wildlife carcasses found less than 100 yards from the roadside will be removed within 24 hours to a location away

from roads and human activities.

- Project crews other than law enforcement personnel will not carry firearms.
- Project crews will carry bear pepper spray when conducting project activities and will be trained in bear safety.
- All project crews working in grizzly bear habitat will meet standards for sanitation, attractant storage, and access.
- All grizzly bear/human confrontations would be reported to Science and Resource management personnel.

Effects Determination and Summary of Rationale

Alternative 3 is not expected to have substantial adverse population level impacts on grizzly bears, nor would it jeopardize the recovery of grizzly bears within the Greater Yellowstone Area. However, the inclusion of separated pathways and expanded road shoulders in grizzly bear habitat, some of which has limited sight distances, would reduce habitat effectiveness, increase potential for habituation and/or food conditioning by some bears, and increase potential for bear mortalities associated with management removals. It is also reasonable to expect that one or more grizzly bears could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone grizzly bear population under Alternative 3 would be long-term and moderate, since one or more individual bears are likely to be adversely affected by this alternative.

Gray Wolf

Direct and indirect effects to wolves resulting from Alternative 3 would include those resulting from road use and maintenance, as described under Alternative 1. The presence and ongoing maintenance of existing park roads within or adjacent to wolf habitat adversely affects wolves, both directly and indirectly. Direct effects include permanent loss of habitat caused by road and pull-out paving and potential for vehicle-caused mortality. Radio-telemetry data have shown that the Teton pack regularly crosses U.S. 89/191 between Moran and the Triangle X dude ranch, and between Moran and the park’s east bound-



ary. Other wolves from unknown pack affiliations have been observed crossing park roads on many occasions (S. Cain, Grand Teton National Park, per. Comm.). Indirect effects from road use and maintenance and transit system use would include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually paved by the road. The loss of habitat associated with existing primary roads is estimated to be 13,583 acres (Table 20). Other indirect effects to wolves include human-caused displacement from areas adjacent to roads, possible habituation to humans, and possibly other behavior modifications.

In addition to the effects resulting from existing conditions, Alternative 3 includes the construction of approximately 23 miles of multi-use pathways and 16 miles of widened shoulders along the main park roads, which would have additional impacts. Direct impacts associated with the proposed action would include the permanent loss of approximately 49 acres of habitat for wolves and some of their prey species (Tables 18 and 19), and an equal, additional temporary loss during construction and revegetation phases. Most of this habitat alteration would occur immediately adjacent to existing roads (16 miles) or within 50 feet of the road (23 miles). Additional indirect habitat loss from extending the zone of influence associated with roads and separated pathways under this alternative would equal 310 acres (Table 20).

Since nearly all of the habitat loss associated with this alternative would occur adjacent to or within existing roads' current zones of influence, and because wolves and most of their primary prey tend to avoid road corridors, the loss in long-term habitat effectiveness would be negligible to minor. Indirect impacts associated with construction and use of the roadsides and separated pathways by more pedestrians and cyclists would include human-caused displacement of wolves from adjacent areas, potential habituation to humans, and possibly other behavior modifications. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20). However, use of the roadsides and pathways by more people may make it more difficult for wolves to habituate to this less

predictable activity along the corridor, and thus the loss in habitat effectiveness in the road's zone of influence could be expected to be greater than under Alternatives 1 or 2.

None of the proposed expanded road shoulders, separated pathways, or related construction activities would occur within 1 mile of known wolf dens or rendezvous sites. Paving of social trails in and near campgrounds would have no effect on wolves.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality could be considered moderate, since this could affect one or more individual wolves, but would not threaten the survival of the species.

Cumulative Effects

Activities occurring within wolf habitat that may adversely affect wolves in the Greater Yellowstone Area are limited and, for public land management agencies, are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect wolves occurring within the recovery zone include live-stock grazing, private land development, vegetation management, potential reduction in elk and bison populations, and control actions.

These activities and others discussed under Alternative 1 cumulatively contribute to increased mortality risks and reduce the availability of secure habitat. However, the total cumulative impact of the above- listed activities, as well as other unidentified actions occurring within the wolf habitat does not appear to have adversely affected population recovery as evidenced by the quick expansion of the wolf population following reintroduction and the continued expansion into areas outside of Yellowstone National Park. The proposed action, in the long-term, could be expected to increase human presence within or improved access to wolf habitat that would cumulatively reduce habitat security by a negligible to minor amount.

Impact Determination and Summary of Rationale

Alternative 3 is not expected to have substantial adverse population level impacts on wolves, nor would it jeopardize the recovery of wolves within

the Greater Yellowstone Area. However, habitat security would be reduced, and it is reasonable to expect that one or more wolves could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone wolf population under Alternative 3 would be long-term and moderate, since one or more individual wolves are **likely to be adversely affected** by this alternative.

Yellow-billed Cuckoo

Similar to Alternatives 1 and 2, no direct adverse impacts to yellow-billed cuckoo would result from implementing Alternative 3. The proposed pathways along the park's roadways would not occur near any known cuckoo nesting or foraging areas; however, approximately 1.2 acres of cottonwood forest, 0.7 acres of riparian wetland, and 0.1 acres of willow that are potential cuckoo habitat would be permanently removed for the construction of pathways (Appendix B). The direct impact from the loss of this habitat would be negligible because the amount of habitat removed would be small.

Indirect impacts to cuckoos include displacement of individuals due to human presence and noise associated with project activities in areas that contain cuckoo habitat such as near the Moose Bridge and Cottonwood Creek; however, no cuckoos have been reported in these areas. Any reduction in effective habitat from pathway construction and increases in pedestrian and cyclist use would be confined to the project's immediate area as well as within the 75 meter zone of influence (see Alternative 1 for discussion on zone of influence for cuckoos). Approximately 20 acres of cottonwood, willow and riparian wetland habitats would be potentially impacted within this zone of influence under Alternative 3. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20). The effects of human disturbance on cuckoos within the zone of influence are unknown but may include displacement of individuals, changes in behavior, reduction in breeding and reproduction success, and movement to less desirable habitats. Although impacts during construction would be short-term, repeated human disturbance from recreational use along the pathways and widened shoulders would be long-term. Overall, impacts

from Alternative 3 would be long-term, minor, and greater than those from Alternatives 1 and 2.

Cumulative Effects

Cumulative impacts to yellow-billed cuckoos associated with Alternative 3 would be greater as those identified in Alternatives 1 and 2 because additional habitat that may be used by cuckoos would be removed under this alternative. Loss of mature cottonwood forests and lack of recruitment have decreased suitable and future habitat for this species (MTPIF 2000). Fragmentation of cottonwood forests has resulted in many areas with patch sizes below the recommended minimum (MTPIF 2000). Any disturbances to yellow-billed cuckoos from pathway construction would contribute only negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads and pedestrian and cyclist use of proposed pathways would contribute to cumulative impacts by a negligible to minor amount. Overall long-term cumulative impacts to yellow-billed cuckoo populations would be minor.

Impact Determination and Summary of Rationale

Under Alternative 3, individual yellow-billed cuckoos may be displaced by human presence, noise, and associated activities with pathway construction, but because the project area does not contain any known breeding or nesting cuckoos, these effects are expected to be negligible to minor. Actions proposed in this alternative could affect potential yellow-billed cuckoo nesting or foraging habitats. Overall, impacts to yellow-billed cuckoo populations under Alternative 3 are expected to be minor. Therefore this alternative **may affect but is not likely to adversely affect** yellow-billed cuckoos.

Bird Species of Special Concern (Not Federally Listed) and Neotropical Migratory Birds

Neotropical Migratory Birds/ Bird Species of Special Concern

Direct and indirect effects to bird species of special concern and neotropical migratory birds resulting from Alternative 3 would be greater than those identified under Alternatives 1 and 2. Under this alternative 16 miles of widened shoulder are proposed along the Teton and the North Park Roads. A portion of the Moose-Wil-



son Road would be realigned and the old road alignment restored. Three separated pathway segments totaling 23 miles are also proposed along U.S. 26/89/191 from the south boundary to the Antelope Flats Road, along the Moose-Wilson Road from the Granite Entrance Station to the JY Visitor Center and along the Teton Park Road from Moose to North Jenny Lake Junction. Shoulder widening, road realignment, and pathway development would result in a direct loss of several different habitat types (Appendix B) and an estimated 11,359 trees would be removed (Table 16). The greatest amount of habitat loss would occur in sagebrush (36.4 acres), conifer forest (3.7 acres), meadow habitat (2.0 acres), and cottonwood forest (1.2 acres; Appendix B). A small amount of riparian wetland and willow habitat would also be removed (0.9 and 0.1 acres, respectively; Appendix B). The removal of these habitats would impact breeding, nesting, brood-rearing, and year-round foraging habitat of several bird species such as sagebrush obligates, sagebrush near-obligates, forest bird dwellers, in particular those that use lodgepole pine forests, and cottonwood or aspen forest-dependant birds. Nests, eggs or young could be destroyed if construction of pathways and road shoulders occurs during the breeding season (mid-May through mid-July); therefore, mitigation measures to reduce these losses would be implemented.

Indirect impacts associated with the construction of road shoulders and pathways and their use by pedestrians and cyclists could cause a reduction in effective habitat within a 75-meter zone of influence (see Alternative 1 discussion on bird species of concern and neotropical migratory bird species zone of influence). An estimated total of 166 acres of habitat could be impacted within this zone of influence including several different habitat types (Table 21), which would impact several bird species. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20). The indirect impacts to birds from human disturbance within the zone of influence would be variable and difficult to quantify. Birds may respond to human use along a pathway in a variety of ways and responses may differ depending upon an individual's species, age,

sex, reproductive status, and habitat requirements. Responses from disturbances can range from nothing to displacement of individuals, modifications in behavior, and a reduction of reproductive success (Boyle and Samson 1985, Knight and Gutzwiller 1995, Miller et al. 1998). Recreational disturbance to diurnal raptors may also disrupt behavior when it deters foraging or flushes birds from foraging perches and roosts (Holmes et al. 1993). Although these disturbances may be brief in time, repeated encounters between recreationists would be long-term and minor to birds.

The construction of pathways along the Moose-Wilson Road and Teton Park Road through contiguous conifer forests, sagebrush, and other habitats may alter bird species composition, distribution, and abundance. Studies have shown that some species of birds dependent upon contiguous habitat types may decline due to the creation of habitat edges and fragmentation from trails whereas habitat generalists increase (Hickman 1990, Miller et al. 1998). Furthermore, nest predation from avian and mammalian predators (e.g. corvids and coyotes) and nest parasitism from brown-headed cowbirds typically increases in areas where habitat edges are created (Miller et al. 1998, Hickman 1990, Paton 1994). Although it is uncertain what effects habitat edges created under Alternative 3 would have on birds, it is expected that these effects would be long-term and minor.

Impacts associated with Alternative 3 are expected to be variable; however, it is in the opinion of the NPS that these impacts would be long-term and minor to bird species of special concern and neotropical migratory birds, and would be greater than those under Alternatives 1 and 2.

Cumulative Effects

Cumulative impacts to birds associated with Alternative 3 would be greater than those identified in Alternatives 1 and 2 due to the amount of habitat loss and fragmentation, the loss of habitat effectiveness, and the potential for human disturbance along the proposed pathway. Although Alternative 3 would remove potential bird habitat, it would be confined to the areas along U.S. 26/89/191, the Teton Park and North Park Roads, and the Moose-Wilson Road. An increase in off-trail use

associated with pathway access would further reduce habitat effectiveness and could increase habitat fragmentation. Any disturbances to birds from pathway construction and from vehicle, pedestrian, and bicyclist use of the proposed pathways would contribute a minor amount to cumulative impacts. Overall long-term cumulative impacts to bird species of special concern and/or other migratory bird populations would be minor.

Mitigation Measures

To minimize the potential for “taking” a nest or egg of a migratory bird species, either 1) any activity that would destroy a nest or egg would occur after July 15, a timeframe outside of the primary nesting season, or 2) a survey for any nests in the project area would be conducted prior to these activities.

Greater Sage-Grouse

Direct impact to sage-grouse resulting from Alternative 3 would primarily involve loss of habitat from the construction of pathways along roadways and increased human use along U.S. 26/89/191 and the Teton Park Road. Approximately 12.6 acres of potential sage-grouse habitat would be permanently removed adjacent to U.S. 26/89/191 between the southern park boundary and Antelope Flats Junction (Appendix B). An additional 16.5 acres of sagebrush habitat would be removed along the inside Teton Park Road (Appendix B). Because no known sage-grouse sightings have been reported along the Moose-Wilson Road, sage-grouse are not anticipated to be impacted by the removal of sagebrush in this area or from human use along this portion of the proposed pathway.

Indirect impacts associated with the construction of road shoulders and pathways and their use by pedestrians and cyclists include a reduction in habitat effectiveness within a zone of influence (see Alternative 1 for discussion on sage-grouse zone of influence). An estimated 80.6 acres of sagebrush habitat would be impacted within this zone of influence along the Teton Park Road from Moose to North Jenny Lake Junction and from the south park boundary along U.S. 26/89/191 to the junction of Antelope Flats Road (Appendix B) beyond the amount of sagebrush habitat impacted

by existing conditions. Potential indirect effects to sage-grouse due to human presence and noise associated with project activities include displacement of individuals, habitat avoidance, and modifications in behavior. Human activity along roadways and dispersed use beyond the roadway could cause occasional flushing of birds from nests or brood-rearing areas. Although impacts during construction would be short-term, repeated human disturbance from recreational use along widened shoulders would be long-term.

The project area north of the Potholes does not contain critical sage-grouse habitat. Activities associated with paving social trails in and adjacent to campgrounds would not affect sage-grouse or their habitat.

Impacts associated with Alternative 3 would be greater than those in Alternatives 1 and 2. The loss of sagebrush habitat and its effectiveness in the zone of influence, as well as the possible displacement of sage-grouse along the proposed pathway could result in long-term, minor effects to the greater sage-grouse.

Cumulative Effects

Cumulative impacts to greater sage-grouse associated with Alternative 3 would be greater than those identified in Alternatives 1 and 2 due to the increase in the amount of sagebrush proposed to be removed under this alternative along U.S. 26/89/191 and the Teton Park Road. Sage-grouse habitat management guidelines (Connelly et al. 2000) suggest protecting suitable breeding (nesting and early brood-rearing) habitats within 5 km from all occupied leks for non-migratory populations, such as the population residing in the park. Based on their research conducted in Grand Teton National Park and due to the tenuous nature of the sage-grouse population in Jackson Hole, Hollar and Anderson (2004) suggest that sagebrush should not be manipulated within 7.7 km of any known leks in the park. Under Alternative 3, sagebrush would be removed along U.S. 26/89/191 and inside park road from areas within a 7.7 km buffer from two active leks (the Airport and Timbered Island leks) and would therefore potentially add to cumulative impacts to local sage-grouse populations.



Any disturbances to sage-grouse from pathway construction would contribute negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of the proposed pathway, would contribute to cumulative impacts by a minor amount. Overall long-term cumulative impacts to greater sage-grouse in the Jackson Hole population would be minor.

General Wildlife

Mammals

Direct and indirect adverse effects to mammals resulting from Alternative 3 would be similar to those described for Alternative 2, i.e., long-term and minor. In addition, Alternative 3 would involve removal of vegetation away from the road shoulder to create multi-use pathways along portions of the Teton Park Road, U.S. 26/89/191 between Moose and Antelope Flats, and the Moose-Wilson Road between the Granite entrance and the JY Visitor Center. Social trails near Jenny Lake and Signal Mountain would also be paved and improved. The road shoulder, road realignment and multi-use pathway construction proposed under Alternative 3 would permanently remove about 49 acres (Table 18) of vegetation, mostly dry sagebrush shrubland, but also some forested habitat. Approximately, 3.1 acres (Table 18) of aspen habitat would be reclaimed following rerouting of a portion of the Moose-Wilson Road. Additional acres of vegetation would be temporarily disturbed by construction activities associated with widened roads and separated pathways. All disturbed areas outside of widened road and separated pathways surfaces (e.g., cut/fill slopes) would be reclaimed and revegetated with native vegetation. New transit facilities would not include any vegetation removal or habitat disturbance. Finally, there may be some loss or disturbance to riparian vegetation and cottonwood communities where the proposed multi-use pathways cross the Snake River near Moose, the Gros Ventre River, and Cottonwood Creek along Teton Park Road, and where shoulder widening occurs in the Willow Flats area and over Pilgrim Creek. Paving of social trails would not remove vegetation, but could cause noise and disturbances that affect wildlife using nearby lakes and habitats.

It is likely that mammals, in the short-term, would

be temporarily displaced from habitat adjacent to the road or pathways due to construction-related activity for the duration of the project. Some mammals may use areas adjacent to the corridors once reclamation activities have been completed and vegetation has become established, depending upon their tolerance to human disturbance. The construction of non-motorized corridors (both expanded shoulders and separated pathways) is expected to result in an increase in non-motorized recreation use in these areas and is likely to result in increased disturbance impacts and potential for wildlife-human conflicts compared to Alternative 2. Separated pathways would increase the 75 meter and 400 meter corridor zone of influence by 166 acres and 310 acres, respectively. Impacts to ungulates would be greatest where cover is poor and least where cover is greatest. Habitats adjacent to the Moose-Wilson corridor are especially diverse and productive, and provide important habitat for a wide range of park wildlife, including black bears and other carnivores.

Existing and anticipated vehicle traffic levels on roads in Grand Teton National Park would be similar to Alternative 1 and would represent a minor potential source of mortality to mammals. There may be a small reduction in peak summer vehicle traffic on the Teton Park Road as more visitors use the multi-use pathways, and this may have negligible beneficial effects on mammals by reducing the potential roadkill threat. Signage would also be provided to warn motorists of wildlife crossing or high use areas. Although wildlife-vehicle collisions usually cause the death of an animal, the relative infrequency of these mortalities ensures that these impacts occur only at an individual level and do not adversely affect mammals at a population level.

Mitigation measures would be implemented to reduce impacts to wildlife habitat including preservation of larger trees and snags, avoidance of nesting and denning seasons, and conducting wildlife surveys as needed to ensure that impacts are avoided or minimized.

Overall, Alternative 3 would have long-term, minor adverse impacts to mammals.

