3.27 Cumulative Impacts

3.27.1 Introduction to Cumulative Impacts

Council on Environmental Quality (CEQ) regulations require an assessment of cumulative impacts. As defined in CEQ's regulations for implementing the National Environmental Policy Act (NEPA; 40 CFR § 1508.7):

> "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place during a period of time.

The following analysis uses the multi-step process outlined in the CEQ handbook, *Considering Cumulative Effects under the National Environmental Policy Act* (1997).

3.27.2 Resources Assessed for Cumulative Impacts

Determining cumulative environmental consequences requires delineating the cause-and-effect relationships between the multiple actions and the resources, ecosystems, and human communities of concern. One of the first steps is to identify the major cumulative effects issues for the project and which resources are important from a cumulative effects perspective. The resources evaluated in this Final Environmental Impact Statement (Final EIS) are based on public and agency scoping and coordination, and the importance of the direct and indirect effects evaluated in the document. Based on these factors, the resources analyzed for cumulative impacts are:

- Land Ownership and Land Use
- Land Use Plans and Policies
- Social Environment (Community Character)
- Housing and Relocation
- Economic Environment
- River Navigation
- Park and Recreation Resources
- Historic and Archaeological Preservation
- Water Bodies and Water Quality
- Air Quality and Climate Change
- Noise
- Visual Environment
- Floodplains

- Wetlands and Vegetation
- Wildlife

The consideration of other actions occurring within the geographic scope of each resource ultimately determines the resources for which a cause-and-effect relationship and resultant cumulative effect are determined.

The following resources were analyzed in previous sections and determined to have inconsequential adverse impacts and little to no issues raised during scoping or consultation. Therefore, the following were not identified as national, regional, or local issues of importance and are not assessed for cumulative impacts:

- **Transportation**. The alternatives are consistent with State and local plans for transportation. While there would be an important beneficial impact to transportation, such as resolving traffic conflicts with public roads and private driveways, no important adverse impacts are anticipated. The actions associated with the reasonably foreseeable future action (RFFA) noted in Section 3.27.4.3, below, as the Sterling Highway Maintenance and Bridge RFFA would include short-term construction-related impacts. During construction, disruption to local traffic and access would occur. There are no other roads in the area suitable for a detour for construction on the existing alignment; therefore, a minimum of one lane of traffic would remain open. Timed stoplights or flaggers and pilot cars would be used to facilitate one-way traffic as needed, and construction would be staged to minimize the length of one-way traffic required.
- **Subsistence**. The alternatives would not alter the availability or competition for subsistence foods. While the No Build Alternative would not result in any new construction in the project area, ongoing operations and maintenance activities would occur. The actions associated with the Sterling Highway Maintenance and Bridge RFFA (see Section 3.27.4.3, below) would include short-term construction-related impacts, but are not anticipated to contribute to adverse subsistence impacts.
- **Utilities**. The alternatives would not affect the long-term use of existing utility infrastructure or affect the construction of planned utility infrastructure. The scheduled construction activities associated with the Sterling Highway Maintenance and Bridge RFFA (see Section 3.27.4.3, below) would not impact existing utility locations and would result in only short-term disruptions in service, if any.
- **Geology and Topography**. The alternatives would not alter the local geology or topography to an extent that they would include long-term risks or effects related to unstable lands. The actions associated with the Sterling Highway Maintenance and Bridge RFFA (see Section 3.27.4.3, below) includes replacement of the three project area bridges that would require excavations and/or blasting to change the topographic contours and remove rock and soils near the bridge abutments. However, these impacts are insignificant in terms of magnitude and intensity. Areas within 10 feet of the project construction limits would be temporarily impacted by construction equipment. Construction staging areas adjacent to the bridge locations would be used for material stockpiling and equipment operation.

- **Hazardous Waste Sites and Spills**. The alternatives would not impact known hazardous materials sites that would expose contaminants to the air or water. In addition, the alternatives would not increase the risk of spills related to transportation of hazardous materials.
- **Energy**. Changes in long-term energy use as a result of implementation of any of the build alternatives would not be substantially different than under the No Build Alternative. The actions associated with the Sterling Highway Maintenance and Bridge RFFA (see Section 3.27.4.3, below) would require a short-term use of energy for construction, but energy (e.g., fuel) availability for construction is adequate.
- **Fish and Essential Fish Habitat**. While all build alternatives have the potential to adversely impact fish and essential fish habitat (EFH), mitigation measures during the construction process and design to minimize permanent in-water changes would result in minimal impact. Regarding alternatives or projects that may result in culvert replacement, minimal permanent impact to fish or EFH would be expected compared to current conditions.
- **Coastal Zone Management**. The Alaska Coastal Management Program (ACMP) expired on June 30, 2011 (see Section 3.23.1). The enforceable policies of the Borough's Coastal Management Plan include resource protection and management prescriptions. Those that relate to resources considered in this cumulative impacts analysis are described by resource in the appropriate sections below.

3.27.3 Geographic Scope and Timeframe of Cumulative Impacts Analysis

3.27.3.1 Geographic Scope of Analysis

The geographic area of analysis used to assess cumulative impacts for most resources is the project area described in detail in Section 1.1.1 of the Purpose and Need chapter (see Map 1.1-1, Map 3.27-1, and most maps in this Final EIS). The project area includes the western end of Kenai Lake and follows the Kenai River Valley downstream for approximately 11 miles, nearly to the western edge of the Kenai Mountains. North and south, the project area extends up Juneau Creek approximately 2.5 miles from its mouth, to a point beyond Juneau Creek Canyon, and it extends up Cooper Creek about 1 mile from its mouth. In elevation, the project area extends from the Kenai River, at elevations between approximately 250 feet (downstream) and 440 feet (at Kenai Lake), to mountain slopes on either side of the valley at elevations of about 1,000–1,500 feet.

In some cases, the geographic areas of analysis are expanded to include a broader area to effectively assess the cumulative effects on a particular resource (e.g. a watershed, ecosystem, or the Kenai Peninsula). The geographic areas of analysis are used to assess the effects of other past, present, and reasonably foreseeable future actions to determine if those actions, combined with project impacts, have a cumulative effect to that resource. Table 3.27-1 identifies the geographic areas of analysis for each resource.

Table 3.27-1. Geographic areas of analysis for cumulative effects analysis

Resource	Geographic Area of Analysis
Land Ownership	Project Area
Land Use Plans and Policy	Project Area
Social Environment	Project Area
Housing and Relocation	Project Area
Economic Environment	Cooper Landing (Project Area and immediate vicinity)
River Navigation	Project Area
Park and Recreation Resources	Project Area and immediate vicinity
Historic and Archaeological Preservation	Project Area
Water Bodies and Water Quality	Upper Kenai River, Middle Kenai River, and Devil's Creek-Quartz Creek Watersheds (HUC10)
Air Quality and Climate Change	Kenai Peninsula Borough; global
Noise	Project Area
Visual Resources	Project Area
Floodplains	Project Area
Wetlands and Vegetation	Upper Kenai River, middle Kenai River, and Devil's Creek-Quartz Creek watersheds (HUC10)
Wildlife	Game Management Units 7, 15A, and 15B

3.27.3.2 Timeframe Scope of Analysis

For the Sterling Highway MP 45–60 Project, the environmental reference point, or temporal boundary for past development, is 1938, the year that the road connecting Cooper Landing and Seward was completed. In accordance with Environmental Protection Agency (EPA) guidance (EPA 1999), this environmental reference point represents a time when the project area was in an ecologically sustainable condition. The introduction of a connection to a tidewater port in Seward brought more efficient movement of materials and greater numbers of people to the previously isolated community of Cooper Landing. At that time, the project area resources were predominantly in a naturally occurring state.

The temporal boundary for future development is based on the project design year, which is 2043. RFFAs and cumulative effects are considered through that time, approximately 20 years from the anticipated opening of the new highway.

3.27.4 Past, Present, and Reasonably Foreseeable Future Actions

3.27.4.1 Past Actions

Major past actions have had a lasting influence on the present-day environment of the Cooper Landing community and the project area as a whole. The major past actions have shaped the baseline condition (or the affected environment) for a variety of resource categories, and, in most cases, continue to influence the baseline condition. These past actions include the following:

- Road connecting Cooper Landing and Seward, built 1938
- National Moose Range (now the Kenai National Wildlife Refuge [KNWR]), established 1941
- Road connecting Cooper Landing and Kenai, opened about 1950
- Dirt road connecting Kenai Peninsula to Anchorage, opened 1951 and paved 1956
- Alaska Statehood enacted in 1959, which enabled the State of Alaska to select Federal lands in the Cooper Landing area from within the Chugach National Forest (CNF) for community settlement
- Cooper Lake Hydroelectric Facility, constructed 1959–1960
- Kenai Peninsula Borough (Borough), incorporated 1964
- Kenai River Special Management Area, established 1984
- Kenai River and Kasilof River personal use dipnet fishery, established 1996
- Portions of the Sterling and Seward highways upgraded, including MP 37–45 (not including the MP 45 to 60 corridor), 2000
- Russian Gap (2001) and Birch and Grouse Ridge (2005) subdivisions developed
- Cooper Lake hydroelectric facility, relicensed 2007

The CNF was established prior to 1938 and, along with KNWR, set a general tone for Federal management of lands in the project area primarily for conservation and recreation. The CNF, in particular, developed campgrounds and recreation areas and upgraded pioneer trails as recreational trails. The State of Alaska and KNWR added boat launch ramps, parking, and the Russian River Ferry. Private entities built lodges, guiding businesses, and a large hotel, the Kenai Princess Lodge, in Cooper Landing.

Population growth within the State of Alaska and the communities of the Kenai Peninsula, along with the opening of popular dipnet fisheries, has increased road traffic in the project area. Increased efforts to attract tourists to the recreational attractions on the Kenai Peninsula and within the project area have also increased road traffic. Industrial and commercial development in western Kenai Peninsula communities has contributed to truck and heavy truck traffic on the highway. The 2014 closure of the Flint Hills refinery in Interior Alaska means that petroleum products required for roadway construction are now sourced from Nikiski and trucked along the Sterling Highway to access the rail and road system. The oil and gas industry is constantly revising its operations and locations. It is unknown whether the resulting increase in heavy truck traffic will continue.