Amphibians and Reptiles

Direct and indirect effects to amphibians and rep-

tiles resulting from Alternative 3 would be greater than those identified under Alternative 1 and similar to those described from Alternative 2. Direct impact to amphibians and reptiles would primarily involve loss of habitat from the construction of pathways. Approximately 49 acres of habitat would be permanently removed, of which 0.9 acres would be riparian wetland (Appendix B). Other wetlands that may not be removed but are within the project area would be protected from construction activities so that erosion and siltation would be minimized. Direct impacts from the removal of riparian wetland habitat would result in the direct loss of potential amphibian breeding habitat. The removal of other habitats, such as sagebrush, conifer forest, willow, and cottonwood, for pathway construction could also cause direct impacts to amphibians or reptiles that use these areas to forage or for cover. Direct and indirect mortality of adult amphibians or reptiles due to human activities and pathway construction could also occur. Overall, impacts from Alternative 3 on reptiles and amphibians would be negligible to minor and short-term.

Cumulative Impacts (General Wildlife)

Cumulative impacts to wildlife under Alternative 3 would be generally the same as those identified in Alternative 1, i.e. long-term, minor to moderate, and adverse. The permanent loss of approximately 37 acres of native vegetation would contribute to cumulative impacts affecting wildlife that relies upon sagebrush and lodgepole pine plant communities, but only negligibly, since these impacts would mostly occur within established road corridors. The permanent or temporary loss of a small portion of wetlands would contribute to cumulative impacts affecting wildlife, especially reptiles, but only negligibly. Wetland mitigation requirements would ultimately result in total replacement and a possible net increase in park wetlands that are similar in type and function to impacted wetlands. Human uses of linear facilities resulting from implementing Alternative 3, including vehicles that might kill wildlife, are not expected to contribute to cumulative impacts. In total, the contribution to wildlife cumulative impacts resulting from Alternative 3 is expected to be very small.

Conclusion (Threatened and Endangered (Federally Listed) Species, Bird Species of Special Concern, and General Wildlife)

Threatened and Endangered (Federally Listed) Species - Alternative 3 may affect but is not likely to adversely affect the bald eagle, Canada Lynx, or yellow-billed cuckoo. Alternative 3 is likely to adversely affect the grizzly bear and gray wolf, because vehicle collisions or mortality related to human conditioning (for bears) may occur that would adversely affect one or more individuals, but the alternative would not threaten the survival of either species.

Bird Species of Special Concern - Alternative 3 would have minor adverse effects on bird species of special concern, neotropical migratory birds, and the greater sage-grouse. Cumulative impacts would be minor and adverse.

General Wildlife - Alternative 3 would have an intermediate level of adverse impacts on wildlife among the alternatives considered. Although Alternative 3 is not expected to have adverse population level impacts on mammals, reptiles, and amphibians, there would be negligible to minor adverse effects. The increased disturbance (both spatially and in terms of recreation use levels) would further fragment habitats and erode habitat effectiveness. These impacts would be greater than under Alternative 2 because of the addition of separated pathways between Jackson and Antelope Flats and along the Moose-Wilson Road. Habitats adjacent to the Moose-Wilson corridor are especially diverse and productive, with irregular openings and forested areas with a diverse understory, which provide important cover and foraging opportunities for park wildlife. The potential for human-wildlife conflicts and associated management actions would be higher than under Alternative 1 due to the addition of separated pathways, which affects a larger area and consequently a greater number of species and individuals. Direct mortality levels are not expected to increase under this alternative, but it is likely that individual mammals would continue to be struck and killed by vehicles using park roads. Although no adverse population level impacts are anticipated, effects to local species distributions and habitat use patterns are likely. Cumulative



impacts to general wildlife under this alternative would be long-term, minor to moderate, and adverse.

Because there would be no major, adverse impacts to wildlife resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wildlife resources, including any listed species or species of special concern.

Effects of Alternative 4 - Extended Pathways

Endangered and Threatened Species (Federally Listed Species)

Bald Eagle

No direct adverse impacts to bald eagles would result from implementing Alternative 4. The proposed pathway would not directly affect bald eagle nesting, foraging or wintering habitat. Construction of pathways would not occur within 0.5 mile of known bald eagle nests. The development of pathways in the vicinity of the Snake River near the Moose Bridge along Cottonwood Creek, and the Jackson Lake dam would be confined to the existing roadway. The proposed pathway along the Moose-Wilson Road from the Granite Entrance to Moose would not be constructed within bald eagle habitat.

Indirect effects from construction activities, pedestrians, and cyclist use along pathways and transit vehicle use would cause a reduction in habitat effectiveness within the zone of influence (see Alternative 1 analysis for the definition of zone of influence for bald eagles). Disturbance from human presence, noise, and recreation along the pathways and from dispersed use off pathways, could displace eagles or occasionally flush birds from perches in areas that contain suitable eagle habitat such as near the Moose Bridge, Cottonwood Creek, and at the Jackson Lake Dam. Other indirect effects from human disturbance would include modifications of behavior, habitat avoidance, and possibly changes in reproductive success. Activities associated with construction would be short-term; however, pedestrian and

cyclist use along pathways would long-term. It is therefore the opinion of the NPS that impacts from Alternative 4 would be greater than under Alternative 1 and similar to Alternatives 2 and 3. These impacts would have long-term, minor effects on bald eagles.

Cumulative Effects

Cumulative impacts to bald eagles associated with Alternative 4 would be generally the same as those identified in Alternatives 1, 2, and 3. Any disturbances to bald eagles from pathway construction would contribute only negligibly to cumulative impacts. Transit and other vehicle use of Grand Teton National Park roads and pedestrian and cyclist use of proposed pathways would contribute to cumulative impacts by a minor amount. Overall long-term cumulative impacts to bald eagle populations would be minor.

Impact Determination and Summary of Rationale

Under Alternative 4, individual bald eagles may be displaced by human presence, noise, and associated activities with pathway construction but given that the project area is outside of bald eagle nest territories, these effects are expected to be minor. No actions are proposed in this alternative that would directly affect important bald eagle wintering or foraging habitats. Overall, impacts to local and ecosystem bald eagle populations under Alternative 4 are expected to be minor. Therefore this alternative **may affect but is not likely to adversely affect** bald eagles.

Canada Lynx

The types of direct and indirect effects to lynx resulting from Alternative 4 would be similar to those occurring under Alternative 1, including direct mortality and direct and indirect impacts to lynx habitat. Overall impacts would be minor and adverse.

In addition to effects resulting from existing conditions, Alternative 4 includes construction of approximately 2 miles of widened shoulders along the Teton Park Road between Signal Mountain Lodge and Jackson Lake Dam, realignment of a 2-mile section of the Moose-Wilson Road and restoration of the old road alignment. Four separated pathway segments totaling approximately 41 miles are also proposed along U.S. 26/89/191 from

the south boundary to the Antelope Flats Road, along the Moose-Wilson Road from the Granite Entrance Station to Moose, along the Teton Park Road from Moose to Jackson Lake Junction and along the north park road from Jackson Lake Junction to Colter Bay. Conifer habitats represent potential habitat for lynx. Shoulder widening and road realignment would result in a direct loss of 0.5 acres (Table 18) of conifer forest vegetation types. An additional 12.9 acres (Table 18) of conifer forest would be lost due to construction of the pathway.

Disturbance impacts to lynx could occur from noise and human presence associated with construction of the shoulders and the pathway and its use. All pathway segments proposed under this alternative (except the U.S. 26/89/191 segment) traverse areas of relatively contiguous conifer habitat, which are mapped as lynx habitat. The width of existing linear corridors range from 18' to 30'. Pathway construction would increase corridor widths to a maximum of 82' to 94' (assuming pathway is 50 feet from the road), with an attendant increase in the zone of influence (ZOI). The separated pathway would affect an additional 174 acres of coniferous forest habitat beyond the existing 400-meter ZOI. Lynx are generally crepuscular animals and may rest in secure habitat during the day and emerge at night to use areas where human activity has stopped or decreased. Consequently, if pathway use occurs primarily during daylight hours, disturbance impacts to lynx habitats adjacent to the road and pathway corridors would be minimal.

Motor vehicle traffic levels under this alternative are expected to be similar to those predicted under the other action alternatives and represent a negligible to minor potential source of mortality for lynx. The overall risk of direct mortality is not expected to increase from pathway construction and use.

Routine snow-plowing operations on northern Grand Teton National Park roads would include the periodic (spatially and temporally) laying back of plowed snow banks and creating plowed openings in snow banks to allow lynx and other wildlife to easily negotiate these obstacles.

Cumulative Effects

Other activities occurring in the Greater Yellowstone Area that may affect lynx or their habitat include timber management, wildland fire management (including prescribed burns both inside and outside the park), grazing (outside and within Grand Teton National Park), winter recreation, and trapping of other furbearers. With the exception of trapping, all of these activities have the potential to affect forest successional stages, and consequently, snowshoe hares and lynx.

Cumulative impacts to Canada lynx associated with Alternative 4 would be generally the same as those identified in Alternatives 1 and 2. Although road density would not increase under this alternative, the overall density of linear features would increase with an addition of roughly 41 miles of separated pathway. The physical footprint of the road would increase slightly and construction of the separated pathway would result in additional direct habitat loss and reduced habitat effectiveness. Disturbances to lynx from road shoulder construction would represent a small contribution to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of proposed improved shoulders, would contribute only minor cumulative impacts.

Effects Determination and Summary of Rationale

Under Alternative 4, individual lynx may be displaced by human presence and noise associated with routine maintenance and continued use of the transportation system. Of the action alternatives considered, direct loss of coniferous forest habitat would be greatest under Alternative 4, but the total of habitat loss (13 acres total) would still be minor given the large amount of coniferous forest remaining that would not be impacted. No actions are proposed in this alternative that are likely to significantly affect important lynx linkage areas. The likelihood of a lynx being hit and killed by a vehicle is anticipated to be low given that lynx likely occur in the park at low densities, if at all, and to date, no vehicle mortalities have been reported. Impacts to lynx or lynx habitat are expected to be greater than those described under the other action alternatives but are still expected to be minor in scale. Based on the above assumptions and conclusions, it is in the opinion of the



NPS that Alternative 4 **may affect but is not likely to adversely affect** Canada lynx.

Grizzly Bear

Direct and indirect effects to grizzly bears resulting from Alternative 4 would include those resulting from road use and maintenance, as described under Alternative 1. The presence and ongoing maintenance of existing park roads within or adjacent to bear habitat adversely affects grizzly bears, both directly and indirectly. Direct effects include permanent loss of habitat caused by road and pull-out paving and the potential for vehicle-caused mortality. Indirect effects from road use and maintenance and transit vehicle use would include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually paved by the road. In the project area, the loss of habitat associated with existing primary roads is estimated to be 5,057 acres. A reduction in habitat effectiveness could potentially result in slightly lower reproductive fitness of some individual bears within home ranges adjacent to the road corridor. However, range and population increases of grizzly bears in Grand Teton National Park suggest that impacts associated with roads have not yet reached a threshold impact level that jeopardize the survival of grizzly bears in the park. Other indirect effects to grizzly bears include human-caused displacement of bears from areas adjacent to roads, habituation to humans, and possibly other behavior modifications.

In addition to the effects resulting from existing conditions, Alternative 4 includes the construction of approximately 41 miles of multi-use pathways and 2 miles of widened shoulders along the main park roads, which would have additional impacts. Direct impacts associated with the proposed action would include the permanent loss of approximately 70 acres of native vegetation (Tables 18 and 19), and an equal, additional temporary loss during construction and revegetation phases. Most of this habitat alteration would occur within 50 meters of the road (41 miles), or immediately adjacent to existing roads (2 miles). Additional indirect habitat loss from extending the zone of influence associated with roads and separated pathways under this alternative would equal 414 acres (Tables 20 and 21).

The impacts associated with pathways south of north Jenny Lake Junction along the Teton Park Road would be the same as in Alternative 3. New impacts under this alternative would result from additional pathways along U.S. 26/89/191, the Moose-Wilson Road corridor, and north of North Jenny Lake Junction.

The addition of separated pathways from north Jenny Lake Junction to Colter Bay under Alternative 4 would result in higher impacts on grizzly bears because this area, in contrast to areas further south, supports a well-established population of grizzly bears. The proposed pathway passes through willow, sage/grass, and mixed lodgepole, spruce-fir cover types where grizzlies are common. Beginning with Jackson Lake Junction and heading north, the pathway would occur immediately adjacent to the grizzly bear PCA (USFWS 2003). The PCA, or grizzly bear recovery zone as it was initially described (USFWS 1982), was delineated to define an area within which to focus grizzly bear recovery efforts after the species was listed in 1975. At the time the boundary was delineated, grizzly bears were uncommon in Grand Teton National Park. Currently, however, grizzly bears are established in large areas outside of the PCA in Grand Teton National Park (Schwartz et al. 2002), and the line has little relevance in terms of grizzly bear distribution.

By maintaining separated pathways generally mostly 50 feet of the road, much of the habitat loss associated with this alternative would occur adjacent to or within the existing roads' current zone of influence. And because bears tend to avoid road corridors (Mace et al. 1996, McLellan et al. 1988), the additional loss in long-term habitat effectiveness would be minor. In small areas where pathways diverge as much as 150 from roadsides, impacts would be increased. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20). Indirect impacts associated with construction and use of the roadsides and separated pathways by more pedestrians and cyclists would include human-caused displacement of bears from adjacent areas, potential habituation (Herrero 1985) to humans, and possibly other behavior modifications. However, use of the

roadsides by more people may make it more difficult for bears to habituate to this less predictable activity; thus, the loss in habitat effectiveness in the roads' zone of influence could be expected to be greater than under Alternatives 1, 2, or 3.

The creation of non-motorized corridors – both expanded road shoulders and separated pathways – is expected to result in an increase in non-motorized use of these areas. Bear-human encounters in these areas may increase because of increased human use and because of the added surprise factor that quiet, non-motorized use represents (see Pathways and Wildlife Hazards discussion). This is particularly true where roads and pathways traverse habitats where terrain and/or vegetation limit sight distances, or where noise from streams can cover noise of approaching humans. Serious human injuries from such encounters are likely to occur, but their frequency cannot be predicted.

Adding pathways in grizzly bear habitat that are easily utilized by large numbers of the public, potentially carrying food, also creates additional opportunities for bears to become conditioned (Herrero 1985) to human foods. Experience in the park has shown that food storage regulation compliance is poorest and hardest to enforce among dispersed recreationists. Therefore, while education efforts would help mitigate this potential, some bears may become conditioned to human foods. Bears that become conditioned to human foods often become aggressive and ultimately need to be destroyed. Because this alternative would have more pathways in grizzly bear habitat than any other alternative, it would represent the highest potential for bear mortality associated with human food conditioning.

In this alternative, none of the proposed separated pathways occur within the grizzly bear recovery zone (USFWS 1993), or PCA identified in the final conservation strategy for the grizzly bear in the Yellowstone ecosystem (USFWS 2003). However, the 5.5-mile section of separated pathway proposed between Jackson Lake Junction and Colter Bay borders the PCA through willow, sage/grass, and mixed lodgepole, spruce-fir cover types where grizzlies are common. The grizzly bear recovery zone was delineated to define an area within which to focus grizzly bear recovery efforts after

the species was listed in 1975. At the time the boundary was delineated, grizzly bears were uncommon in Grand Teton National Park. Currently, however, grizzly bears are established in large areas outside of the PCA in Grand Teton National Park (Schwartz et al. 2002) and the line has little relevance in terms of grizzly bear distribution.

The final conservation strategy for the grizzly bear in the Yellowstone ecosystem (USFWS 2003) was developed to guide grizzly bear management after the species is delisted. It includes a “no-net-loss” of secure habitat standard for all of the PCA. Thus, while the loss of secure habitat from separated pathways adjacent to the PCA would be technically allowable, considering the current distribution of bears it would be blatantly contrary to the conservation goals of the conservation strategy, of which Grand Teton National Park is a signatory.

Currently grizzly bears are uncommon in the area of proposed separated pathways on the Teton Park Road south of North Jenny Lake Junction. The probability of human-bear encounters in this area is further reduced because habitat cover types are predominately open with long sight distances. However, it is likely that grizzly bears would become more common in this area in the future. While grizzly bears are also currently uncommon along the Moose-Wilson Road corridor, individuals have been known to travel through the area. Adding separated pathways in this area, along with varied terrain, heavy cover, and several noisy stream crossings, would escalate the probability of human-grizzly bear encounters and associated human injuries.

Improving social trails in and near campgrounds would perhaps help to keep visitors from straying into bear habitat, but otherwise would have no effect on bears.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality and from potential mortality from human conditioning could be considered moderate, since this could affect one or more individual bears, but would not threaten the survival of the species.

Cumulative Effects

Actions occurring on public lands within the re-



covery zone that may adversely affect grizzly bears or their habitat, such as oil and gas exploration and development, logging, and mining, are limited by the ESA (USFWS 1982) and are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect grizzly bears in the recovery zone include:

- Livestock grazing, which may impact grizzly bears through management actions
- Private land development
- Firewood cutting
- Road use/management
- Timber harvest (past)
- Recreation activities, especially big game hunting, that leads to human-bear conflicts
- Vegetation management
- Wildland fire and prescribed fires
- Loss or decline of important food sources (e.g., whitebark pine seeds due to fire suppression)
- Potential reduction in elk and bison populations

These activities and issues cumulatively contribute to increased mortality risks, reduce availability of secure habitat, and diminish habitat effectiveness for grizzly bears. The total cumulative impact of the above-listed activities, as well as other unidentified actions occurring within the grizzly bear recovery zone, does not appear to be adversely affecting population recovery as evidenced by the expanding grizzly bear population in the Greater Yellowstone Area (Eberhardt and Knight 1996; Schwartz et al. 2002; Pyare et al. 2004).

Cumulative impacts to grizzly bears in the Greater Yellowstone Area specific to this alternative would be similar to those under Alternatives 1, 2, and 3 and include road kills, recreation use, management removals, and road or project construction. To date, no grizzly bears have been reported killed by vehicles in Grand Teton National Park. However, existing road conditions and grizzly bear distribution suggest it is only a matter of time before this occurs. In the past 25 years, 13 grizzly

bears have been killed by vehicles in the Greater Yellowstone Area. The cumulative impacts of these actual losses and possible future road kills are likely to be minor, because road kills are not a significant source of mortality to the population in the Greater Yellowstone Area.