3.27.4.2 Present Actions

The existing land use conditions described earlier in this document represent the present actions that could contribute to a cumulative impact on resources in the project area, as well as the following three projects (see Map 3.27-2 for general locations).

CNF Bean North Vegetation Management

The Forest Service, U.S. Department of Agriculture (Forest Service) approved actions in 2012 for a 705-acre area along Juneau and Bean creeks for fire prevention and protection, hazardous fuels reduction, improvement of forest health, and wildlife habitat enhancement (Forest Service 2012b). Known as the Bean North Vegetation Project, the management actions were considered under the Healthy Forest Restoration Act. The Resurrection Pass Trail and the Bean Creek Trail pass through the Bean North Vegetation Project area. Work on this project was completed shortly after the Draft SEIS was released in 2015.

Chugach Electric Association Cooper Lake Hydroelectric Facility Projects

The Federal Energy Regulatory Commission (FERC) issued a relicensing supplemental agreement in 2007 to reauthorize the existing 19.4-megawatt Cooper Lake hydroelectric facility, located at the end of Snug Harbor Road near the community of Cooper Landing (powerhouse located at Kenai Lake, dam on Cooper Lake at the head of Cooper Creek). The agreement provides for development of an access road and diversion of Stetson Creek into Cooper Lake and of lake water into Cooper Creek to provide lake-based water into Cooper Creek. This is meant to benefit salmon and trout. Under an agreement between Chugach Electric Association and the Forest Service, this project included a winter recreation enhancement consisting of a new 50-space parking lot for snowmobilers at the end of the Snug Harbor Road (construction completed) and a $6,000 annual contribution to the Kenaitze Indian Tribe cultural and educational program for the term of the license. The stream diversion was completed in July 2015. Chugach Electric will continue to monitor stream flow and contribute funding for fish habitat monitoring.

Sterling Highway MP 57 Erosion Protection

The Alaska Department of Transportation and Public Facilities (DOT&PF) undertook emergency stabilization near MP 57 and proposes to realign about 2,500 feet of the Sterling Highway at that location away from the Kenai River. The river channel has moved closer to the highway, and an eroding river bank was within 16 feet of the edge of pavement. The realignment is expected to be completed in approximately 2019, prior to the start of the Sterling Highway MP 45–60 Project.

3.27.4.3 Reasonably Foreseeable Future Actions

For the purposes of this analysis, RFFAs are other actions by Federal, State, or local agencies, or actions undertaken by private individuals or organizations, that are likely to occur by 2043, regardless of whether the Sterling Highway MP 45-60 Project is built. To identify RFFAs for this cumulative impact analysis, the project team queried local, State, and Federal agencies; landowners; user groups; and the public on future actions they anticipated in the project area. The project team reviewed local and State plans that describe needs and intended patterns of growth and change. This section presents a discussion of the RFFAs that might have an effect on the resources, ecosystems, and human environment within the project area.

RFFAs occurring by 2043 include the following (see Map 3.27-2 for general locations).

Russian River Land Act—Land Exchange

The Russian River Land Act of 2002 ratified an agreement between CIRI and the U.S. government (specifically KNWR and CNF) to resolve Alaska Native land claims. The agreement included the ability for KNWR and CIRI to exchange KNWR lands in the project area north of the existing Sterling Highway, including land designated as Wilderness, for CIRI lands

elsewhere that have equal or better habitat and wilderness values. The prospect of a land exchange has been part of the backdrop for this project since Congress passed the act. At various times, CIRI or KNWR has indicated in meetings that it was willing to entertain a land exchange or that it was actually initiating the land exchange, but no formal action to initiate such a trade occurred. FHWA does not take action or advocate for action that might predetermine the outcome of an EIS process, and has therefore taken the position that FHWA must evaluate the project based on actual land status or determine that the land exchange is reasonably foreseeable. Without formal action to undertake the land exchange, FHWA and DOT&PF previously had not considered the exchange to be an RFFA. However, circumstances have changed since publication of the Draft SEIS.

In a letter to the Secretary of the Interior dated April 3, 2017, CIRI formally stated its willingness to negotiate a land exchange with USFWS. The Department of the Interior (DOI) wrote a letter dated August 22, 2017, to FHWA's Alaska Division Administrator stating, "if the Juneau Creek Alternative is selected, the Service will promptly commence negotiations with Cook Inlet Region, Inc. (CIRI) to enter into the land exchange authorized by the Russian River Land Act…." (DOI 2017).

FHWA and DOT&PF are charged with objectively evaluating the alternatives based on the information available. Based on the 2017 CIRI and DOI letters, which present in writing new information about the intentions of the DOI, FHWA and DOT&PF consider the land exchange to be an RFFA for the Juneau Creek Alternative.

Based on discussions with these entities, DOT&PF and FHWA assume that the land exchange would be minimal in terms of acreage, would be intended to accommodate the Juneau Creek Alternative, and would not be intended to provide CIRI with other developable land. As stated in Section 3.2.2.5, the Juneau Creek Alternative would result in acquisition of about 18.7 acres north of the existing highway that currently is KNWR land, and it would affect another 17.4 acres north of the highway by isolating it from the rest of the KNWR (total about 36 acres of KNWR land). It is assumed that, with a buffer and/or a desire to follow survey lines in cardinal directions, the land exchange would involve about 60 acres of KNWR land. Further, it is assumed, based on the Russian River Land Act agreement, that the land exchange would involve about 60 acres of land currently owned by CIRI near the mouth of the Killey River. It is acknowledged that any lands that would be included in a land exchange and the actual area and acreage of those lands would be determined through negotiations between the USFWS and CIRI.

Based on the information in the preceding paragraphs, the RFFA is as follows:

- Land ownership would change because the Juneau Creek Alternative is identified as the preferred alternative in this Final EIS.
- The land exchange is expected to encompass an assumed 60 acres of KNWR land and about 60 acres of CIRI land.
- At least 19 acres (and up to the entire 60 acres) of the exchanged land held by CIRI after the transaction would be acquired by DOT&PF for construction of the Juneau Creek Alternative. DOT&PF would purchase the necessary right-of-way from CIRI through a standard acquisition process (Section 3.4 provides additional information about the process).

- Only development associated with this project would occur on the CIRI exchanged lands (other development is not anticipated).
- All of the exchanged land held by KNWR after the transaction would remain in its existing natural state to be held in perpetuity and managed for wildlife refuge purposes.

Sterling Highway Maintenance and Bridge Replacement

Normal maintenance and bridge replacement would occur along the Sterling Highway. Within the project area, the following maintenance and program work is anticipated to occur:

- Replace pavement (twice before 2043)
- Replace three project area bridges because of age

Types of pavement preservation treatments range from crack sealing to thin, hot mix asphalt overlays. The Sterling Highway in the MP 45–60 area received a thin, hot mix asphalt overlay during the summers of 2013 and 2014; such an overlay has an expected life of 5 to 12 years. Based on the current pavement management process at DOT&PF, it is anticipated that two additional pavement replacements or overlays would be required by 2043. These projects would typically include culvert replacements along the roadway where necessary.

Bridges on the Sterling Highway in the project area are approaching the end of their design life and are likely to be replaced under DOT&PF's Bridge Program prior to 2043. The Cooper Creek Bridge was built in 1955, the Schooner Bend Bridge over the Kenai River was built in 1964, and the Cooper Landing Bridge over the Kenai River was built in 1965 (DOT&PF 2009a). By 2043, all three of these bridges would be well past the typical 50- to 75-year bridge design life. Although there currently is no schedule for replacement, for purposes of this Final EIS, it is anticipated that all would be replaced before 2043.

As discussed in Section 2.6.1 (Transportation, No Build Alternative), each of these actions is anticipated to occur regardless of a preferred alternative selection and implementation; however, the timing of these actions may vary depending on the selection of a build alternative because of the changes in traffic volumes for the roadway and bridges (cumulative loads).

Specific to the bridge replacements, the following provides the timing differences for each of the alternatives:

- Under the No Build Alternative, all three existing bridges are anticipated to be replaced before 2043.
- Under the Cooper Creek Alternative, the Cooper Landing Bridge and Schooner Bend Bridge would be replaced as part of the project (by 2023), and it is anticipated that the existing Cooper Creek Bridge would be replaced by 2043.
- Under the G South Alternative, the Schooner Bend Bridge would be replaced as part of the project (by 2023). It is anticipated that the other two bridges—Cooper Landing Bridge and Cooper Creek Bridge—would be replaced by 2043.
- Under the Juneau Creek and Juneau Creek Variant alternatives, none of the existing bridges would be replaced as part of the project. Similar to the No Build Alternative, it is anticipated that all would be replaced by 2043 because of the ages of the bridges.

Russian River Campground Entrance Improvements

The Forest Service has entered into an agreement with FHWA for the redesign of the entrances and access roads to the Russian River Campground. The Forest Service considered several alternatives for traffic entering and exiting the campground from the Sterling Highway. It is anticipated to be complete prior to the construction of the MP 45–60 project (Berg, personal communication 2015). The Russian River Campground Entrance Improvements were examined in a separate NEPA process, with a decision signed in 2014. The Forest Service briefly addressed cumulative impacts in that document. Assuming that the redesigned entrance would occur generally within the same footprint as the existing entrance, its contribution to a cumulative effect with the Sterling Highway MP 45–60 Project would be minor.

Sterling Highway Rehabilitation and Passing Lanes, MP 58–79

The 2013–2015 Statewide Transportation Improvement Program includes a project to reconstruct the Sterling Highway between MP 58 and 79, which would involve resurfacing, minor widening in some areas, and widening for the addition of passing lanes in some areas. This project proposes passing lanes close to where it adjoins the western end of the Sterling Highway MP 45–60 project, and about 2 miles from passing lanes proposed as part of the MP 45–60 project. DOT&PF expects the project will include measures to reduce risk of vehicle-wildlife collisions, such as fencing and underpasses. The MP 58–79 project has begun and is anticipated to be complete prior to construction of the MP 45–60 project.