Increases in backcountry recreation by humans in and around Grand Teton National Park may negatively affect grizzly bears if human-bear encounters increase. Hunting of elk during the park's annual elk reduction occurs in approximately 66,600 acres of the park's backcountry, 29,100 of which is in the recovery zone or PCA. Hunting of elk and other big game also occurs outside of and adjacent to the park's boundaries. Conflicts between grizzly bears and hunters appear to be increasing (Gunther et al. 2004), and these encounters are a potential source of bear mortality. In 2004, 7 of 19 (37 percent) human-caused grizzly bear mortalities in the Yellowstone ecosystem were attributed to hunter conflicts (M. Haroldson, IGBST, pers. comm.), and for the first time in many years, grizzly bear recovery mortality limits were exceeded. However, unless hunter-related conflicts increase substantially, the cumulative adverse effects of these conflicts at current grizzly bear population levels are likely to be minor. Land and wildlife management agencies, including Grand Teton National Park, have active programs designed to educate backcountry users about grizzly bears and requirements designed to reduce human-bear conflicts.

Several privately owned and State of Wyoming-owned in-holdings are present in Grand Teton National Park; depending upon future human activities occurring on these properties, grizzly bears may be negatively affected. Grand Teton National Park has, for many years, attempted to secure these in-holdings with lifetime leases and out-right purchases and has been quite successful in doing so. No large-scale developments or land-based projects have been proposed for these in-holdings. The JY Ranch (about 1,100 acres in southern Grand Teton National Park) is being converted into an interpretive center, and much of the existing development is being removed and reclaimed. In addition, management of this in-holding eventually will be handed over to Grand Teton National Park. Recently, efforts have been

made by the federal government to secure several parcels of state-owned land within Grand Teton National Park. The cumulative adverse effects of possible future development occurring on these in-holdings are likely to be minor.

In the past 20 years, two grizzly bears have been removed from Grand Teton National Park for management reasons: one for cattle depredations and one because of human habituation and food conditioning. The latter bear came to Grand Teton National Park as a problem bear after being relocated from the northern to the southern part of the ecosystem. An additional bear that had broken into a cabin at the AMK Ranch in Grand Teton National Park was killed after being relocated from Grand Teton National Park to Montana and continuing its nuisance behavior there. Management removals within the PCA and a 10 mile buffer around it are counted against recovery parameters (USFWS 2003). Implementation of this alternative would increase the potential for management removals, adding cumulatively to removals throughout the ecosystem.

In summary, losses of habitat effectiveness, and potential lowering of reproductive fitness of some individual bears resulting from existing roads and approximately 41 miles of new paved, separated pathways would have minor contributions to cumulative impacts. Vehicle use of Grand Teton National Park roads, pedestrian and bicyclist use of proposed pathways, and potential management removals associated with this use are expected to have minor cumulative impacts. Thus, overall long-term cumulative impacts to grizzly bears in the Greater Yellowstone Area as a result of this alternative would be minor.

Mitigation Measures

- “Bearwise” education will be conducted with all personnel involved in road and pathway construction and maintenance projects.
- All food and other attractants will be properly stored at all times, and all food materials, garbage, and other attractants will be packed out on a daily basis if it cannot be stored in bear-resistant containers.
- Project crews other than law enforcement personnel will not carry firearms.

- Project crews will carry bear pepper spray when conducting project activities and will be trained in bear safety.
- All project crews working in grizzly bear habitat will meet standards for sanitation, attractant storage, and access.
- All grizzly bear/human confrontations would be reported to Science and Resource management personnel.

Effects Determination and Summary of Rationale

Alternative 4 would have the highest level of adverse impacts among the alternatives considered. The inclusion of separated pathways in grizzly bear habitat, much of which has limited sight distances, would result in loss of habitat effectiveness, a high potential for habituation and/or food conditioning by some bears, and bear mortalities associated with management removals. These activities are not expected to have adverse population level impacts on grizzly bears. However, management removals would contribute to cumulative mortalities in the ecosystem and could result in recovery delays. Removal of females would reduce the reproductive potential of grizzly bears locally, potentially resulting in a decrease in bear density. It is also reasonable to expect that one or more grizzly bears could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone grizzly bear population under Alternative 4 would be long-term and moderate, since one or more individual bears are likely to be adversely affected by this alternative.

Gray Wolf

Direct and indirect effects to wolves resulting from Alternative 4 would include those resulting from road use and maintenance, as described under Alternative 1 (No Action Alternative). The presence and ongoing maintenance of existing park roads within or adjacent to wolf habitat adversely affects wolves, both directly and indirectly. Direct effects include permanent loss of habitat caused by road and pull-out paving and potential for vehicle-caused mortality. Radio-telemetry data have shown that the Teton pack regularly crosses U.S. 89/191 between Moran and the Triangle X dude ranch, and between Moran and the park’s



east boundary. Other wolves from unknown pack affiliations have been observed crossing park roads on many occasions (S. Cain, Grand Teton National Park, pers. comm.). Indirect effects from road use and maintenance and transit vehicle use would include a reduction in habitat effectiveness within a zone of influence beyond the boundaries of the habitat actually paved by the road. The loss of habitat associated with existing primary roads is estimated to be 13,583 acres (Table 20). Other indirect effects to wolves include human-caused displacement from areas adjacent to roads, possible habituation to humans, and possibly other behavior modifications.

In addition to the effects resulting from existing conditions, Alternative 4 includes the construction of approximately 41 miles of multi-use pathways and 2 miles of widened shoulders along the main park roads, which would have additional impacts. Direct impacts associated with the proposed action would include the permanent loss of approximately 70 acres of habitat for wolves and some of their prey species (Tables 18 and 19) and an equal additional temporary loss during construction and revegetation phases. Most of this habitat alteration would occur within 50 meters of the road (41 miles), with a short section of expanded shoulders immediately adjacent to the road (2 miles). Additional indirect habitat loss from extending the zone of influence associated with roads and separated pathways under this alternative would equal 414 acres (Table 21).

Since nearly all of the habitat loss associated with this alternative would occur adjacent to or within the existing roads' current zone of influence, and because wolves and most of their primary prey tend to avoid road corridors, the loss in long-term habitat effectiveness would be negligible to minor. Indirect impacts associated with construction and use of the roadsides and separated pathways by more pedestrians and cyclists would include human-caused displacement of wolves from adjacent areas, potential habituation to humans, and possibly other behavior modifications. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20). Use of the pathways by more people may make it more difficult for wolves to

habituate to this less predictable activity along the corridor as well; therefore, the total loss of habitat effectiveness in the pathways' zone of influence could be expected to be greater than under any of the other alternatives.

None of the proposed expanded road shoulders, separated pathways, or related construction activities would occur within 1 mile of known wolf dens or rendezvous sites. Improving social trails in and near campgrounds would have no effect on wolves.

Most of these adverse impacts would be considered minor, but impacts from vehicle mortality could be considered moderate, since this could affect one or more individual wolves, but would not threaten the survival of the species.

Cumulative Effects

Activities occurring within wolf habitat that may adversely affect wolves in the Greater Yellowstone Area are limited and, for public land management agencies, are analyzed both individually and cumulatively via the NEPA compliance process. Other activities and issues likely to affect wolves occurring within the recovery zone include live-stock grazing, private land development, vegetation management, potential reduction in elk and bison populations, and control actions.

These activities cumulatively contribute to increased mortality risks and reduce the availability of secure habitat. However, the total cumulative impact of the above-listed activities, as well as other unidentified actions occurring within the wolf habitat, does not appear to have adversely affected population recovery as evidenced by the quick expansion of the wolf population following reintroduction and the continued expansion into areas outside of Yellowstone National Park. The proposed action, in the long term, could be expected to increase human presence within or improve access to wolf habitat by a negligible to minor amount that would cumulatively reduce habitat security.

Effects Determination and Summary of Rationale

Alternative 4 is not expected to have substantial adverse population level impacts on wolves, nor would it jeopardize the recovery of wolves within

the Greater Yellowstone Area. However, habitat security would be reduced, and it is reasonable to expect that one or more wolves could be hit and killed by vehicles using park roads during the lifetime of this plan. Therefore, adverse impacts to the park and Greater Yellowstone wolf population under Alternative 4 would be long-term and moderate, since one or more individual wolves are **likely to be adversely affected** by this alternative.

Yellow-billed Cuckoo

Similar to Alternatives 1-3, no direct adverse impacts to yellow-billed cuckoo would result from implementing Alternative 4. The proposed pathways along the park's roadways would not occur near any known cuckoo nesting or foraging areas; however, approximately 1.2 acres of cottonwood forest, 1.5 acres of riparian wetland, and 2.4 acres of willow that are potential cuckoo habitat would be removed during construction of the pathway (Appendix B). Most of this direct loss would occur in the section of the project that is proposed along the Moose-Wilson Road and the JY Ranch. The direct impact from removing this habitat would be minor because the amount removed would be small.

Indirect impacts to cuckoos include displacement of individuals due to human presence, and noise associated with project activities in areas that contain cuckoo habitat such as near the Moose Bridge and Cottonwood Creek; however, no cuckoos have been reported in the project area. Reduction in effective habitat from pathway construction and increases in pedestrian and cyclist use would be confined to the project's immediate area, as well as within the 75 meter zone of influence (see Alternative 1 (No Action Alternative) for discussion on zone of influence for cuckoos). Approximately 38 acres of cottonwood, willow and riparian wetland habitats would be within this zone of influence under Alternative 4 (Appendix B) beyond what is impacted from existing conditions. The effects human disturbance would have on cuckoos within the zone of influence are unknown but may include displacement of individuals, changes in behavior, reduction in breeding and reproduction success, and movement to less desirable habitats. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but

perhaps moderate amount at times (Figure 20). Although impacts during construction would be short-term, repeated human disturbance from recreational use along the pathways would be long-term. Overall, impacts from Alternative 4 would be long-term, minor, and greater than those from Alternatives 1 and 2 but similar to Alternative 3.

Cumulative Effects

Cumulative impacts to yellow-billed cuckoos associated with Alternative 4 would be greater as those identified in Alternatives 1 and 2 and similar to Alternative 3. Loss of mature cottonwood forests and lack of recruitment have decreased suitable and future habitat for this species (MT-PIF 2000). Fragmentation of cottonwood forests has resulted in many areas with patch sizes below the recommended minimum (MTPIF 2000). Any disturbances to yellow-billed cuckoos during pathway construction would contribute only negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads and pedestrian and cyclist use of proposed pathways would contribute to cumulative impacts by a minor amount. Overall long-term, cumulative impacts to yellow-billed cuckoo populations would be minor.

Impact Determination and Summary of Rationale

Under Alternative 4, individual yellow-billed cuckoos may be displaced by human presence, noise, and associated activities from pathway construction, but because the project area does not contain any known breeding or nesting cuckoos, these effects are expected to be none to negligible. No actions are proposed in this alternative that would affect important yellow-billed cuckoo nesting or foraging habitats. Overall, impacts to yellow-billed cuckoo populations under Alternative 4 are expected to be minor. Therefore this alternative **may affect but is not likely to adversely affect** yellow-billed cuckoos.

Bird Species of Special Concern (Not Federally Listed) and Neotropical Migratory Birds

Neotropical Migratory Birds/Birds Species of Special Concern

Direct and indirect effects to bird species of special concern and neotropical migratory birds resulting from Alternative 4 would be greater than



those identified under Alternatives 1-3. Direct impact to birds would primarily be the permanent loss of 70 acres of habitat (Table 18) and an estimated 41,001 trees (Table 16) from the construction of over 41 miles of separated pathways. A portion of the Moose-Wilson Road would be realigned and the old road alignment restored. Shoulder widening, road realignment, and pathway development would result in a direct loss of several different habitat types (Appendix B). The greatest amount of habitat loss would occur in sagebrush (50 acres), conifer forest (13 acres), meadow habitat (2.0 acres), and cottonwood forest (1.2 acres; Appendix B). A small amount of riparian wetland and willow habitat would also be removed (1.5 and 2.3 acres, respectively; Appendix B). The removal of these habitats would impact breeding, nesting, brood-rearing, and year-round foraging habitat of several bird species such as sagebrush obligates, sagebrush near-obligates, forest bird dwellers, in particular those that use lodgepole pine forests, and cottonwood or aspen forest-dependant birds. Nests, eggs or young could be destroyed if construction of pathways and road shoulders occurs during the breeding season (mid-May through mid-July); therefore, mitigation measure to reduce these losses would be implemented. Because of the amount of habitat removed under Alternative 4, direct impacts to neotropical migratory birds and bird species of special concern would be negligible to minor.

Indirect impacts associated with the construction of pathways and their use by pedestrians and cyclists could cause a reduction in effective habitat within a 75 meter zone of influence (see Alternative 1 (No Action Alternative) discussion on bird species of concern and neotropical migratory bird species zone of influence). An estimated net loss of 281 acres of habitat could be impacted within this zone of influence and in several different habitat types (Table 21). An increase in off-trail use associated with pathway access would further reduce habitat effectiveness by an unknown but perhaps moderate amount at times (Figure 20). The indirect impacts to birds from human disturbance within the zone of influence would be variable and difficult to quantify. Birds may respond to human use along a pathway in a variety of ways, and responses may differ depending upon an

individual's species, age, sex, reproductive status, and habitat requirements. Responses from disturbances can range from nothing to displacement of individuals, modifications in behavior, and a reduction of reproductive success (Boyle and Samson 1985, Knight and Gutzwiller 1995, Miller et al. 1998). Recreational disturbance to diurnal raptors may disrupt behavior when it deters foraging or flushes birds from foraging perches and roots (Holmes et al. 1993). Although these disturbances may be brief in time, repeated encounters between recreationists would be long-term and negligible to birds.

The construction of pathways along the Moose-Wilson Road and Teton Park Road through contiguous conifer forests, sagebrush, and other habitats could also alter bird species composition, distribution, and abundance. Studies have shown that some species of birds dependant upon contiguous habitat types may decline due to the creation of habitat edges and fragmentation from trails, whereas habitat generalists increase (Hickman 1990; Miller et al. 1998). Furthermore, nest predation from avian and mammalian predators (e.g. corvids and coyotes) and nest parasitism from brown-headed cowbirds typically increases in areas where habitat edges are created (Miller et al. 1998, Hickman 1990, Paton 1994). Although it is uncertain what effects habitat edges created under Alternative 4 may have on birds, it is expected these effects would be long-term and minor.

Overall, impacts associated with Alternative 4 are expected to be variable; however it is in the opinion of the NPS that these impacts would be long-term and minor to bird species of special concern and neotropical migratory birds. These impacts would be greater than those in Alternatives 1, 2 or 3.

Cumulative Effects

Cumulative impacts to birds under Alternative 4 would be greater than those identified under Alternatives 1 through 3, due to the amount of habitat loss and fragmentation, the loss of habitat effectiveness, and the potential for human disturbance along the proposed pathway. Although Alternative 4 would remove potential bird habitat, removal would be confined to the areas along U.S. 26/89/191, the Teton Park and North Park Roads,

and the Moose-Wilson Road. An increase in off-trail use associated with pathway access would further reduce habitat effectiveness and could increase habitat fragmentation. Disturbances to birds from pathway construction and vehicle, pedestrian, and bicyclist use of proposed pathways would contribute to cumulative impacts by a minor amount. Overall long-term, cumulative impacts to bird species of special concern and/or other migratory bird populations would be minor.

Mitigation Measures

To minimize the potential for “taking” a nest or egg of a migratory bird species, either 1) any activity that would destroy a nest or egg would occur after July 15, a timeframe outside of the primary nesting season, or 2) a survey for any nests in the project area would be conducted prior to these activities.

Greater Sage-Grouse

Direct impact to sage-grouse resulting from Alternative 4 would primarily involve loss of habitat from the construction of pathways along roadways and increased human use along U.S. 26/89/191 and the Teton Park Road. Approximately 29 acres of sagebrush habitat would be permanently removed adjacent to U.S. 26/89/191 between the southern park boundary and Antelope Flats Junction and the inside Teton Park Road from Moose Junction to North Jenny Lake Junction (Appendix B) in areas where sage-grouse have been documented to nest, brood-rear and winter (Holloran and Anderson 2004). Sage-grouse have not been reported using sagebrush habitats along the Moose-Wilson Road and Teton Park Road north of North Jenny Lake Junction; therefore, removal of sagebrush in these habitats would not directly impact sage-grouse.

Indirect impacts associated with the construction of road shoulders and pathways and their use by pedestrians and cyclists include a reduction in habitat effectiveness within a zone of influence (see Alternative 1 (No Action Alternative) for discussion on sage-grouse zone of influence). An estimated 81 acres of sagebrush habitat would be impacted within this zone of influence along the Teton Park Road from Moose to North Jenny Lake Junction and from the south park boundary along U.S. 26/89/191 to the junction of Antelope

Flats Road (Appendix B) beyond what is impacted from existing conditions. Potential indirect effects to sage-grouse due to human presence and noise associated with project activities include displacement of individuals, habitat avoidance, and modifications in behavior. Human activity along roadways and dispersed use beyond the roadway could cause occasional flushing of birds from nests or brood-rearing areas. Although impacts during construction would be short-term, repeated human disturbance from recreational use along widened shoulders would be long-term. As a result, impacts from Alternative 4 would have long-term, minor impacts to the greater sage-grouse.

Cumulative Effects

Any disturbances to sage-grouse from pathway construction would contribute negligibly to cumulative impacts. Vehicle use of Grand Teton National Park roads, and pedestrian and bicyclist use of the proposed pathway, would contribute negligibly to cumulative impacts. Overall long-term cumulative impacts to greater sage-grouse in the Jackson Hole population would be negligible.

Cumulative impacts to greater sage-grouse associated with Alternative 4 would be greater than those identified in Alternatives 1 and 2 and similar to those from Alternative 3. Sage-grouse habitat management guidelines (Connelly et al. 2000) suggest protecting suitable breeding (nesting and early brood-rearing) habitats within 5 km from all occupied leks for non-migratory populations, such as the population residing in the park. Based on their research conducted in Grand Teton National Park and due to the tenuous nature of the sage-grouse population in Jackson Hole, Holloran and Anderson (2004) suggest that sagebrush should not be manipulated within 7.7 km of any known leks in the park. Alternative 4 would contribute to the loss of sagebrush habitat along U.S. 26/89/191 and the inside Teton Park Road within a 7.7 km buffer from two active leks (the Airport and Timbered Island leks) and would therefore potentially add to cumulative impacts to local sage-grouse populations.

Impacts associated with Alternative 4 would be greater than those in Alternatives 1 and 2 and similar to Alternative 3. The loss of sagebrush habitat and its effectiveness in the zone of influence, as



well as the possible displacement of sage-grouse along the proposed pathway, could result in long-term, minor effects to the greater sage-grouse.

General Wildlife

Mammals

Direct and indirect effects to mammals resulting from Alternative 4, would be similar to those described for other alternatives, but at a slightly higher impact level because of the additional pathways. In addition to effects resulting from existing conditions, Alternative 4 includes construction of approximately 2 miles of widened shoulders along the Teton Park Road between Signal Mountain Lodge and Jackson Lake Dam, realignment of a 2.1-mile section of the Moose-Wilson Road and restoration of the old road alignment. Four separated pathway segments totaling 41 miles are also proposed along U.S. 26/89/191 from the south boundary to the Antelope Flats road, along the Moose-Wilson Road from the Granite Entrance Station to Moose, along the Teton Park Road from Moose to Jackson Lake Junction and along the North Park Road from Jackson Lake Junction to Colter Bay. Shoulder widening, road realignment and pathway construction would result in a direct loss of approximately 71 acres (Table 18) of native vegetation. Mainly sagebrush and conifer forest habitats would be affected, although some cottonwood, aspen, willow, and riparian habitats would also be impacted.

Although these vegetative impacts translate into habitat loss to some species of mammals, most of these impacts would be concentrated at or within approximately 150 feet of previously disturbed areas along road corridors and within the most common plant communities. Also, mitigation measures would be implemented to reduce impacts to wildlife habitat. These include preservation of larger trees and snags, avoidance of nesting and denning seasons, and conducting wildlife surveys as needed to ensure that impacts are avoided or minimized.

It is likely that mammals, in the short-term, would be temporarily displaced from habitat adjacent to the road or pathways due to construction-related activity for the duration of the project. Some mammals may use areas adjacent to the corridors once reclamation activities have been completed

and vegetation has become established depending upon their tolerance to human disturbance. The construction of separated pathways is expected to result in an increase in non-motorized recreation use in these areas and is likely to result in increased disturbance impacts and potential for wildlife-human conflicts. Disturbance impacts to mammals are likely to be highest under this alternative because the separation of the pathway and the road increases the width of the linear corridor and its area of influence. Separated pathways would increase the 75-meter and 400-meter corridor zone of influence by 281 acres and 414 acres, respectively (Table 21). In addition, separation of the pathway from the road may encourage more stopping by users (because safety is improved), leading to increased levels of disturbance and an increased potential for human-wildlife conflicts. Impacts to ungulates would be greatest where cover is poor and least where cover is greatest.

Existing and anticipated vehicle traffic levels on roads in Grand Teton National Park would be similar to Alternative 1 (No Action Alternative) and would represent a minor potential source of mortality to mammals. There may be a small reduction in peak summer vehicle traffic on the Teton Park Road as more visitors use the multi-use pathways, and this may have negligible beneficial effects on mammals by reducing the potential roadkill threat. Signage would also be provided to warn motorists of wildlife crossing or high use areas. Although wildlife-vehicle collisions usually cause the death of an animal, the relative infrequency of these mortalities would ensure that these impacts occur only at an individual level and do not adversely affect mammals at a population level.

Overall, Alternative 4 would have long-term, moderate adverse impacts to mammals.

Reptiles and Amphibians

Direct and indirect effects to amphibians and reptiles resulting from Alternative 4 would be greater than those identified under Alternative 1 (No Action Alternative) and similar to those described from Alternatives 2 and 3. Direct impact to amphibians and reptiles would primarily involve loss of habitat from the construction of pathways. Approximately 70 acres of habitat would be per-

manently removed of which 1.5 acres would be riparian wetland (Appendix B). Other wetlands that may not be removed but are within the project area would be protected from construction activities so that erosion and siltation would be minimized. Direct impacts from the removal of riparian wetland habitat would result in the direct loss of potential amphibian breeding habitat. The removal of other habitats such as sagebrush, conifer forest, willow, and cottonwood for pathway construction could also cause direct impacts to amphibians or reptiles that use these areas to forage or for cover. Direct and indirect mortality of adult amphibians or reptiles due to human activities and pathway construction could also occur. Overall, impacts to amphibians and reptiles from Alternative 4 would be negligible and short-term.

Cumulative Impacts (General Wildlife)

Cumulative impacts to general wildlife under Alternative 4 would be generally the same as those identified in Alternative 1, i.e. long-term, minor to moderate, and adverse. The permanent loss of approximately 70 acres of native vegetation would contribute to cumulative impacts affecting wildlife that relies upon sagebrush and coniferous forest plant communities. The permanent or temporary loss of a small portion of wetlands would contribute to cumulative impacts affecting wildlife, especially reptiles, but only negligibly. Wetland mitigation requirements would ultimately result in total replacement and a possible net increase in park wetlands that are similar in type and function to impacted wetlands. Direct mortality, habitat loss, and reduced habitat effectiveness associated with impacts from implementing Alternative 4, would contribute to cumulative impacts, although the overall contribution is expected to be minor.

Conclusion (Threatened and Endangered (Federally Listed) Species, Bird Species of Special Concern, and General Wildlife)

Threatened and Endangered (Federally Listed) Species - Alternative 4 may affect but is not likely to adversely affect the bald eagle, Canada Lynx, or yellow-billed cuckoo. Alternative 4 is likely to adversely affect the grizzly bear and gray wolf, because vehicle collisions may occur that would adversely affect one or more individuals, but the

alternative would not threaten the survival of either species.

Bird Species of Special Concern- Alternative 4 would have minor adverse effects on bird species of special concern, neotropical migratory birds and the greater sage-grouse. Cumulative impacts would be minor and adverse.

General Wildlife - Alternative 4 would have the highest level of adverse impacts on wildlife of the alternatives considered. Although direct habitat impacts on mammals, reptiles, and amphibians would be relatively small, the increased disturbance (both spatially and in terms of recreation use levels) would further fragment habitats and erode habitat effectiveness. These impacts would be greater than under Alternative 3, because three segments of separated pathway are proposed. The addition of pathways, particularly along the Moose-Wilson corridor, but also between Jackson Lake Junction and Colter Bay, would affect some of the parks most diverse and productive habitats. The potential for human-wildlife conflicts and associated management actions would be greatest under this alternative due to the larger area affected by the proposed pathways and the diverse habitats they traverse (i.e. greater number of species and individuals affected). Direct mortality levels are not expected to increase under this alternative, but it is likely that individual mammals would continue to be struck and killed by vehicles using park roads. Although no adverse population level impacts are anticipated, effects to local species distributions and habitat use patterns are likely and would be negligible to moderate and adverse. Cumulative impacts to wildlife under this alternative would be long-term, moderate, and adverse.

Because there would be no major, adverse impacts to wildlife resources or values whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of the park's wildlife resources, including any listed species or species of special concern.



Cultural Resources

Methods and Assumptions

Section 106 of the National Historic Preservation Act (NHPA) requires a federal agency to take into account the effects of its undertakings on properties included in, eligible for inclusion in, or potentially eligible for inclusion in the National Register of Historic Places (NRHP), and afford the following a reasonable opportunity to comment on such undertakings: the State Historic Preservation Officer (SHPO), affiliated American Indian tribes and, as appropriate, the Advisory Council on Historic Preservation (ACHP), individuals and organizations with a demonstrated interest in the undertaking, and the general public.

In accordance with the ACHP’s regulations implementing Section 106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to cultural resources were identified and evaluated by (1) determining the area of potential effects (APE); (2) identifying cultural resources present in the APE that are either listed in or eligible to be listed in the NRHP (categorized as “historic prop-

erties”); (3) applying the criteria of adverse effects to affected historic properties; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the ACHP’s regulations, a determination of either adverse effect or no adverse effect is made for affected historic properties. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a property that qualifies it for inclusion in the NRHP, i.e., diminishing the integrity of the resource’s location, design, setting, materials, workmanship, feeling, or association. Adverse effects also include reasonably foreseeable effects that would occur later in time, be farther removed in distance, or be cumulative (36 CFR Part 800.5, Assessment of Adverse Effects). A determination of no adverse effect means that the property may be affected, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the NRHP.

CEQ regulations and the NPS’s Conservation Planning, Environmental Impact Analysis and

Impact Threshold Definitions

Negligible	Impact at the lowest levels of detection – barely measurable, with no perceptible consequences. For purposes of Section 106, the determination of effect would be no historic properties affected.
Minor	Adverse impact - Disturbance of a site(s) results in little, if any, loss of integrity. The determination of effect for Section 106 would be no adverse effect. Beneficial impact - Maintenance and preservation of a site(s). The determination of effect for Section 106 would be no historic properties affected.
Moderate	Adverse impact - Disturbance of a site(s) results in loss of integrity. Section 106 effect determination would be adverse effect. A Memorandum of Agreement (MOA) is executed among the NPS and applicable state or tribal historic preservation officer and, if necessary, the ACHP in accordance with 36 CFR 800.6(b). Measures identified in the MOA to minimize or mitigate adverse impacts reduce the intensity of impact under NEPA from major to moderate. Beneficial impact - Stabilization of a site(s). The determination of effect for Section 106 would be no historic properties affected.
Major	Adverse impact - Disturbance of a site(s) results in loss of integrity. The determination of effect for Section 106 would be adverse effect. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the NPS and applicable state or tribal historic preservation officer and/or ACHP are unable to negotiate and execute an MOA in accordance with 36 CFR 800.6(b). Beneficial impact - Active intervention to preserve a site(s). The determination of effect for Section 106 would be no historic properties affected.
Duration	Short term - Recovers in less than three years. Long term - Takes more than three years to recover.
Area of Analysis	Within park boundary.

Decision Making (Director's Order #12) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, i.e., reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by Section 106 is similarly reduced. Although adverse effects under Section 106 may be mitigated, the effect remains adverse.

Archeological Resources

Direct impacts to archeological resources are measured by the extent of physical disturbance or degradation of the resource. This can occur as a result of grading, trenching, or other activities that damage the structure of an archeological site. Indirect impacts can occur as a result of increasing visitor activity or management action in the immediate vicinity, leading to unfortunate consequences such as artifact collection, accelerated soil compaction, and erosion.

Proposed roadway shoulder, pathway, transit, and other improvements were located on a base sheet provided by park staff that identified known archeological resources and the completeness and adequacy of related survey data. It should be noted that this analysis only considers known archeological sites. Additional field survey work is required before construction to identify additional sites, as well as their data potential and potential for inclusion in the NRHP.

Impacts to archeological resources are considered permanent unless otherwise noted. Every effort will be made to avoid historic properties (i.e., those archeological site listed on or considered eligible for listing in the NRHP) through careful project design and subsequent site-specific environmental compliance. If sites cannot be avoided, all data recovery to retrieve important information will be done in consultation with the Wyoming State Historic Preservation Office and in accordance with the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (SGAHP).

Effects of Alternative 1 – No Action Alternative

Under Alternative 1, no new road improvements would occur, and impacts to archeological resources would be attributable to future increases in visitation or continued road maintenance. As noted previously, it is assumed that visitation would increase only slightly over the life of this plan. Expected types of impacts include the erosion of vegetative cover and soil layers in heavily traveled areas, and exposure of new artifacts and features to potential loss through theft or destruction before they can be documented by staff. Areas of highest intensity of use with known resources include South Jenny Lake, Jenny Lake Lodge, String/Leigh Lake, the Moose area, and Taggart Lake. Areas of road improvements would include repair of existing pavement and possible widening as needed.

Because archeological survey work has not been completed in many segments, or has not been completed in accordance with SGAHP, the data potential for such resources is unknown, and thus it is difficult to estimate the intensity of impacts. Because visitation is expected to grow relatively slowly during the period, and road improvements would be done in areas that have already been disturbed during the initial construction of the road, impacts may range from negligible to minor depending on the number of resources affected in a given area and their data potential. Known sites should be avoided and archeological surveys conducted in those areas where impacts are anticipated.

Cumulative Impacts

Recent, current, and planned projects within Grand Teton National Park that may affect archeological resources include rehabilitation and adaptive use of the Murie Ranch, construction of a new visitor center at Moose, and construction of an interpretive center for the JY Ranch. Other smaller projects include the replacement of entrance stations at Moose and Moran Junction, and the addition of one entrance lane; and the construction of a new duplex housing unit within the existing housing complex at Moose.

Widening of North Park Road would take place within an existing road corridor within the park.



In addition, WYDOT is planning reconstruction of U.S. 26/287 (Togwotee Pass), U.S. 26/89 from Hoback Junction to South Park, WY 22 from Jackson to Wilson, and WY 390 (Teton Village Road). All of these developments would occur in areas where human activities are already concentrated, thus minimizing the likelihood that previously unknown archeological resources would be disturbed.

Of these projects, the Moose Visitor Center is the only project that would be expected to impact previously recorded archeological sites in the area due to increased ground disturbance related to construction. A surface survey of the proposed site located three historic pits of unknown use or origin, one foundation, two abandoned two-track roads, and isolated areas of historic debris, none in high concentrations. No proposed facilities would be located in areas where these resources have been found. Should additional resources be discovered during construction, they will be properly documented and evaluated for NRHP eligibility.

The impacts of these related actions, in conjunction with the impacts of Alternative 1, would result in negligible to minor long-term cumulative impacts to archeological resources within the park.

Conclusion

Alternative 1 would result in negligible to minor adverse impacts on known archeological sites located within the park, depending on the number of resources affected and their data potential. Because many areas where resources are known to exist have either not been surveyed, or have not been surveyed in accordance with SGAHP, additional research, fieldwork, and consultation with the Wyoming SHPO and Native American tribal governments will be needed to determine whether these sites are eligible for listing in the NRHP. Should the sites be considered eligible for listing in the NRHP, consultation with the Wyoming SHPO and Native American governments would be required to make a determination of “no adverse effect” or “adverse effect,” in compliance with Section 106 of the NHPA. Cumulative impacts would be long term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to an archeological resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park’s GMP or other relevant NPS planning documents, there would be no impairment of the park’s archeological resources.

Effects of Alternative 2 - Minimal Action Alternatives

Alternative 2 would propose no transit facilities, limited shoulder improvement (widening to 5 feet), and temporal road closures on Signal Mountain Road. In addition, information kiosks would be added to South Jenny Lake, Signal Mountain Lodge, Jackson Lake Lodge, and Colter Bay. To avoid impacts to archeological resources, these facilities would be sited in locations without known resources. Because known archeological resources would be avoided wherever possible, potential long-term adverse impacts could range from negligible to minor depending on the number of resources affected and their data potential.

Because field surveys have either not been conducted or are inadequate to support a determination of the resource’s eligibility for the NRHP, additional fieldwork and consultation would be carried out before any ground-disturbing activities and a determination of eligibility made. Should the sites be determined eligible for listing in the NRHP, consultation with the Wyoming SHPO and Native American governments would be required to determine whether the project constitutes a “no adverse effect” or “adverse effect.” If adverse, a mitigation plan would be developed, again in consultation with the Wyoming SHPO and affiliated tribal governments.

Cumulative Impacts

Current and planned projects within Grand Teton National Park that may affect archeological resources are similar to those described under Alternative 1. The impacts of these related actions, in conjunction with the specific impacts of Alternative 2 would result in negligible to minor long-term cumulative impacts to archeological resources within the park.

Conclusion

Alternative 2 would result in potentially negligible to minor long-term adverse impacts on known archeological sites located within the park, depending on the number of resources affected and their data potential. Because many areas where resources are known to exist have either not been surveyed, or have not been surveyed in accordance with SGAHP, additional research, fieldwork and consultation with the Wyoming SHPO and Native American tribal governments will be needed to determine whether these sites are eligible for listing in the NRHP. Should the sites be determined eligible for listing in the NRHP, consultation with the Wyoming SHPO and Native American governments would be required to make a determination of “no adverse effect” or “adverse effect.” Cumulative impacts would be long-term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to an archeological resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park’s GMP or other relevant NPS planning documents, there would be no impairment of the park’s archeological resources.

Effects of Alternative 3 – Preferred Alternative

Impacts to cultural resources under Alternative 3 would range from negligible to minor depending upon the chosen location. The majority of the area has not been surveyed for archaeological resources, and a cultural resource inventory must be conducted prior to construction activities. Direct and indirect effects could be mitigated by diverting the separated pathway in such a way as to avoid archaeological and ethnographic resources.

Granite Entrance Station to Moose: Only the Granite Entrance Station and the Poker Flats area have been inventoried. Two sites occur on the west side of the road. No other archaeological surveys have been conducted in the areas along the Moose-Wilson Road. It is likely that placing the separated pathway on the east side of the road would have fewer impacts to cultural resources than placing it on the west, based on past survey results and

predictive factors. The proposed road realignment passing to the east of the wetland area would have negligible impacts if all disturbance would remain within the footprint of a previous road alignment. The section of the Moose-Wilson Road that would be realigned to intersect with the Teton Park Road has been inventoried. Areas of the existing road which are planned to be removed and restored to natural conditions are near archaeological sites, which would be protected during restoration activities.

Moose to Jenny Lake: While no archaeological inventories have been conducted for the majority of this area, 12 archaeological sites have been identified, all of which occur east of the existing road. Placing the separated pathway on the west side of the road would most likely have fewer impacts to cultural resources than placing the pathway on the east side, based on past survey results and predictive factors.

Jenny Lake to Colter Bay: Both Jenny Lake and Colter Bay developed areas have been inventoried for cultural resources; however, the area between these two locations has not been inventoried. Sites located on the west side of the road will be avoided. An inventory will be conducted prior to any construction activity.

Cumulative Impacts

Current and planned projects within the park that may affect archeological resources are similar to those described under Alternative 1. A combination of all past, present, and reasonably foreseeable future actions that could cause cumulative impacts would result in negligible to minor adverse impacts, depending upon chosen location and what is yet to be identified through future cultural resource inventories. Adverse impacts to the majority of cultural resources should be avoided by diverting the pathways around site locations.

Conclusion

Alternative 3 would result in potentially negligible to minor long-term adverse impacts on known archeological sites located within the park, depending on the number of resources affected and their data potential. Because many areas where resources are known to exist have either not been surveyed, or have not been surveyed in accordance



with SGAHP, additional research, fieldwork and consultation with the Wyoming SHPO and Native American tribal governments will be needed to determine whether these sites are eligible for listing in the NRHP. Should the sites be determined eligible for listing in the NRHP, consultation with the Wyoming SHPO and Native American governments would be required to make a determination of “no adverse effect” or “adverse effect.” Cumulative impacts would be long-term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to an archeological resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park’s GMP or other relevant NPS planning documents, there would be no impairment of the park’s archeological resources.

Effects of Alternative 4 – Extended Pathways

Impacts to cultural resources under Alternative 4 would range from negligible to minor depending upon the chosen location. The majority of the area has not been surveyed for archaeological resources, and a cultural resource inventory will be conducted prior to construction activities. Direct and indirect effects would be mitigated by diverting the separated pathway in such a way as to avoid archaeological resources.