Senior Citizen Housing Development

The Cooper Landing Senior Citizens Corporation, Inc., formed in 1999, is developing a senior citizen housing complex approximately 1.8 miles east on Snug Harbor Road from its intersection with the Sterling Highway. While the first two phases of development (comprising 12 residential units) are complete, the project would eventually encompass as many as 30 or more individual living units, a 30,000-square-foot senior center, 2,400-square-foot maintenance shop, and a long-term care facility.

CNF Cooper Creek Restoration

The Forest Service proposes to conduct stream and riparian restoration on the lower 0.75 mile of the creek. The purpose of the project is to provide more diverse fish habitat in lower Cooper Creek and capitalize on efforts to improve stream water temperatures for salmon and trout spawning and rearing (resulting from the Stetson Creek diversion; see Cooper Lake Hydroelectric Dam Facility Projects under Section 3.27.4.2). Long-term benefits are anticipated to include improved aquatic habitat, improved channel and floodplain function, improved wildlife habitat, and increased plant species and diversity within the riparian area. The Forest Service anticipates implementing the project within 3–5 years (approximately 2018–2020).

Cook Inlet Region, Incorporated Land Development

Cook Inlet Region, Incorporated (CIRI), a regional Alaska Native corporation established under the Alaska Native Claims Settlement Act (ANCSA), has received a 42-acre parcel of former CNF lands on a bluff above Sportsman's Landing on the north side of the Kenai River, overlooking the confluence of the Kenai and Russian rivers (see Map 3.27-2). The Russian River Land Act (RRLA) recognized the "abundant archaeological resources of significance to the Native people of the Cook Inlet Region, the Kenaitze Indian Tribe, and the citizens of the United States" of the lands near the confluence of the Russian and Kenai rivers and provided

authorization and funding to develop the parcel. CIRI intends to develop the site, referred to as Tract A, jointly with the Forest Service and U.S. Fish and Wildlife Service (USFWS) to create a visitor's interpretive center and base of archaeological research for the Sqilantnu Archaeological District. The RRLA provided $13.8 million to CIRI for this development. CIRI has indicated in meetings for this Final EIS that it has developed an access plan and is developing a site plan. Other development described in the RRLA agreement includes a restaurant and lodging that would accommodate overnight guests, offices for the research center, dormitory-style housing for staff, trails, and other ancillary facilities (USFWS, CIRI, Forest Service 2001).

The agreement ratified by Congress in the RRLA required the Forest Service to provide access to Tract A both from the existing Sterling Highway and, in the event the selected alternative were routed north of the existing highway, from the new highway. DOT&PF and FHWA consider this a requirement of law.

Cooper Landing Residential Land Development

In 2004, the Borough Assembly approved residential zoning of the Birch and Grouse Ridge Subdivision (Ordinance 2004-27). Approximately 23 lots comprise the subdivision, ranging in size from 2 to 5 acres. Owners have built on several of these lots, and others are likely to be built upon over time. The Borough has not released all lots for sale and has not improved Slaughter Ridge Road far enough to access all the platted lots. Such further development is foreseeable by 2043.

State Land Management Unit 395 Rural Residential Development

Based on the *Kenai Area Plan for State Lands* (DNR 2001) and land transfer decisions made in 2014 by DNR, Unit 395 will be transferred to the Borough for rural residential development. Although the 2001 *Kenai Area Plan* states that this decision will be based in part on the final alignment of the Sterling Highway (the decision to be determined by this Final EIS), DNR has moved forward with the land transfer process (DNR 2014).

Because DOT&PF plans to retain access rights for the segment of each alternative that would be built on a new alignment, no driveways or side roads would be connected to the new highway (in accordance with the *Cooper Landing Land Use Plan*). Provision of access for Unit 395 residential development is expected to occur from the existing highway under any of the alternatives, as it could today. Because there would be no change in accessibility to Unit 395 resulting from the selection of a preferred alternative, this project would not affect the likelihood or timing of development. As indicated in Section 3.2, however, depending on the alternative selected, this project may affect the number of lots that could be developed. This is because the combination of the highway right-of-way (generally 300 feet wide) and a planned road buffer (100 feet each side) would result in removal of up to 120 acres from Unit 395 under either of the Juneau Creek alternatives. Some of this land would be considered developable for residences if the highway were not built across Unit 395.

For purposes of this cumulative analysis, it is assumed that Unit 395 likely would begin to be developed prior to 2043.

A geographic information systems (GIS) analysis of Unit 395 was conducted to estimate the amount of developable land contained within the unit. The results were used to predict the maximum number of houses the unit could contain if fully developed. It is assumed that Unit 395 would be developed as a rural residential area, as indicated in adopted plans. Borough Code of

Ordinances, Title 21.44.170, requires a minimum lot size of 100,000 square feet (approximately 2.3 acres) for rural residential districts. However, the Borough's action to create the existing Birch and Grouse Ridge Subdivision on the north side of Cooper Landing was on terrain similar to Unit 395 and included substantial steep ground, and average lot sizes there are in excess of 5 acres. The GIS analysis determined that the percentage of the area that was developable, marginally developable, or not developable based on slope angle was similar to the existing subdivision. For this reason, the GIS analysis was based on the lot density in Birch and Grouse Ridge, a method that accounts for terrain limitations, the land needed for access roads, and for some lands retained by the borough for open space. Table 3.27-2 presents the results of the analysis.