Granite Entrance Station to Moose: This alternative could have a slightly greater potential for disturbing cultural resources than Alternative 3, because of new road and pathway construction proposed in this corridor. The areas around the Granite Entrance Station, Poker Flats, and where the existing Moose-Wilson Road would be re-aligned to intersect with the Teton Park Road have been inventoried. Two sites have been found on the west side of the road; therefore, it is assumed that placing the separated pathway on the east side of the road would have fewer impacts to cultural resources than placing it to the west. The proposed road realignment passing to the east of the wetlands and the Sawmill Ponds area would have negligible impacts if all disturbance remains within the footprint of a previous road alignment. In other areas,

no archeological survey has been conducted as of yet. Known archeological sites and any others found during pre-construction surveys would be protected during road construction and restoration activities.

Moose to Jenny Lake: While no archaeological inventories have been conducted for the majority of this area, 12 archaeological sites have been identified, all of which occur east of the existing road. Placing the separated pathway on the west side of the road would most likely have fewer impacts to cultural resources than placing the pathway on the east side.

Jenny Lake to Colter Bay: Both Jenny Lake and Colter Bay developed areas have been inventoried for archeological resources; however, the area between these two locations has not been inventoried. Known archaeological sites on the west side of the road will be avoided. The widened shoulders of the Teton Park Road between Signal Mountain Lodge and Jackson Lake Dam would have no adverse effects on known cultural resources. Prior to construction, a cultural resource inventory would be conducted to identify previously undocumented archeological, historic, ethnographic, and/or cultural landscape resources. If any are found, staff would consult with the Wyoming SHPO regarding additional actions needed to protect cultural resources.

Cumulative Impacts

Current and planned projects within the park that may affect archeological resources are similar to those described under Alternative 1. A combination of all past, present, and reasonably foreseeable future actions that could cause cumulative impacts would result in negligible to minor and adverse impacts, depending upon chosen location and what is yet to be identified through future cultural resource inventories. Adverse impacts to the majority of cultural resources would be avoided by diverting the pathways around site locations.

Conclusion

Alternative 4 would result in potentially negligible to minor long-term adverse impacts on known archeological sites located within the park, depending on the number of resources affected and their data potential. Because many areas where resources

es are known to exist have either not been surveyed, or have not been surveyed in accordance with SGAHP, additional research, fieldwork and consultation with the Wyoming SHPO and Native American tribal governments will be needed to determine whether these sites are eligible for listing in the NRHP. Should the sites be determined eligible for listing in the NRHP, consultation with the Wyoming SHPO and Native American governments would be required to make a determination of “no adverse effect” or “adverse effect.” Cumulative impacts would be long-term, negligible to minor, and adverse.

Because there would be no major, adverse impacts to an archeological resource or value whose conservation is (1) necessary to fulfill specific purposes identified in the establishing legislation of Grand Teton National Park; (2) key to natural or cultural integrity of the park; or (3) identified as a goal in the park’s GMP or other relevant NPS planning documents, there would be no impairment of the park’s archeological resources.

TRANSPORTATION SYSTEM AND TRAFFIC

Methods and Assumptions

Impacts to the transportation system and traffic were analyzed relative to mode options available to visitors and employees under each alternative.

Future Park Visitation. Grand Teton National Park has not experienced substantial growth in annual recreational visitation over the past decade. Summer visitation has actually been on a

slight downward trend, while shoulder season (spring and fall) and winter visitation have shown a modest upward trend. Since summer visitation is the largest share of annual visitation, the overall trend is unclear. At the same time, there is no compelling evidence to expect that future visits to the park would trend downward permanently. For purposes of this analysis, the assumption for Grand Teton National Park is that visitation would increase slightly throughout the life of this plan, from the current visitation of approximately 2.8 million visitors per year.

Motor vehicle traffic. Due to the relatively modest increases in visitation predicted through the life of this plan, future motor vehicle traffic is also expected to remain at or near current levels.

Effects of Alternative 1 – No Action Alternative

Under Alternative 1, the park would introduce no transit service, and no improvements in bicycling facilities would be made. Traffic is expected to increase only minimally in the next 5 to 10 years, resulting in minor impacts to the transportation system and traffic.

Parking areas at some of the most popular destinations currently experience varying levels of crowding during the peak visitation season. For example, South Jenny Lake sometimes fills to capacity by late morning and remains full until mid to late afternoon. During this period, it can be difficult to find a parking space, although turnover rates are frequent enough that patient visitors can often find a space. A few other parking areas also

Impact Threshold Definitions

Negligible	The effects would not be detectable and would have no discernable effect on traffic flow and /or road conditions.
Minor	The effects would be slightly detectable but there would not be an overall effect on traffic flow and/or road conditions.
Moderate	The effects would be clearly detectable, and the action could have an appreciable effect on traffic flow and/or road conditions.
Major	The effects would be substantial, with a highly noticeable influence, and the traffic flow and/or road conditions could be permanently altered.
Duration	Short term – effects last one year or less.
	Long term – effects last longer than one year.
Area of Analysis	The principal paved and unpaved roadways within the park, as described below, as well as parking areas located at pullouts, trailheads, and activity centers along these roadway corridors.

experience crowding, but to a somewhat lesser degree. Generally minor adverse impacts would continue under this alternative.

The Moose – Wilson Road provides a different experience than many of the other main roads in the park. Due to its narrow width, limited sight distances, and slow speeds, it provides opportunities for visitors to experience the park in a different way. The corridor is rich in wildlife values and is highly scenic. The road is not well constructed, lacks shoulders, and is not striped. A 2-mile-long section between the Granite Canyon Trailhead and the JY Ranch is unpaved. The speed limit is 25 mph. Traffic volumes on the road are approximately 1,600 vehicles per day on the south end, and somewhat higher on the north end. Higher traffic volumes could result in deterioration of the road, especially the unpaved section, which already develops a very rough and washboard surface during periods of peak use. In addition, the road is susceptible to congestion when wildlife or other attractions are present. Since the road is narrow and few turnouts are present, it is easily blocked by visitors who stop to enjoy the views.

Under this alternative, several different management strategies would be tested during the next 5 to 10 years, with the goal of maintaining the existing character of the road and protecting its important wildlife and scenic values. Management of the Moose – Wilson Road is expected to result in minor to moderate beneficial impacts on traffic in this area. Limitations on the amount of use on the Moose – Wilson Road could lead to commensurate increases in traffic volumes on routes outside the park.

Cumulative Impacts

Related projects near Grand Teton National Park that may impact the transportation system include the reconstruction of Wyoming State Highway (WY) 22, WY 390, and U.S. 287, all of which are located outside of the park. WYDOT has anticipated traffic increases in these corridors as part of overall regional traffic, potentially increasing traffic coming into the park. However, additional bike and pedestrian facilities planned around the park, such as the Jackson Hole Pathways Program, may encourage visitors to use alternative modes, thereby decreasing traffic in the park. Overall, cu-

mulative impacts under Alternative 1 are expected to be long term, minor, and adverse.

Conclusion

Alternative 1 would result in negligible to minor adverse impacts on roadways within the park. On the Moose – Wilson Road, impacts would be minor to moderate and beneficial. Minor adverse impacts would be expected at parking areas throughout the park. Cumulative impacts would be long term, minor, and adverse.

Effects of Alternative 2 – Minimal Action Alternative

Under Alternative 2, short-term minor construction-related activity affecting roadways would include the construction of improved shoulders along Teton Park Road. These minor construction activities are expected to last a season or less and to incur only brief traffic impacts, such as short spells of on-site traffic control or flagmen. All construction activities are expected to have short-term, negligible to minor, adverse impacts on traffic, as the construction activities would generate some traffic from construction vehicles and construction workers' personal vehicles. The additional traffic is expected to be short in duration and relatively low. This alternative requires a limited amount of construction, and the transportation impacts would be long term, negligible to minor, and adverse.

Under this alternative, changes in the amount and timeliness of information dispersed to motorists would increase efficiency of roadway traffic and personal travel within the park. Providing information to motorists about locations of congestion early on in their travels (via variable messaging signs at intersections, information available at their lodges or on the park website, etc.) would enable motorists to choose other routes and reduce the amount of time spent waiting on long queues, a minor beneficial impact.

As in Alternative 1, under this alternative, several different management strategies would be tested on the Moose – Wilson Road during the next 5 to 10 years, with the goal of maintaining the existing character of the road and protecting its important wildlife and scenic values. Management of the Moose – Wilson Road is expected to result in

minor to moderate beneficial impacts on traffic in this area. Limitations on the amount of use on the Moose – Wilson Road could lead to commensurate increases in traffic volumes on routes outside the park.

Cumulative Impacts

Cumulative impacts under Alternative 2 would be expected to be similar to those under Alternative 1, with a minor beneficial impact due to widening shoulders within the park, which connect to trails being planned outside of the park. Overall, cumulative impacts would be long term, minor, and both beneficial and adverse.

Conclusion

Alternative 2 would generally result in impacts similar to those under the No Action Alternative, with the exception of negligible to minor, short-term adverse impacts resulting from construction of widened shoulders on Teton Park Road. Improvements in the dissemination of information to park visitors would result in long-term, minor, beneficial impacts. Cumulative impacts would be long term, minor, and both beneficial and adverse.

Effects of Alternative 3 –Preferred Alternative

Under Alternative 3, short-term construction-related activity affecting roadways would include the construction of multi-use pathways, improved shoulders, realignment of two segments of the Moose – Wilson Road, and transit stops. In this alternative, the addition of roadway shoulders and construction to realign the Moose – Wilson Road would be the main sources of short-term construction-related transportation impacts, which would be minor and adverse, and the impacts from the rest of the construction activities would be negligible and adverse.

Under this alternative, no changes to the management of roadways other than the Moose – Wilson Road would be made. As described under Alternative 1, different management options would be tested, resulting in variable effects along the Moose – Wilson Road, with potential beneficial effects if traffic volumes are moderated. Limitations on the amount of use on the Moose – Wilson Road could lead to commensurate increases in traffic volumes on routes outside the park.

A transit system between Jackson and Moose, Jenny Lake, and Colter Bay, as well as on the Moose – Wilson Road, would reduce personal vehicular traffic on Teton Park Road, North Park Road, and U.S. 26/89/191 north of Moose by very slight amounts (negligible, beneficial impacts) in comparison to Alternative 1. Realignment of the Moose – Wilson Road may alleviate some of the congestion that occurs as a result of wildlife viewing in those areas, resulting in a minor beneficial impact.

Also, similar to Alternative 2, changes in the amount and timeliness of information dispersed to motorists would increase efficiency of roadway traffic and personal travel within the park. Providing information to motorists about locations of congestion early on in their travels (via variable messaging signs at intersections, information available at their lodges or on the park website, etc.) would enable motorists to choose other routes and reduce the amount of time spent waiting on long queues, a minor beneficial impact.

Development of a system of multi-use pathways would result in minor to moderate beneficial effects, due to the increased mode choices available to visitors in the park. The system of pathways and widened shoulders would provide greater opportunities for cyclist and pedestrians, which may slightly decrease vehicular traffics within the park. However, the expanded pathways system may actually increase demand for parking in some areas. When fully constructed, the pathways would provide a connection from Jackson to points along the Teton Park Road corridor (assuming construction by Teton County of a link to the south boundary). Many visitors, however, would likely choose to drive to locations within the park, for example Moose or the Taggart Lake Trailhead, and begin bicycling from there. The additional demand for parking in order to accommodate this new use could result in minor to moderate adverse impacts at certain parking areas.

The pilot transit service included in this alternative would operate in concert with existing and planned public and private transit services in Jackson Hole. The Town and County Southern Teton Area Rapid Transit (START) public transit system operating in and around the Town of Jack-



son would connect directly with the Grand Teton system routes at the MAC Campus in town. This would create some opportunity for transfers between systems, extending and leveraging the utility of both systems. Introduction of a pilot transit program would help reduce some traffic congestion along the route, a minor beneficial effect.

The availability of transit service into and within the park would also tend to leverage and expand the usefulness of the services provided by private operators in Jackson Hole. For example, someone planning a trip to Grand Teton and arriving by air would be encouraged to ride private transit to lodging in town (rather than rent a car) because they would know that they could get to many places in the park on transit. During the day, visitors could ride START from many of the lodging sites in Jackson Hole to the MAC Campus, and then transfer to the park transit system to travel into the park.

Cumulative Impacts

Cumulative impacts would occur from other past, present, and future actions that affect the park's transportation system and traffic, as described under Alternative 1, but with additional beneficial and adverse impacts due to the creation of the multi-use pathways system. Overall, cumulative impacts would be long term, minor, and beneficial.

Conclusion

Alternative 3 would result in both beneficial and adverse impacts to transportation and traffic. The transit system implemented under Alternative 3 would provide additional options for visitors, but would not measurably alter the amount of traffic on park roads. Therefore, long-term impacts on traffic and park roadways as a result of this action would generally be negligible to minor and beneficial; however, the management strategies employed on the Moose – Wilson Road would result in moderate beneficial impacts. Minor adverse impacts would continue to affect some parking areas due to crowding at certain times, and selected parking areas may experience minor to moderate adverse impacts as a result of new parking demand associated with use of the pathway system. Short-term impacts from the construction activi-

ties required for the addition of roadway shoulders would be minor and adverse, and the impacts from the rest of the construction activities would be negligible and adverse. Cumulative impacts to the transportation system are expected to be long term, minor, and beneficial.

Effects of Alternative 4 - Extended Pathways

Under Alternative 4, short-term construction-related activity affecting roadways would include the construction of multi-use pathways, improved shoulders, realignment of two segments of the Moose – Wilson Road, and transit stops. In this alternative, the addition of roadway shoulders and construction to realign the Moose – Wilson Road would be the main sources of short-term construction-related transportation impacts, which would be minor and adverse, and the impacts from the rest of the construction activities would be negligible and adverse.

Under this alternative, no changes to the management of roadways other than the Moose – Wilson Road would be made. As described under Alternative 1, different management options would be tested, resulting in variable effects along the Moose – Wilson Road, with potential beneficial effects if traffic volumes are moderated. Limitations on the amount of use on the Moose – Wilson Road could lead to commensurate increases in traffic volumes on routes outside the park. A transit system between Jackson and Moose, Jenny Lake, and Colter Bay, as well as on the Moose – Wilson Road, would reduce personal vehicular traffic on Teton Park Road, North Park Road, and U.S. 26/89/191 north of Moose by very slight amounts (negligible, beneficial impacts) in comparison to Alternative 1. Realignment of the Moose – Wilson Road may alleviate some of the congestion that occurs as a result of wildlife viewing in those areas, resulting in a minor beneficial impact.

Changes in the amount and timeliness of information dispersed to motorists would increase efficiency of roadway traffic and personal travel within the park. Providing information to motorists about locations of congestion early on in their travels (via variable messaging signs at intersections, information available at their lodges or on the park website, etc.) would enable motorists to

choose other routes and reduce the amount of time spent waiting on long queues, a minor beneficial impact.

Development of a system of multi-use pathways would result in minor to moderate beneficial effects, due to the increased mode choices available to visitors in the park. The system of pathways and widened shoulders would provide greater opportunities for cyclist and pedestrians, which may slightly decrease vehicular traffic within the park, similar to Alternative 3.. However, the expanded pathways system may actually increase demand for parking in some areas. When fully constructed, the pathways would provide a connection from Jackson to points along the Teton Park Road corridor (assuming construction by Teton County of a link to the south boundary). Many visitors, however, would likely choose to drive to locations within the park, for example Moose or the Taggart Lake Trailhead, and begin bicycling from there. The additional demand for parking in order to accommodate this new use could result in minor to moderate adverse impacts at certain parking areas.

The pilot transit service included in this alternative would operate in concert with existing and planned public and private transit services in Jackson Hole. The Town and County Southern Teton Area Rapid Transit (START) public transit system operating in and around the Town of Jackson would connect directly with the Grand Teton system routes at the MAC Campus in town. This would create some opportunity for transfers between systems, extending and leveraging the utility of both systems. Introduction of a pilot transit program would help reduce some traffic congestion along the route, a minor beneficial effect.

The availability of transit service into and within the park would also tend to leverage and expand the usefulness of the services provided by private operators in Jackson Hole. For example, someone planning a trip to Grand Teton and arriving by air would be encouraged to ride private transit to lodging in town (rather than rent a car) because they would know that they could get to many places in the park on transit. During the day, visitors could ride START from many of the lodging sites in Jackson Hole to the MAC Campus, and

then transfer to the park transit system to travel into the park.

Cumulative Impacts

Cumulative impacts would occur from other past, present, and future actions that affect the park's transportation system and traffic, as described under Alternative 1, but with additional beneficial and adverse impacts due to the expansion of the multi-use pathways system. Overall, cumulative impacts to the transportation system are expected to be long term, minor, and beneficial.

Conclusion

Alternative 4 would result in both beneficial and adverse impacts to transportation and traffic. The transit system implemented under Alternative 4 would provide additional options for visitors, but would not measurably alter the amount of traffic on park roads. Therefore, long-term impacts on traffic and park roadways as a result of this action would generally be negligible to minor and beneficial; however, the management strategies employed on the Moose – Wilson Road would result in moderate beneficial impacts. Minor adverse impacts would continue to affect some parking areas due to crowding at certain times, and selected parking areas may experience minor to moderate adverse impacts as a result of new parking demand associated with use of the pathway system. Short-term impacts from the construction activities required for the addition of roadway shoulders would be minor and adverse, and the impacts from the rest of the construction activities would be negligible and adverse. Cumulative impacts to the transportation system are expected to be long term, minor, and beneficial.

Visitor and Employee Experience

Methods and Assumptions

For park visitors, this impact analysis considers various aspects of visitor use and experience at Grand Teton National Park, including the effects on:

- Visitors' ability to experience the park's primary resources and their natural and cultural settings (e.g., vistas, natural sounds and smells and viewing wildlife)



Impact Threshold Definitions

Negligible	Visitors or employees would not be affected, or changes in their experience would be below or at the level of detection. The visitor or employee would not likely be aware of the effects associated with the alternative.
Minor	Changes in visitor or employee use and/or experience would be slight but detectable, would affect few individuals, and would not appreciably limit or enhance experiences identified as fundamental to the park's purpose and significance.
Moderate	Some characteristics of visitor or employee use and/or experience would change, and many individuals would likely be aware of the effects associated with implementation of the alternative; some changes to experiences identified as fundamental to the park's purpose and significance would be apparent.
Major	Multiple characteristics of visitor or employee experience would change, including experiences identified as fundamental to park purpose and significance; most individuals would be aware of the effects associated with implementation of the alternative and would likely express a strong opinion about the changes.
Duration	Short term - occurs only during the treatment effect.
	Long term - occurs after the treatment effect.
Area of Analysis	Within park boundary and, for employees, areas within and outside of the park frequented by employees, including the major transportation corridors; the employee housing areas and major commuting patterns; and major commercial and civic destinations in the Town of Jackson

- Access and quality of movement throughout the park (e.g., level of freedom/spontaneity, reliability, affordability, timeliness, availability of facilities, access to places of interest, convenience, minimal congestion, continuous system of connections, level of universal access)
- Access to orientation and interpretation information (e.g., availability and appropriateness)
- Access to high quality recreation opportunities (e.g., access to diverse recreation opportunities, including turn-around trips, new recreation activities, tranquil/contemplative environments, opportunities for social interaction with family/friends, opportunities to meet new people)
- Visitor safety (both real and perceived)

The analysis is based on how visitor use and experiences would change with the way potential management actions were applied in the alternatives. A major focus of the impact assessment is the degree to which visitors are able to safely, comfortably and freely visit the major destinations in the park.