Table 3.27-2. Likely maximum development in Unit 395, by alternative

	Alternatives		
	No Build, Cooper Creek, G South	**Juneau Creek**	**Juneau Creek Variant**
Developable acres (slopes <10%)	69	61	62
Marginally developable acres (slopes 10%–20%)	165	146	148
Not developable acres (slopes >20%)	853	756	750
Not developable acres (land for highway right-of-way and State mandated buffer)*	NA	124	127
Total	1,087	1,087	1,087
Approximate maximum number of developed lots	**143**	**126**	**128**

* Project mitigation may further limit developable acres.

Based on these assumptions, a maximum of 126–143 rural residential units could be added in Unit 395. Because these numbers are equal to more than a third of all existing developed residential parcels in the Cooper Landing area, and because the Birch and Grouse Ridge Subdivision itself is not yet fully developed after more than a decade, it seems unlikely that full development of Unit 395 would occur by 2043.

Access to Unit 395 from the Sterling Highway is undetermined. Under the No Build, Cooper Creek, and G South alternatives, the Borough would need to request access to the area from the Forest Service, and the Forest Service is obligated under the Alaska National Interest Lands Conservation Act (ANILCA) to provide reasonable access. Under either of the Juneau Creek alternatives, the Borough could request access across CNF lands from the existing highway or request access directly off the new highway, or both (redundant access often is desirable for evacuation and emergency vehicle access). It is possible that the Borough would request access using West Juneau Road, a gravel logging road just west of the Schooner Bend bridge (MP 53) and the Resurrection Pass Trailhead that is currently closed to public access by motorized vehicles except for snowmobile users. It is anticipated that the Borough would upgrade the road to subdivision standards. Widening the road and lowering grades to meet Borough standards could require modifications to the road alignment and result in impacts to National Forest

System lands. These impacts are reasonably foreseeable future impacts but would be the result of Borough and Forest Service actions, not the result of the Sterling Highway MP 45–60 Project.

The Forest Service, in its role as a cooperating agency, requested that this EIS address the cumulative impacts of two different access routes under the Juneau Creek alternatives so that these impacts might be compared.

(1) Access from existing highway. A subdivision access road likely would be a two-lane gravel road, similar to the improved portion of Slaughter Ridge Road, likely with a top surface about 20 feet wide. It would have traffic year round at relatively low levels. The improved road may need to be about 1 mile long on CNF lands to achieve reasonable grades for the climb of approximately 300 feet from the existing highway to the southern boundary of Unit 395. For the purposes of this assessment, it is assumed that the clearing limits would be 50 feet wide, about 30 feet wider than is currently cleared.

(2) Access from Juneau Creek alternatives. Under either of the Juneau Creek alternatives, access could also occur at one or both of the overpasses provided where the highway alignment would pass over West Juneau Road. Under these alternatives, DOT&PF and FHWA would require that access be provided via ramps (standard parallel ramps in a diamond interchange configuration. This access would be constructed by others (e.g., Kenai Peninsula Borough) and may require use of land outside the highway right-of-way in Unit 395. For the purposes of this assessment, it is assumed that there would be four ramps at each intersection, with off-ramps for deceleration, each estimated at about 1,200 feet long, and with on-ramps for acceleration at about 2,900 feet long. Each ramp would be a single lane, paved, with shoulders, for a total top width of approximately 20 feet.

Cooper Landing Walkable Community Project Improvements

The community of Cooper Landing completed the *Cooper Landing, Alaska, Walkable Community Project* plan in 2010 (LDN 2010a), subtitled "Alternative transportation planning to address congestion and road impacts near the Russian and Kenai Rivers." In April 2010, the *Walkable Community Project* plan was incorporated into the *Kenai Peninsula Borough Comprehensive Plan* by the Borough Assembly (Ordinance 2010-13). Pertinent improvements include:

- Clearly delineating entry and exit to businesses
- Creating a "gateway" feel to the area
- Improving portions of the existing highway to add shoulders and straighten curves
- Providing pedestrian undercrossing of the highway bridge at the outlet of Kenai Lake and improving safety of the pedestrian walkway across the length of the bridge
- Adding acceleration-deceleration/turning lanes throughout the community
- Adding a separated pedestrian and bicycle route throughout much of the project area (MP 45–53, Quartz Creek to Schooner Bend)

3.27.5 Characterization of the Resources to be Evaluated

This section characterizes the resources being evaluated for cumulative effects with the geographic and timescale scope of analysis. The resource characterization is based on historical data and existing conditions to establish the baseline used for the cumulative effects analysis.

3.27.5.1 Land Ownership and Land Use

The geographic area of analysis for land ownership and land use cumulative impact analyses encompasses the project area (Map 3.27-1), with a specific area around the confluence of the Killey River and Kenai River added only for the Juneau Creek Alternative and land exchange RFFA.