Information gathered in the visitor survey discussed in Chapter 3 - Affected Environment section was used, along with public input during the planning process, to evaluate the potential impacts of each alternative on visitors. Based on these sources of information, visitors have expressed that scenic views and preservation of native plants

and animals are important to their experiences in the park. In addition, visitors have expressed concern about congestion and crowding at major destination points, conflicts with traffic along roadways, unsafe bicycle and pedestrian access, and lack of continuous pathway and multi-use pathway opportunities for both recreation and travel opportunities. An important consideration regarding evaluation of visitor experience impacts is that impacts may vary based on visitor expectations and desires, which are often a result of level of experience with the park or similar park environments.

For park employees, two measures of transportation system impacts on employee experience are considered: the employee's level of mobility to work sites and locations associated with activities of daily living (shopping, worship); and the quality of the travel experience, as measured by reliability of transportation, cost, and commuting time. These variables have been assessed in a qualitative manner using information from the 2001 Employee Transportation Survey on employees' current mobility options and constraints, as well as typical destinations. It has been assumed that responses to the employee survey are an accurate representation of those that would be given by the employee population as a whole.

Effects of Alternative 1 – No Action Alternative

Visitor Use and Experience

Under this alternative, no changes would be made regarding the types of recreational opportunities and experiences that are available to park visitors. Popular activities include general sightseeing, driving for pleasure, hiking, floating the Snake River, wildlife viewing, mountain climbing, bicycling, and fishing. Annual surveys of park visitors taken between 2000 and 2004 in order to comply with the Government Performance and Results Act have indicated that on average, 99 percent of visitors are satisfied overall with the services, facilities, and recreational opportunities provided at Grand Teton National Park (Visitor Survey Card Report Data 2000 – 2004).

Visitation to the park over the next 5 to 10 years is expected to remain relatively steady or increase slightly. Visitation trends are difficult to predict and are influenced by a wide variety of factors including population growth, economic trends, demographics, recreational preferences, gas prices, and weather. The anticipated visitation trends over this period may result in some popular parking areas becoming full earlier in the day and staying full longer and possibly extending the length of the peak visitation season, resulting in generally minor, adverse, long-term impacts on visitor experience.

Pleasure driving would continue to be a highly popular activity and visitors would continue to have the freedom to travel throughout the park at their own pace and choosing destinations of interest. Localized traffic congestion would continue to occur, generally in conjunction with wildlife sightings. Although traffic congestion can be assumed to cause moderate adverse impacts on visitor experience, the opportunity to stop and view wildlife is considered by most visitors to be beneficial to their visit and enhances their enjoyment of the park.

Within some of the activity areas in the park, visitors currently choose to drive relatively short distances rather than walk between nearby destinations. For example, at Jenny Lake, it is common for campers to drive their cars between the campground and the Jenny Lake Store, even though the

two destinations are within easy walking distance. Pedestrians within the activity areas often tend to walk through parking lots or on social trails. Inadequate signing and a lack of clearly identifiable walking paths contribute to this activity, which results in unnecessary auto travel and competition for parking spaces. Under the No Action Alternative, these issues would be addressed on a case-by-case basis, with existing conditions persisting based on the availability of resources available to address the problems. Impacts on visitor experience as a result of this would be expected to be minor and adverse over both the short and long term.

Opportunities for bicycling exist throughout the park; however, bicycles are limited to the same roadways used by automobiles. The relatively flat topography of Jackson Hole makes bicycling an attractive recreational option, although only a small percentage of park visitors engage in this activity while visiting the park. In recent years, approximately 180 organized commercial bicycle tours have served approximately 2,000 visitors annually. A 2001 survey indicated that 2.3 percent of inbound vehicles at the Moose Entrance Station carried one or more bicycles.

While bicycling is permitted on all park roads, not all visitors are comfortable with sharing the road with high speed motor vehicle traffic. Road shoulders vary in width from almost non-existent to 5 feet. The inherent and perceived risks of bicycling on road shoulders may discourage some visitors from bicycling altogether, and may adversely affect the experience for others by requiring them to concentrate on traffic and their own safety rather than the scenic views. Although rare, accidents have the potential to be serious, and two fatalities have occurred in recent years.

Under the No Action Alternative, no improvements would be made with regard to bicycling facilities, resulting in long-term, minor to moderate adverse impacts on visitor experience.

Several different management strategies would be piloted on the Moose – Wilson Road over the next 5 to 10 years, with the objective of managing traffic volumes so as to retain the existing character of the road corridor. Strategies could include making the road one-way during the peak season or



allowing bi-directional traffic from both ends of the road to a point in the middle (such as the JY Ranch) where a gate would be provided in order to preclude its use as a through road. Other options could include closures at certain times or on certain days in order to provide opportunities for non-motorized use, or combinations of some of these methods. A pilot transit system would also be implemented. In any event, the park would work closely with the local community in order to develop and publicize pilot management strategies well in advance of their implementation in order to avoid confusion and disruption, and mitigate potential impacts.

The effect of these pilot management strategies would result in both beneficial and adverse impacts on visitor experience, and would vary between different strategies. Overall, most visitors using the Moose – Wilson Road would experience a beneficial impact as a result of the current character being maintained. Some visitors may be inconvenienced under some management strategies if they were not able to travel in the direction they desired, travel all the way through, or reach one of the trailheads without driving around through Jackson. In general, implementation of the various strategies would result in minor, short-term impacts, both beneficial and adverse.

Employee Use and Experience

Under this alternative, no changes in the management of employee transportation in the park would be expected. Employees with access to vehicles would continue to have high mobility to their work sites. Employees without access to a personal vehicle would continue to rely on concession-provided transit, ride to work with colleagues, or walk to and from work.

The slight increase in traffic volumes on park roadways through the life of this plan (5 to 10 years) may have an effect on the length of employee commutes and the quality of that commute. Long-term impacts on commuting times would be negligible to minor and adverse.

Cumulative Impacts

Grand Teton National Park is one component of the Greater Yellowstone Area, which includes Yellowstone National Park, several national forests,

the National Elk Refuge, and communities such as Jackson and Cody, Wyoming; West Yellowstone, Gardiner, and Bozeman, Montana; and Idaho Falls, Idaho. Visits to Grand Teton are often combined with visits to a wide variety of destinations elsewhere in the three-state area, and a virtually unlimited array of opportunities and experiences are available throughout the Greater Yellowstone Area.

Within the park, a new visitor center is planned for construction at Moose which will provide improved opportunities for education and information about the park, as well as how to best visit it. Reconstruction of North Park Road would facilitate travel between the south entrance of Yellowstone and Lizard Creek Campground. Widened shoulders on that section of road would provide improved opportunities for bicycling. Likewise, reconstruction of U.S. 287/26 over Togwotee Pass by WYDOT would improve opportunities for both automobile and bicycle travel.

The impacts of these related actions, in conjunction with the impacts of Alternative 1, would result in negligible to minor long-term adverse cumulative impacts to employee commuting time, and negligible, long-term, beneficial cumulative impacts on employee mobility choices; cumulative impacts on visitor experience would be moderately beneficial and long term.

Conclusion

Overall, implementation of Alternative 1 would result in minor to moderate impacts on visitor and employee experience, both beneficial and adverse. Cumulative impacts would include negligible to minor, long-term adverse cumulative impacts to employee commuting time; negligible, long-term, beneficial cumulative impacts on employee mobility choices; and moderately beneficial and long term cumulative impacts on visitor experience.

Effects of Alternative 2 – Minimal Action Alternative

Visitor Use and Experience

The effects of Alternative 2 would be generally the same as described for Alternative 1, except that improved road shoulders would provide a minor to moderate beneficial impact on visitor experience by enhancing the quality and safety of bicy-

climbing opportunities. In addition, periodic closure of Signal Mountain Road to allow for non-motorized uses would also provide a minor beneficial impact on visitor experience for some visitors; conversely, visitors who desire to visit the summit by automobile could be adversely affected if they were unable to schedule that activity around the periods when the road was closed.

Beneficial impacts relative to the No Action Alternative would also result from improved traveler information, such as information kiosks, enhanced use of variable messaging signs, and traveler information radio broadcasts.

Employee Use and Experience

Under this alternative, no increase in the current level of transit would be provided, though improved shoulders would be constructed in areas where there are presently measurable safety hazards. Employees with access to vehicles would continue to have high mobility to work sites. Those employees without access to a personal vehicle would continue to rely on concession-provided transit, rides from co-workers, or walk to and from work. The 5-foot shoulder from Jackson to Moose would be extended to Signal Mountain Lodge along Teton Park Road, providing employees that choose to bicycle commute from Jackson a continuous bike lane along the shoulder, a minor to moderate beneficial impact.

Short-term construction-related impacts on visitor and employee experience would be expected to consist of short delays on some localized areas of roadways, which may affect visitor access to certain locations, the commute to and from work, and work-related travel within the park. The overall short term impact to visitor and employee experience would be negligible and adverse.

Cumulative Impacts

Cumulative impacts would be generally the same as those described under Alternative 1, with negligible to minor, long-term adverse cumulative impacts to employee commuting time, negligible, long-term, beneficial cumulative impacts on employee mobility choices; and moderately beneficial and long term cumulative impacts on visitor experience.

Conclusion

Overall, implementation of Alternative 2 would result in minor to moderate beneficial impacts, and negligible to moderate adverse impacts on visitor and employee experiences. Cumulative impacts would include negligible to minor, long-term adverse cumulative impacts to employee commuting time; negligible, long-term, beneficial cumulative impacts on employee mobility choices; and moderately beneficial and long term cumulative impacts on visitor experience.

Effects of Alternative 3 – Preferred Alternative

Visitor Use and Experience

Compared to Alternative 1, implementation of Alternative 3 would result in additional moderate to major beneficial impacts on visitor experience due to the availability of approximately 23 miles of separated multi-use pathways and 16 miles of improved road shoulders. These improvements would enhance opportunities for safe and enjoyable bicycling in the park, a moderate to major beneficial impact. Although a relatively small percentage of visitors currently engage in bicycling while visiting the park, it could be expected that the popularity of this activity would increase as a result of the new facilities.

In addition, implementation of a limited transit system would result in long-term, minor beneficial impacts by providing a means for visitors to access certain areas of the park without the need to depend on private automobiles. It is anticipated that this additional service would serve visitors (and employees) having a single destination for the day (or a large portion of a day), rather than as an alternative to pleasure driving or touring the park. For example, the shuttle service could allow lodge or motel guests to access a trailhead in the park from which to begin a hike, without having to the need for a car. It could also provide a shuttle between various trailheads, making possible circuit hikes that cannot currently be done without having two cars. Transit vehicle would be equipped with bicycle carriers in order to allow visitors to reach certain parts of the pathway system without having to ride the entire distance.

Adverse effects on visitor use and experience may



also result from the construction of approximately 23 miles of separated pathways. These new facilities would, to varying degrees, intrude upon the natural landscape and therefore adversely affect the experience of some visitors by increasing the development footprint and thereby altering the character of the road corridors from less developed to more developed. Construction of a pathway along the Moose – Wilson Road corridor may noticeably alter the character of the area due to the removal of large numbers of trees in segments of the corridor that are forested, resulting in long-term, minor to moderate, adverse impacts on visitor use and experience.

Employee Use and Experience

Under this alternative, a pilot transit service would be provided between Jackson and Moose, Jenny Lake, and Colter Bay via Teton Park Road. Improved multi-use pathways would be provided along high-use roadways, safer bicycling routes would be available for employees, and social trails would be improved and delineated in several activity areas.

Employees with access to vehicles could continue to commute to work by personal vehicle. The pilot transit service between Jackson and the park would provide a convenient alternative, though with possibly longer commute times. Employees without access to a personal vehicle would experience improved mobility options. Access to work sites and recreation opportunities would be available for almost all employees in the park.

The safety, convenience, and quality of employee bicycle and walk commute to and from work would be improved. Separated pathways would connect Jackson to Moose and Beaver Creek to Moose. An improved bicycle shoulder would connect Colter Bay and Jackson Lake Lodge. Improvements in pathway systems at activity areas would connect employee housing to the main activity core areas within Colter Bay and Signal Mountain Lodge.

Short-term construction-related impacts on visitor and employee experience would be expected to consist of short delays on some localized areas of roadways, which may affect visitor access to certain locations, the commute to and from work, and work-related travel within the park, for some

employees. The impact to employee experience would be negligible to minor and adverse.

Cumulative Impacts

Cumulative impacts on visitor experience would be generally the same as under the other alternatives. Recent, current, and planned projects within Grand Teton National Park that may influence employee mobility within the park are the same as for Alternative 1. The impacts of these related actions, in conjunction with the impacts of Alternative 3, would result in negligible to minor, long-term adverse cumulative impacts to employee commuting time, negligible, long-term, beneficial cumulative impacts on employee mobility choices; and moderately beneficial and long term cumulative impacts on visitor experience.

Conclusion

Overall, implementation of Alternative 3 would result in minor to major beneficial impacts associated with the additional pathways and transit, and negligible to moderate adverse impacts on visitor and employee experience associated with the change to the landscape. Cumulative impacts would include negligible to minor, long-term adverse cumulative impacts to employee commuting time; negligible, long-term, beneficial cumulative impacts on employee mobility choices; and moderately beneficial and long term cumulative impacts on visitor experience.

Effects of Alternative 4 - Extended Pathways

Visitor Use and Experience

Compared to the No Action Alternative, implementation of Alternative 4 would result in additional moderate to major beneficial impacts on visitor experience due to the availability of approximately 41 miles of separated multi-use pathways. These improvements would enhance opportunities for safe and enjoyable bicycling in the park, a moderate to major beneficial impact. Although a relatively small percentage of visitors currently engage in bicycling while visiting the park, it could be expected that the popularity of this activity would increase as a result of the new facilities.

In addition, implementation of a limited transit

system would result in long-term, minor beneficial impacts by providing a means for visitors to access certain areas of the park without the need to depend on private automobiles. It is anticipated that this additional service would serve visitors (and employees) having a single destination for the day (or a large portion of a day), rather than as an alternative to pleasure driving or touring the park. For example, the shuttle service could allow lodge or motel guests to access a trailhead in the park from which to begin a hike, without having to the need for a car. It could also provide a shuttle between various trailheads, making possible circuit hikes that cannot currently be done without having two cars. Transit vehicle would be equipped with bicycle carriers in order to allow visitors to reach certain parts of the pathway system without having to ride the entire distance.

Adverse effects on visitor use and experience may also result from the construction of approximately 41 miles of separated pathways. These new facilities would, to varying degrees, intrude upon the natural landscape and therefore adversely affect the experience of some visitors by increasing the development footprint and thereby altering the character of the road corridors from less developed to more developed. Construction of a pathway along the entire length of the Moose – Wilson Road corridor may noticeably alter the character of the area due to the removal of large numbers of trees in segments of the corridor that are forested, resulting in long-term, moderate, adverse impacts on visitor use and experience. Similar impacts would also occur on sections of the Teton Park Road and North Park Road that are forested.

Employee Use and Experience

Under this alternative, a pilot transit service would be provided between Jackson and Moose, Jenny Lake, and Colter Bay via Teton Park Road. Improved multi-use pathways would be provided along high-use roadways, safer bicycling routes would be available for employees, and social trails would be improved and delineated in several activity areas.

Employees with access to vehicles could continue to commute to work by personal vehicle. The pilot transit service between Jackson and the park would provide a convenient alternative, though

with possibly longer commute times. Employees without access to a personal vehicle would experience improved mobility options. Access to work sites and recreation opportunities would be available for almost all employees in the park.

The safety, convenience, and quality of employee bicycle and walk commute to and from work would be improved. Separated pathways would connect Moose to Jackson, Teton Village, Beaver Creek, South Jenny Lake, and points further north. Improvements in pathway systems at activity areas would connect employee housing to the main activity core areas within Colter Bay and Signal Mountain Lodge.

Short-term construction-related impacts on visitor and employee experience would be expected to consist of short delays on some localized areas of roadways, which may affect visitor access to certain locations, the commute to and from work, and work-related travel within the park, for some employees. The impact to employee experience would be negligible to minor and adverse.

Cumulative Impacts

Cumulative impacts on visitor experience would be generally the same as under the other three alternatives. Recent, current, and planned projects within Grand Teton National Park that may influence employee mobility within the park are the same as for Alternative 1. The impacts of these related actions, in conjunction with the impacts of Alternative 4, would result in minor to moderate long-term beneficial cumulative impacts on employee mobility options, and negligible to minor adverse cumulative impacts on commuting time, and moderately beneficial and long term cumulative impacts on visitor experience.

Conclusion

Overall, implementation of Alternative 4 would result in minor to major beneficial impacts associated with the additional pathways and transit, and minor to moderate adverse impacts on visitor and employee experience. Cumulative impacts would include negligible to minor, long-term adverse cumulative impacts to employee commuting time; negligible, long-term, beneficial cumulative impacts on employee mobility choices; and moderately beneficial and long term cumulative impacts on visitor experience.



Social and Economic Environment

Methods and Assumptions

This analysis considers effects of the alternatives on population, economic activity, housing, community infrastructure, public sector fiscal conditions, local governance, social institutions, and quality of life.

The approach to assessing the socioeconomic impacts of the transportation alternatives relies on three factors: (1) existing conditions at Grand Teton National Park in the context of the surrounding socioeconomic environment; (2) the linkages between different elements of the economic and social environment; and (3) the aspects of the transportation alternatives that may trigger changes in the contextual relationships. Given these factors, the direct, indirect, and induced socioeconomic consequences of the transportation-related changes were assessed. The analysis considers the magnitude or intensity and duration of consequences, as well as the temporal, spatial, and distributional dimensions of their incidence.

The existing economic and social linkages between the park and the Jackson/regional environment are predicated on the park's proximity to the community, the relatively limited private land in the area, the geographical relationship between the park and regional highway network, and the park's outstanding scenic beauty and rich recreational, historical, and cultural resources.

These factors combine with annual visitation that consistently ranks within the top 10 among the 57 national parks administered by the NPS, to create conditions wherein the park's presence plays a substantial role in shaping the local economic and social environment.

A review of the transportation alternatives identified the primary aspects of the alternatives that could trigger socioeconomic impacts. Those events and actions include:

- Construction and related capital expenditures associated with implementation
- Annual transportation system operating and maintenance expenditures
- Changes in business opportunities, particularly those of concessioners, associated with transportation-related changes in accessibility.

Beyond the actions identified above, a fundamental assumption of the analysis is that the transportation alternatives may slightly alter the geographical distribution of visitors within the park or the activity profile of their visits, but the overall level of future visitation would be essentially unaffected or experience only a slight increase. In light of the assumption regarding visitation, the socioeconomic analysis is relatively straightforward. Quantitative estimates of direct costs and employment serve as the basis for estimating the associated indirect and induced effects using a traditional

Impact Threshold Definitions

Negligible	No effects would occur, or the effects to socioeconomic conditions would be below or at the level of detection and with no discernible effect on the character of the social and economic environment.
Minor	The effects to socioeconomic conditions would be detectable. Any effects would be small and, if mitigation is needed to offset potential adverse effects, would be simple and successful and not expected to alter the character of the established social and economic environment.
Moderate	The effects to socioeconomic conditions would be readily apparent. Any effects would result in changes to socioeconomic conditions on a local scale. If mitigation is needed to offset potential adverse effects, it could be extensive, but would likely be successful and could have an appreciable effect on the social and economic environment.
Major	The effects to socioeconomic conditions would be readily apparent and would cause substantial changes to socioeconomic conditions in the region. Mitigation measures to offset potential adverse effects would be extensive and their success could not be guaranteed and are likely to have a noticeable influence on the social and economic environment.
Duration	Short term - occurs only during the treatment effect/project period.
	Long term - occurs after the treatment effect/beyond project period.
Area of Analysis	The two-county area encompassing Teton County, Wyoming, and neighboring Teton County, Idaho.

“economic multiplier” approach. The subsequent incidence of those effects is then determined based on comparisons to changes under the No Action Alternative and professional judgment.

Effects of Alternative 1 – No Action Alternative

Population, Demographics, and Mobility

The underlying economic conditions that have stimulated the region’s population growth, high levels of immigration and economic expansion are expected to continue over the foreseeable future. Consequently, long-term population growth would occur under the No Action Alternative. The resident population of Teton County, Wyoming, is projected to increase to 26,179 by 2010, a 43 percent increase, and the population of Teton County, Idaho, is expected to climb to 6,579, or 14 percent, over the same period (Table 24). Seasonal and visitor populations would also increase.

The strong growth would sustain high levels of net immigration to the region. Teton County, Idaho, would likely see a continuation of the spillover effects of the growth in the Jackson area as some new residents opting to live in Teton County, Idaho, and commute to jobs in neighboring Teton County, Wyoming.

The economic and social influences associated with the park’s presence, its operations, staff and the visitors attracted to the area would continue with no fundamental change. Thus, while the park would remain an important factor in the socioeconomic landscape, its operations and functioning under Alternative 1 would result in no substantial changes in altering that landscape, representing at most an indirect response to slight increases in visitation levels.

Cumulative Impacts

Long-term changes in socioeconomic conditions

in the region would occur over the next 10 to 20 years. Economic and population growth in the region are driven not so much by discrete and foreseeable activities or events, such as the recruitment of a large new employer, but by a series of many smaller, largely independent actions on the part of individuals, businesses, and governmental agencies. Together, these actions are expected to increase employment by about 10,000 jobs, result in population growth of 43 percent between 2000 and 2010, spur construction upwards of 4,000 new dwellings units, and affect local quality-of-life. These changes themselves constitute major long-term changes in regional socioeconomic conditions.

The socioeconomic impacts of Alternative 1, in combination with the major effects from other actions identified above, would result in major cumulative socioeconomic impacts both beneficial and adverse. However, the increment associated with Alternative 1 would be very small, relative to the overall cumulative socioeconomic impacts.

Conclusion

Alternative 1 would result in negligible to minor, long-term, and slightly beneficial socioeconomic impacts. The economic and social influences associated with the park’s presence, its operations, staff and the visitors attracted to the area would continue with no fundamental change and there would be no substantial changes in the socioeconomic landscape, representing at most an indirect response to slight increases in visitation levels. Cumulative impacts would be both beneficial and adverse and major, with the increment associated with this alternative considered negligible.

Effects of Alternative 2 – Minimal Action Alternative

The transportation system management changes

TABLE 24
PROJECTED POPULATION GROWTH, 2000-2010

	2000	2005	2010	Changes
Teton County, Wyoming	18,251	21,951	26,179	+7,928 / +43%
Teton County, Idaho	5,793	6,177	6,579	+ 783 / +14%

Sources: Teton County Housing Authority, 2002 and Idaho Department of Commerce.



proposed under Alternative 2 would generate a small amount of economic stimulus into the regional economy beyond that associated with the No Action Alternative. The direct stimuli associated with Alternative 2 would be the capital investment of approximately \$5 million that would be required to widen road shoulders for use by cyclists and to add to the information system.

Population, Demographics and Mobility

Any temporary impacts due to construction activities involving non-local contractors would be within the scope of such activities that already occur within the regional economy from time to time. Population changes over the long term under Alternative 2 are estimated at fewer than 20 people. The temporary and long-term population impacts of Alternative 2 are of such a limited scale as to effectively constitute no impact.

Cumulative Impacts

The incremental impacts of Alternative 2 would contribute little to long-term cumulative social and economic impacts in the region. Project-related effects, including employment, population and housing demand, would be seasonal in nature and very small in magnitude. While the traveling public and residents of the local community would be aware of some of the physical equipment and devices associated with Alternative 2, few would be cognizant of the presence of any additional staff at the park, or their incomes within the community.

Thus, the impacts of Alternative 2, in combination with the major regional socioeconomic impacts arising from underlying growth trends, would result in major cumulative socioeconomic impacts, both beneficial and adverse. However, the increment associated with Alternative 2 would be negligible in the context of overall cumulative socioeconomic impacts.

Conclusion

Alternative 2 would result in no readily discernible or apparent effect on local economic and social conditions, either temporary or long term. Cumulative impacts would be long-term, major, and both beneficial and adverse, with the increment associated with this alternative considered negligible.

Effects of Alternative 3 –Preferred Alternative

The pilot transit service and related changes proposed under Alternative 3 would generate added economic stimulus into the regional economy beyond that associated with Alternative 1. The direct stimuli associated with Alternative 3 would be a capital investment of approximately \$32 million.

Population, Demographics and Mobility

The temporary and long-term population impacts of Alternative 3 are comparable to those for Alternative 2, with a slight increase due to the expanded pathway system planned. Demand for housing for temporary workers would increase, a minor adverse impact. Those impacts would be minor relative to the current population and the growth anticipated under the Alternative 1, and neither inherently beneficial or adverse in character. Overall, Alternative 3 would have minor economic and social impacts in the region.

Cumulative Impacts

The incremental socioeconomic effects of Alternative 3 represent a small portion of the underlying cumulative trends affecting economic, demographic, and quality-of-life in the region. Thus, the impacts of Alternative 3, in combination with the major regional socioeconomic impacts arising from underlying growth trends, would result in major cumulative socioeconomic impacts, both beneficial and adverse. However, the increment associated with Alternative 3 would be minor in the context of overall cumulative socioeconomic impacts.

Conclusion

Alternative 3 would result in minor economic and social impacts in the region. The impacts would consist of both direct and indirect elements and tend to be seasonal in nature, with both short-term and long-term dimensions. Impacts on local housing conditions would be minor, but adverse. These impacts would occur against a backdrop of other trends and influences that are likely to continue as the primary agents of change in the region. Cumulative impacts would be long term, major, and both beneficial and adverse, with the increment associated with this alternative considered negligible.

Effects of Alternative 4 - Extended Pathways

The pilot transit service and related changes proposed under Alternative 4 would generate added economic stimulus into the regional economy beyond that associated with the Alternative 1. The direct stimuli associated with Alternative 4 would be a capital investment of approximately \$39 million.

Population, Demographics and Mobility

The temporary and long-term population impacts of Alternative 4 are comparable to those for Alternative 3, with a slight increase due to the more expanded pathway system planned. Demand on housing for temporary workers would increase, a minor adverse impact. Those impacts would be minor relative to the current population and the growth anticipated under the Alternative 1, and neither inherently beneficial or adverse in character. Overall, Alternative 4 would result in minor economic and social impacts in the region.

Cumulative Impacts

The incremental socioeconomic effects of Alternative 3 represent a small portion of the underlying cumulative trends affecting economic, demographic, and quality-of-life in the region. Thus, the impacts of Alternative 4, in combination with the major regional socioeconomic impacts arising from underlying growth trends, result in major cumulative socioeconomic impacts, both beneficial and adverse. However, the increment associated with Alternative 4 would be minor in the context of overall cumulative socioeconomic impacts.

Conclusion

Alternative 4 would result in minor economic and social impacts in the region. The impacts would consist of both direct and indirect elements and tend to be seasonal in nature, with both short-term and long-term dimensions. Impacts on local housing conditions would be minor, but adverse. These impacts would occur against a backdrop of other trends and influences that are likely to continue as the primary agents of change in the region. Cumulative impacts would be long term, major, and both beneficial and adverse, with the

increment associated with this alternative considered negligible.

Local Communities

Methods and Assumptions

This analysis considers opportunities afforded by each of the alternatives to increase collaboration and partnering between the park and local gateway communities. This Plan/DEIS offers opportunities for the park to collaborate with local gateway communities in addressing common transportation problems and issues. Initial groundwork has already been laid in collaborative planning for the new MAC Campus to be constructed in Jackson, for example. Each of the action alternatives has been framed in a slightly different manner to promote future collaboration between the park and surrounding communities, though measuring the extent of such collaboration is possible only in a qualitative sense.

Alternatives that maximize the ability of local communities (the public and cooperative agencies) to embrace or participate in transportation networking opportunities and that promote or maximize the ability of the park to cooperate and participate with the local community would be favored. Adverse impacts would be actions that would weaken or not maximize the park's relationship with the local community. Conversely, beneficial impacts would be actions that strengthen or maximize the park's relationship with the local community.



Impact Threshold Definitions

Negligible	Changes in local community participation would be below the level of detection. Little noticeable change in opportunities for collaboration. Changes would affect a small proportion of park neighbor(s).
Minor	Changes in local community participation would be detectable, although the changes would be slight and likely short term. Detectable changes in collaboration, though highly limited in scope (e.g., a single project in a localized geographic area). Changes would affect a small proportion of park neighbor(s).
Moderate	Changes in local community participation would be readily apparent and mostly long term. Readily detectable changes in collaboration, across multiple projects or geographic areas. Changes would affect a moderate proportion of park neighbor(s).
Major	Changes in local community participation would be readily apparent and have substantial long-term consequences. Readily apparent changes in collaboration, across virtually all project and geographic areas, and involving substantial financial partnerships and cost sharing. Changes would affect a large proportion of park neighbor(s).
Duration	Short term - Effects extend only through the period of one project or event. Long term - Effects extend beyond the project or event and generally last for the duration of the proposed Plan/DEIS.
Area of Analysis	The developing areas of Teton County, Wyoming, surrounding Grand Teton National Park to the east and south, Yellowstone National Park to the north, and the Teton crest with several small communities on the "Idaho side" (which includes the western-most portions of Teton County, Wyoming, as well as Teton County, Idaho) to the west.

Effects of Alternative 1 – No Action Alternative

Under this alternative, the park would continue to collaborate with town and county partners on the design and implementation of the MAC Campus in Jackson. The park would continue to permit Grand Teton Lodge Company to operate existing levels of transit service in the park, serving mainly lodge guests, but would not encourage increased visibility for this transit service or any expansion. Finally, it is expected that the park would respond to the construction of pathways in Teton County that would approach the south park boundaries on a case-by-case basis.

The overall level of coordination and integration between the park and gateway communities would remain modest and focused on individual project opportunities, resulting in a negligible to minor long-term beneficial impact on collaboration and partnerships between the park and its gateway communities. Only a limited number of visitors and local residents – in this case, users of the MAC Center – would benefit from the collaboration that did exist.

Lifestyle and Social Conditions

Local governments and the community at large would continue their multi-faceted efforts to address a wide spectrum of "quality of life" issues in the face of ongoing growth and development under the No Action Alternative. In addition to housing, those issues include the preservation of

open space and scenic vistas, community infrastructure development, preservation of small town values and the area's western heritage, supporting a socially and economically diverse population, and local public and other transportation needs. Alternative 1 would continue the status quo within the park regarding transportation needs, and it would not contribute beneficial or adverse effects on the regional quality of life.

Cumulative Impacts

Cumulative impacts to local communities include rehabilitation and adaptive use of the Murie Ranch and construction of an interpretive center for the JY Ranch. Both of these facilities may draw both local residents as well as visitors from out of town. Long-term impacts would be negligible to minor and beneficial.

Development in Teton County, especially around Jackson, Wilson, and Teton Village, is ongoing, and private lands have not yet reached maximum build-out. The extent and timing of this build-out is unknown. Among the projects that have been planned or recently completed that could increase both residential and guest activity include the Four Seasons, Teton Lodge, Snake River Lodge & Spa, Moose Creek Townhomes, Teton Club, Millward Project (WY 390), and Jackson Hole Golf & Tennis. Together, these projects may add 100 to 140 dwelling units and between 300 and 350 guest units.

Teton County has developed and continues to expand its trail system primarily along existing roads. Among the recently completed and planned projects are:

- **Moose-Wilson Trail:** This project completes a trail for about 7 miles, from WY 22 to the southwest park boundary along WY 390.
- **Jackson-Moose Scenic Pathway:** This project would complete a trail of approximately 3.5 miles from the MAC Campus in Jackson to the park boundary.
- **Regional Trails:** The following trails are also scheduled for future construction: Teton Pass Millennium Trail – 18 miles from Wilson to Victor. Hoback Junction Pathway – 5.7 miles from Game Creek to Hoback Junction. Hoback Junction Pathway – 5.7 miles from Game Creek to Hoback Junction Wyoming Centennial Scenic Byway – U.S. 26/191 (location unclear). WY 22 Pathway and Snake River Bridge – 5.5 miles from Y-intersection to Wilson.

Long-term impacts would be negligible to minor and beneficial.

Overall, impacts of actions described under Alternative 1, combined with impacts of other actions that could affect local communities, would result in negligible to minor, long-term, beneficial cumulative impacts on interjurisdictional collaboration between the park and surrounding gateway communities.

Conclusion

Alternative 1 would result in a negligible to minor long-term beneficial impact on collaboration between the park and its gateway communities. Collaboration would continue at a modest and project specific level. Cumulative impacts on local communities would be long term, negligible to minor, and beneficial.

Effects of Alternative 2 – Minimal Action Alternative

Alternative 2 proposes no enhancements to existing transit service, though existing service would be more heavily publicized for park visitors. Selected shoulder improvements would be proposed to connect key destinations or correct measurable public safety hazards along Teton Park Road.

These improvements are expected to result in negligible to minor long-term beneficial impacts, affecting a small fraction of the visitor population.

There would be occasional road restrictions on Signal Mountain Road to provide non-motorized users the opportunity to use the roadway at certain time and improve the experience and safety of users. In all other areas of the park, cyclists and pedestrians would share the road with vehicular traffic. Implementation of this alternative would result in minor to moderate long-term beneficial impacts on coordination between the park and gateway communities.

Finally, Alternative 2 proposes substantial improvements to the park's traveler information system, including dissemination of real time information to lodge guests; placement of variable messaging signs at key intersections to disseminate information about construction delays, congested areas, accidents, wildlife jams, and similar transportation problems; and improvement of the park's website. These actions would provide minor long-term beneficial impacts for a segment of the local and out-of-area visitor population.

Lifestyle and Social Conditions

Alternative 2 would trigger few changes in the local quality of life. Efforts to enhance motorist safety through the improvement of roadway shoulders on Teton Park Road, and reduce congestion through providing additional travel options, would benefit residents of the region. However, some residents would perceive adverse effects related to temporal road restrictions on the Signal Mountain Road and the Moose – Wilson Road. The scale and timing of these impacts would be such that they would be considered minor and indeterminate in character.

Cumulative Impacts

Cumulative impacts to local communities would be similar to those described under Alternative 1. Overall, cumulative impacts would result in long-term, negligible, beneficial cumulative impacts on interjurisdictional collaboration, as a result of the improved shoulders; minor long-term beneficial cumulative impacts as a result of the traveler information system; and minor long-term adverse



cumulative impacts, as a result of roadway management on Signal Mountain Road.

Conclusion

Alternative 2 would result in negligible to minor, long-term beneficial impacts on interjurisdictional collaboration, as a result of the improved road shoulders that can be used as cycling trails connecting to Moose; minor, long-term beneficial impacts as a result of the traveler information system; and minor, long-term adverse impacts, as a result of roadway management on Signal Mountain Road. Cumulative impacts on local communities would be long term, negligible to minor, and beneficial.

Effects of Alternative 3 – Preferred Alternative

Alternative 3 would provide a pilot transit service connecting Jackson with Moose, Jenny Lake, and Colter Bay, as well as along the Moose – Wilson Road. A park-and-ride facility would be provided at the MAC Campus. At Teton Village, transit boarding would be coordinated with individual lodges. Coordination would still be necessary with existing transit providers regarding schedule, rolling stock, maintenance, and operations.

The transit service would be expected to have negligible to minor long-term beneficial impacts on coordination between the park and gateway communities. A small portion of visitors and local residents would be affected by implementation. Transit use would be purely voluntary.

Alternative 3 would also propose a system of separated pathways and widened road shoulders that would improve the safety and experience of cyclists and pedestrians. At the south park boundary abutting Jackson, a separated pathway continuing to North Jenny Lake would be designed to interface with the county system, maximizing coordination between facilities. Likewise, the separated pathway on the Moose – Wilson Road would connect with the pathway already constructed along WY 390 by Teton County. Implementation of this alternative would result in moderate long-term beneficial impacts on coordination between the park and gateway communities.

Lifestyle and Social Conditions

Alternative 3 would provide a higher level of expanded transit service that would benefit some residents and employees that do not have access to personal vehicles or who favor using transit for personal reasons. Outdoor enthusiasts would also benefit from the increased opportunities to cycle on the expanded bike/pathways network. The net effect of Alternative 3 on the local quality of life would be minor, but indeterminate in character.