Residential development is limited almost exclusively to the unincorporated community of Cooper Landing. Commercial establishments cater primarily to tourism and recreational fishing. Minor logging and mining also occur on private property and Forest Service-owned land. The majority of the project area is undeveloped open space and is managed for preservation, recreation, watershed, wildlife, fishery, or habitat purposes. Section 3.1 describes the present land use trends and status in full detail. Since 1992, local land use planning updates have shown an increase in recreational and preservation land use classifications, and a desire to provide for lands for public and private ownership, but without sudden community change (CLAPC (1996); adopted by the Borough in 2010).

Land designation (Federal, State, and Borough) and gradual development have affected the current land use in the project area. Overall, the project area is owned primarily by Federal, State, and Borough governments, and only about 5 percent of land (614 acres) is owned privately.

Lands owned by CIRI in the Killey River confluence area are undeveloped, with portions platted for future road construction (Smolt Drive) and platted with riverfront lots (most lots are about 2.5 acres).

3.27.5.2 Land Use Plans and Policies

The geographic study area of analysis for the land use plans and policy cumulative impact analysis encompasses the project area (see Map 3.27-1).

The majority of the project area is undeveloped open space, and is managed for preservation, recreation, watershed, wildlife, fishery, or habitat purposes. Section 3.1 describes the present land use trends and status in full detail. Since 1992, local land use planning updates have shown a drastic increase in recreational and preservation land use classifications, and a desire to provide for lands for public and private ownership, but without sudden community change (CLAPC (1996); adopted by the Borough in 2010). Within the project area, due to the various types of land ownership, multiple land use plans and policies exist (see Section 3.2 for detail). These plans have been developed over time and are continually being implemented and updated.

3.27.5.3 Social Environment

The geographic area of analysis for the social environment cumulative impact analysis covers the project area (see Map 3.27-1).

Population and Social Groups. In 1950, Cooper Landing had a year-round population of 60 (KPB 2000). Cooper Landing's population peaked in 2001 at 391, and by 2010 declined to 289. Summer populations are larger. While seasonal population counts are not available from U.S. Census data, seasonal housing accounts for more than half (52.4 percent) of the available housing in Cooper Landing (USCB 2010c).

According to 2010 U.S. Census data, 4.5 percent of the residents of Cooper Landing are considered part of a minority group. The median household income for Cooper Landing increased between 1999 and 2009 from $34,844 to $72,837 (USCB 2010b). In both years, results were above the poverty threshold for the State of Alaska. The median age of population in Cooper Landing rose between 2000 and 2010, from 45.7 to 55.6 years old (higher than the State average), indicating either the population is aging or new residents are older. Section 3.3.1.1 in the Social Environment section describes the present population and social groups' trends and status in more detail.

Community Character. Section 3.3.1.2 describes the present community character trends and status in full detail. The 86-room Kenai Princess Lodge is a good example of trends of increasing recreational and tourism development. Constructed in 1990, the lodge was expanded in 1991, 1994, 1996, and 1999 (Princess 2010).

Results from meetings and interviews conducted by the project team in 2005 indicated that in recent subdivision development, many buyers were high-income professionals from Anchorage building retirement or vacation homes, indicating a trend in community composition toward older residents and seasonal occupancy. In 2000, 76 children under 19 were residents in Cooper Landing; by 2010, the number of children dropped to 25.

The Sterling Highway is a defining feature of Cooper Landing. The highway bisects the community, with residential housing, commercial development, and community and public services located on the north and south of the highway. The *Cooper Landing, Alaska, Walkable Community Project* notes that "as most travel is by vehicle, the ability for casual contact among residents is limited" (LDN 2010a).

Community and Public Facilities. There is a local public library, school, and volunteer fire and ambulance facility. These facilities have remained relatively static, except for an enrollment decrease at the local school. There are no identified plans for additional facilities or facility closures. Most residents in Cooper Landing rely on community facilities in neighboring communities, such as Soldotna. Section 3.3.1.3 describes the present trends and status of community and public facilities in full detail.

3.27.5.4 Housing and Relocation

The geographic area of analysis of cumulative impacts for housing and relocations is the project area (see Map 3.27-1).

Historical Census data indicates a total of 6 homes existed within Cooper Landing prior to 1939 (USCB 2003a). Additional homesteads and home sites were made available by the Forest Service in the 1930s and 1940s, but with only "summer residence" permits granted. With the completion of the Sterling Highway and its improvements in the 1940s and 1950s, roadhouses were built to accommodate travelers, as well as gas stations, lodges, and ferry operations. By 1950, the Sterling Highway was a "modern highway," providing increased access to travelers along the Kenai Peninsula (CRC 2010). Homestead sites and businesses continued to increase

with demand throughout the latter half of the twentieth century. By 1980, there were 108 recorded homes in Cooper Landing (USCB 2003b). While housing information before 1970 is not available for places with a population of fewer than 1,000, population information for Cooper Landing suggests variability in residents over time—88 in 1960, 31 in 1970, and 116 in 1980 (USCB 1982). Since 1980, housing units have steadily increased. Total housing units in 1990, 2000, and 2010 were 299, 372, and 395, respectively.

3.27.5.5 Economic Environment

The geographic area of analysis for cumulative economic effects encompasses the Cooper Landing community, which is approximately the project area (see Map 3.27-1).