Cumulative Impacts

Cumulative impacts under Alternative 3 would be very similar to those described under Alternatives 1 and 2, with the addition of transit and separated pathways increasing mode choice within the park. Overall, cumulative impacts to local communities would result in minor long-term beneficial cumulative impacts on inter-jurisdictional collaboration, as a result of implementation of transit; and minor to moderate long-term beneficial cumulative impacts, as a result of the separated pathway system.

Conclusion

Alternative 3 would result in long-term, minor, beneficial impacts on inter-jurisdictional collaboration, as a result of implementation of transit; and minor to moderate long-term beneficial impacts, as a result of the separated pathway system. Cumulative impacts to local communities would be long-term, minor to moderate, and beneficial.

Effects of Alternative 4 - Extended Pathways

Alternative 4 would provide a pilot transit service connecting Jackson with Moose, Jenny Lake, and Colter Bay, as well as along the Moose – Wilson Road. A park-and-ride facility would be provided at the MAC Campus. At Teton Village, transit boarding would be coordinated with individual lodges. Coordination would still be necessary with existing transit providers regarding schedule, rolling stock, maintenance, and operations.

The transit service would be expected to have negligible to minor long-term beneficial impacts on coordination between the park and gateway communities. A small portion of visitors and local residents would be affected by implementation. Transit use would be purely voluntary.

Alternative 4 would also propose a more expanded system of separated pathways and widened road shoulders that would improve the safety and experience of cyclists and pedestrians. At the south park boundary abutting Jackson, a separated pathway continuing to Moose and ultimately to Colter Bay via the Teton Park Road would be designed to interface with the county system, maximizing coordination between facilities. Likewise, the separated pathway on the Moose – Wilson Road would connect with the pathway already constructed along WY 390 by Teton County. Implementation of this alternative would result in moderate, long-term, beneficial impacts on coordination between the park and gateway communities.

Lifestyle and Social Conditions

Alternative 4 would provide a higher level of expanded transit service that would benefit some residents and employees that do not have access to personal vehicles or favor using transit for personal reasons. Outdoor enthusiasts would also benefit from the increased opportunities to cycle on the expanded bike/pathways network. The net effect of Alternative 4 on the local quality of life would be minor, but indeterminate in character.

Cumulative Impacts

Cumulative impacts under Alternative 4 would be very similar to those described under the other alternatives, with the addition of transit and separated pathways increasing mode choice within the park. Overall, cumulative impacts to local communities would result in minor long-term beneficial cumulative impacts on inter-jurisdictional collaboration, as a result of implementation of transit; and minor to moderate long-term ben-

eficial cumulative impacts, as a result of the separated pathway system.

Conclusion

Alternative 4 would result in long-term, minor, beneficial impacts on inter-jurisdictional collaboration, as a result of implementation of transit; and minor to moderate long-term beneficial impacts, as a result of the separated pathway system. Cumulative impacts to local communities would be long-term, minor to moderate, and beneficial.

Park Operations

Methods and Assumptions

For the analysis of impacts to park operations, the principal measure of impact examined is the change in staff required to implement each alternative. The increasing rents and housing prices in the Jackson Hole area, which affect the park's ability to hire and retain staff, were taken into account when determining the intensity of the impacts.

Estimates were also made of staff requirements for certain key positions that would be affected by implementation of the action alternatives. Park staff familiar with the requirements of these affected positions, including park maintenance, interpretative, and ranger staff, provided input for this analysis. Estimates were made of staff required for oversight and monitoring for proposed roadway improvements, interpretation, enforcement and emergency services for and maintenance of shared use pathways, and administrative support for additional staff. These estimates of staff requirements were compared with staffing under Alternative 1 to derive a measure of impact.



Impact Threshold Definitions

Negligible	Park operations would not be affected or the effect would be at or below the lower levels of detection, and would not have an appreciable effect on park operations.
Minor	The effect would be detectable, but would be of a magnitude that would not have an appreciable effect on park operations. If mitigation was needed to offset adverse effects, it would be relatively simple and likely successful.
Moderate	The effects would be readily apparent and would result in a substantial change in park operations in a manner noticeable to staff and the public. Mitigation measures would probably be necessary to offset adverse effects and would likely be successful.
Major	The effects would be readily apparent, and would result in a substantial change in park operations in a manner noticeable to staff and the public and would be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, would be extensive, and their success could not be guaranteed.
Duration	Short term - effects lasting for the duration of any construction.
	Long term - effects lasting longer than the duration of any construction.
Area of Analysis	Within park boundary.

Effects of Alternative 1 – No Action Alternative

Under this alternative, no changes in park operations other than those already planned or anticipated are expected, with the exception of the implementation of several different strategies for managing the Moose – Wilson Road. Visitation would remain at about or slightly above current levels through the life of this plan (5 to 10 years). Implementation of various management strategies for the Moose – Wilson Road would result in minor to moderate workload increases for park staff involved in the planning and coordination of these actions, and to adequately communicate to the local communities and park visitors. The level of park staffing may or may not be adjusted to accommodate changes in operations or visitation, were these to occur. In the event that staff levels did not keep pace with workloads, negligible to minor, long-term adverse impacts could result.

Cumulative Impacts

Cumulative impacts to park operations would include a number of new facility projects planned, including construction and operation of a new visitor center at Moose, rehabilitation and adaptive reuse of the Murie Ranch, construction of a new entrance station, acquisition and operation of the JY Ranch, and potential adaptive reuse of the Whitegrass Ranch as a historic preservation training center. Each of these actions requires, to vary-

ing degrees, increases in budget and staffing levels. Some, but not all of these additional operating requirements have already been accounted for in base operating increases, while other portions of the increases may be met or partially met through the help of volunteers and park partner organizations (e.g., Grand Teton Natural History Association, etc.). Increasing rents and housing prices in the Jackson Hole area may decrease the ability of Grand Teton National Park to hire and retain staff, however. The impacts of these related actions, in conjunction with the impacts of Alternative 1, would result in minor to moderate long-term adverse cumulative impacts on park operations.

Conclusion

Alternative 1 would result in negligible to minor long-term adverse impacts on park operations, if staffing levels do not keep pace with workloads in the future and because increasing rents and housing prices in the local market may make it difficult to attract and retain employees. Cumulative impacts would be long term, minor to moderate, and adverse.

Effects of Alternative 2 – Minimal Action Alternative

Under this alternative, widened shoulders would be added in the park along Teton Park Road from Moose Junction to Signal Mountain Lodge, and Signal Mountain Road would be closed to motorized use at certain times in order to allow use

by bicyclists and pedestrians. Enhanced use of variable messaging signs and traveler information radio would improve the availability and timeliness of information provided to park visitors.

Compared to the No Action Alternative, implementation of Alternative 2 would result in minor increases to the level of park operations. Primarily, these would result from the necessity of ranger staff to manage the recurring opening and closing of Signal Mountain Road during the summer. The addition of widened shoulders would result in a very small incremental change in road maintenance activities; however, planning, design, and construction of the shoulders would result in a minor to moderate increase in workload and could result in the deferral of other priority projects. Implementation of various management strategies for the Moose – Wilson Road would result in minor to moderate workload increases for park staff involved in the planning and coordination of these actions, and to adequately communicate to the local communities and park visitors.

The enhanced use of information technology to communicate with visitors would also result in additional operating costs and staffing requirements. Beyond the capital costs of the equipment, operational costs would be incurred for such activities as updating the information content, developing and maintaining an improved website, and maintenance of the equipment.

Cumulative Impacts

Cumulative impacts under Alternative 2 would be essentially the same as those described under Alternative 1, with additional maintenance required on extended shoulders used by cyclists and other additional needs described above. Overall, cumulative impacts to park operations would be long term, minor to moderate, and adverse.

Conclusion

Alternative 2 would result in minor long-term adverse impacts on park operations, because staffing levels to perform current functions may not keep pace with workloads in the future and the added responsibilities of expanded shoulders maintenance and other administrative and communication system functions would add to these responsibilities, possibly requiring still more staff. At the

same time, increasing rents and housing prices in the local market may make it difficult to attract and retain employees. Cumulative impacts would be long term, minor to moderate, and adverse.

Effects of Alternative 3 – Preferred Alternative

Under this alternative, a network of multi-use pathways and widened shoulders would be added along the high use roadways in the park. A pilot transit system would be developed from Jackson to Moose, Jenny Lake, and Colter Bay along Teton Park Road, and along the Moose – Wilson Road. The resulting increase in park staff requirements associated with changes in operations implemented by this alternative would have long-term, moderate adverse impacts.

The addition of approximately 23 miles of paved, multi-use pathways would result in an increased workload for park staff in order to perform routine and cyclic maintenance. Routine patrols by park staff would be necessary for a variety of purposes related to managing visitor use, but also in order to identify any developing maintenance issues, especially those that could become safety concerns for bicyclists or other users if not addressed promptly. Planning, design, and construction of the new multi-use pathways would result in an increased workload from many park staff, and would likely lead to deferral of other high priority projects. Similarly, the addition of widened shoulders would result in a small incremental change in road maintenance activities; however, planning, design, and construction of the shoulders would result in a minor to moderate increase in workload and could result in the deferral of other priority projects. Implementation of various management strategies for the Moose – Wilson Road would result in minor to moderate workload increases for park staff involved in the planning and coordination of these actions, and to adequately communicate to the local communities and park visitors.

Development and implementation of a pilot transit program would result in a moderate increase in workload for park staff. Planning, coordinating, contracting, and other activities associated with introducing a new program into park operations would require the addition of new staff, and the



time and attention of existing staff and managers.

The enhanced use of information technology to communicate with visitors would also result in additional operating costs and staffing requirements. Beyond the capital costs of the equipment, operational costs would be incurred for such activities as updating the information content, developing and maintaining an improved website, and maintenance of the equipment.

In addition to the direct impacts on park operations, indirectly any increases in park staffing levels required to support new operations also require a corresponding increase in the need for housing, vehicles, office space, and administrative support.

Cumulative Impacts

Cumulative impacts under Alternative 3 would be very similar to those described under Alternatives 1 and 2, with additional staff and/or responsibilities for current staff from the additional maintenance, enforcement, administrative, and communications functions under Alternative 3. Overall, cumulative impacts to park operations would be long term, moderate, and adverse.

Conclusion

Alternative 3 would result in long-term moderate adverse impacts on park operations due to the substantial increased workload necessary to implement and manage the new programs. Increased staffing and funding would be necessary to ensure that the multi-use pathways were properly managed and maintained, that the transit system operated effectively, and that management strategies for the Moose – Wilson Road were implemented in close coordination with the local communities and that information was made available to park visitors. In addition, the corresponding requirements in housing, vehicles, office space, and administrative support necessary to support additional staff would contribute to the long-term impacts. Short-term impacts on park operations would also be moderate and adverse due to the substantial workload involved in planning, design, and construction.

Effects of Alternative 4- Extended Pathways

Under this alternative, a network of multi-use pathways and widened shoulders would be added along the high use roadways in the park, but would be more extensive than in Alternative 3. A pilot transit system would be developed from Jackson to Moose, Jenny Lake, and Colter Bay along Teton Park Road, and along the Moose – Wilson Road. The resulting increase in park staff requirements associated with changes in operations implemented by this alternative would have long-term, moderate to major adverse impacts.

The addition of approximately 41 miles of paved, multi-use pathways would result in an increased workload for park staff in order to perform routine and cyclic maintenance. Routine patrols by park staff would be necessary for a variety of purposes related to managing visitor use, but also in order to identify any developing maintenance issues, especially those that could become safety concerns for bicyclists or other users if not addressed promptly. Planning, design, and construction of the new multi-use pathways would result in a substantially increased workload for many park staff, and would likely lead to deferral of other high priority projects. Similarly, the addition of widened shoulders would result in a small incremental change in road maintenance activities; however, planning, design, and construction of the shoulders would result in a minor to moderate increase in workload and could result in the deferral of other priority projects. Implementation of various management strategies for the Moose – Wilson Road would result in minor to moderate workload increases for park staff involved in the planning and coordination of these actions, and to adequately communicate to the local communities and park visitors.

Development and implementation of a pilot transit program would result in a moderate increase in workload for park staff. Planning, coordinating, contracting, and other activities associated with introducing a new program into park operations would require the addition of new staff, and the time and attention of existing staff and managers.

The enhanced use of information technology to communicate with visitors would also result in ad-

ditional operating costs and staffing requirements. Beyond the capital costs of the equipment, operational costs would be incurred for such activities as updating the information content, developing and maintaining an improved website, and maintenance of the equipment.

In addition to the direct impacts on park operations, indirectly any increases in park staffing levels required to support new operations also require a corresponding increase in the need for housing, vehicles, office space, and administrative support.

Cumulative Impacts

Cumulative impacts under Alternative 4 would be very similar to those described under the previous alternatives, but the additional staff and/or responsibilities for current staff from the additional maintenance, enforcement, administrative, and communications functions under Alternative 4 would add to adverse impacts. Overall, cumulative impacts to park operations would be long term, moderate to major, and adverse.

Conclusion

Alternative 4 would result in long-term moderate to major adverse impacts on park operations due to the substantial increased workload necessary to implement and manage the new programs. Increased staffing and funding would be necessary to ensure that the multi-use pathways were properly managed and maintained, that the transit system operated effectively, and that management strategies for the Moose – Wilson Road were implemented in close coordination with the local communities and that information was made available to park visitors. In addition, the corresponding requirements in housing, vehicles, office space, and administrative support necessary to support additional staff would contribute to the long-term impacts. Short-term impacts on park operations would also be moderate and adverse due to the substantial workload involved in planning, design, and construction. Cumulative impacts would be long term, moderate to major, and adverse.

Unavoidable Adverse Impacts

The following discussion identifies impacts to

resources associated with the implementation of each alternative. These impacts have been identified as being unavoidable, moderate or major, and adverse.

Alternative 1 (No Action)

Threatened and Endangered Species – Grizzly Bear and Gray Wolf

A moderate adverse impact results from the potential take of an individual bear or wolf due to vehicle collision or (for bears) acclimation to human presence.

Visitor and Employee Experience

Moderate adverse impacts would result from the inconveniences related to the construction of the road shoulders and pathways, and the potential continued parking demand.

Alternative 2

Threatened and Endangered Species – Grizzly Bear and Gray Wolf

A moderate adverse impact results from the potential take of an individual bear or wolf due to vehicle collision or (for bears) acclimation to human presence.

Visual Quality

Moderate short-term adverse impacts would result during construction of new road shoulders and facilities.

Visitor and Employee Experience

Moderate adverse impacts would result from the inconveniences related to the construction of the road shoulders and pathways, and the potential continued parking demand.

Alternative 3

Threatened and Endangered Species – Grizzly Bear and Gray Wolf

A moderate adverse impact results from the potential take of an individual bear or wolf due to vehicle collision or (for bears) acclimation to human presence.

Visual Quality

Moderate long-term and short-term adverse impacts would result during construction of new road shoulders, multi-use pathways, and facilities.



Soils and Vegetation

Moderate long-term adverse impacts would result from the construction and continued use of new shoulders, multi-use pathways, and facilities, with short-term moderate adverse effects to vegetation during construction.

Transportation, Visitor and Employee Experience

Moderate adverse impacts would result from the inconveniences related to the construction of the road shoulders and pathways, and the potential increase in parking demand.

Park Operations

Moderate adverse impacts would be associated with staff increases needed to oversee the new pathways and communications system. Increasing housing prices in the Jackson area would make it difficult to attract and retain employees.

Alternative 4

Threatened and Endangered Species – Grizzly Bear and Gray Wolf

A moderate adverse impact results from the potential take of an individual bear or wolf due to vehicle collision or (for bears) acclimation to human presence.

Visual Quality

Moderate long-term and short-term adverse impacts would result during construction of new road shoulders, multi-use pathways, and facilities.

Soils and Vegetation

Moderate long-term adverse impacts would result from the construction and continued use of new shoulders, multi-use pathways, and facilities, with short-term moderate adverse effects to vegetation during construction.

Transportation, Visitor and Employee Experience

Moderate adverse impacts would result from the inconveniences related to the construction of the road shoulders and pathways, and the potential increase in parking demand.

Park Operations

Moderate to major adverse impacts would be associated with staff increases needed to oversee the

new pathways and communications system. Increasing housing prices in the Jackson area would make it difficult to attract and retain employees.

Irreversible or Irretrievable Commitments of Resources

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to the loss of an experience as an indirect effect of a permanent change in the nature or character of the land.

An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production foregone is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production.

The irretrievable and irreversible commitments of resources that are associated with each alternative are summarized below. Irreversible commitments are those that cannot be reversed, except perhaps in the extreme long term. Irretrievable commitments are those that are lost for a period of time.

Alternative 1 (No Action)

The irretrievable and irreversible commitments of resources associated with Alternative 1 are mainly limited to the consumption of energy resources, because no specific actions would be taken to change any of the natural or cultural resources, visitor experience or park operations.

Alternatives 2, 3, and 4

Under these alternatives, no appreciable irreversible or irretrievable commitments of resources would be associated with water resources, air quality, visual and scenic resources, noise, visitor experience, transportation, social and economic environments, or park operations. If any wetlands, soils, or roadside vegetation are impacted during construction, this would be an irretrievable commitment of this resource for at least the duration of the alternative. However, it would be possible to rehabilitate impacted areas and return them to their preconstruction state at some point in the future.

The Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

This section discusses the effects of the uses of resources on the long-term productivity of the resources.

Alternative 1 (No Action)

No measurable change from current conditions is expected. The existing relationship of short-term uses of the environment and the maintenance and enhancement of long-term productivity would be expected to continue. Visitation levels would continue to grow slightly, resulting in occasional or localized crowding, congestion, and delays for visitors. Crowded and full parking lots would continue to prompt visitors to park on roadway and parking area shoulders, creating safety hazards and degrading vegetative cover. Therefore, the impacts associated with the short-term use of the

environment would continue to adversely affect long-term productivity.

Alternatives 2, 3, and 4

Transportation System and Traffic

The short-term impacts associated with construction of the expanded shoulders in the park would include soil removal and compaction, vegetative disturbance, and increased erosion. However, the beneficial effects associated with additional pathways would outweigh these adverse impacts.

Visitor and Employee Experience

The short-term impacts associated with construction in the park would include soil removal and compaction, vegetative disturbance, and increased erosion. However, the beneficial effects associated with quality of visitor and employee movement within the park as well as availability of travel mode options and choices, would outweigh these adverse impacts.