The economy in Cooper Landing originally was based on mining and logging. Those interests have decreased dramatically, and the economy today is heavily based on tourism, recreational fisheries, and recreation. Tourism has been growing in importance across the Borough over the last decade. Cooper Landing is also a second-home and retirement community. Businesses tend to be either river-based (serving anglers, boaters, and overnight guests) or highway-based (including gas stations, restaurants, lodges, and gift shops). Personal income in Cooper Landing is on the rise, growing 4.4 percent annually (USBEA 2011). The *Kenai Area Plan* (DNR 2001) set the stage for future development of additional lands on Unit 395, and Borough platting of the Birch and Grouse Ridge Subdivision began the process of adding private lands in the Bean Creek area. See Section 3.5 for more details on present economic trends.

3.27.5.6 River Navigation

The geographic area of analysis for cumulative impacts for river navigation encompasses the Kenai River within the project area (see Map 3.27-1).

Float trips are common on the upper Kenai River due to its popularity as a fresh-water fishery and because the area is scenic. In 1955, the Russian River Ferry was established near MP 55 for access to the mouth of the Russian River. In response to increasing use of the river and its subsequent threat to the river system's health, the Alaska legislature established the Kenai River Special Management Area (KRSMA) in 1984 as a unit of the State park system. The KRSMA consists of more than 105 linear miles of rivers and lakes, including Kenai Lake, Skilak Lake, and the Kenai River from Cooper Landing downstream to Kenai. Much of the upper Kenai River in the project area has been designated “non-motorized,” which reduces wake impacts on stream bank habitat; reduces motorized/non-motorized user conflicts; and creates a high-quality recreational experience for rafting, canoeing, kayaking, fishing from boats and from the bank, and other non-motorized uses. Commercial navigational use (e.g., guiding services) of the upper river is limited by permit. On Kenai Lake, powered watercraft are allowed. See Section 3.7 for more details regarding river navigation.

3.27.5.7 Park and Recreation Resources

The geographic area of analysis for the parks and recreation resources cumulative impacts analysis is the project area (see Map 3.27-1).

The project area grew increasingly popular for recreation from the early 1900s onward, reflecting “discovery” of the area’s fish and wildlife resources for anglers and hunters, increases in access (opening of the Sterling Highway), increased population in Anchorage, the development of Kenai and Soldotna (largely spurred by oil and gas development), and increases in tourism in

Alaska. The Kenai and Russian rivers are the two most popular fisheries for sockeye salmon in the state, and the Forest Service has withdrawn lands specifically to provide recreational access to the river. Many trails cross the project area and are accessible from the Sterling Highway. Several campgrounds (also Forest Service recreation withdrawals) also are found in the area. These all are heavily used facilities. Table 3.8-5 in the Park and Recreation Resources section shows numbers of annual visitors at area facilities from 2008 to 2012, which generally show an upward trend each year. See Section 3.8 and Chapter 4 for more details on present park and recreation resources trends.

3.27.5.8 Historic and Archaeological Preservation

The geographic area of analysis of the cumulative impacts analysis for historic properties is the project area (see Map 3.27-1).

Many parts of the project area, particularly the river bottom areas, have a rich history, with continued use from prehistoric times up to today. Substantial prehistoric use of the area is evident in the now-buried sites of villages, ceremonial houses and other homes, food storage areas, and burial sites of Alaska Natives. Historic use is evident in the sites of mining claims, mining buildings, prospecting pits, trails, and other indications of mining. In 1981, the Sqilantnu Archaeological District was determined eligible for the NRHP. Fieldwork for the early Sterling Highway Draft EIS located "significant prehistoric sites within the construction limits of the preferred alternative and throughout the area" (DOT&PF 1994). In the 1990s, the Beginnings and K'Beq Heritage sites began to be used for cultural interpretation and minor improvements were made (e.g., small parking lots, interpretive signs, pathways, etc.). In 2011, the Beginnings site was closed to reduce foot traffic and erosion. In general, the trend in the project area and Kenai Peninsula is toward additional formal identification, preservation, and protection of historic properties by the Kenaitze Indian Tribe, CIRI, and Federal and State agencies, including the U.S. Congress in the RRLA. See Section 3.9 for more details on the current status of historic properties.

3.27.5.9 Water Bodies and Water Quality

The geographic area of analysis for cumulative impacts for water quality encompasses the Quartz Creek, upper Kenai River, and middle Kenai River watersheds within the upper Kenai Peninsula watershed (see Map 3.27-1).

These three watersheds all contribute to the upper Kenai River. They include numerous rivers, streams, and lakes. The National Hydrologic Dataset (NHD) from the United States Geological Survey, identifies 40 creeks and streams within these three watersheds, totaling approximately 620 miles of channel length. This includes Crescent Creek, Daves Creek, Devils Creek, Quartz Creek, Primrose Creek, Ptarmigan Creek, Cooper Creek, Hidden Creek, Russian River, and the Kenai River. There are also numerous lakes identified in these watersheds on the NHD. More than 30 lakes exist with approximately 51,725 acres of surface area. Due to limited development, little has changed the character of these resources over time. The Kenai River has seen increased pressure from fishing and other recreational use. For those reasons, the KRSMA was formed in 1984 (see Section 3.27.5.6).

Water quality data indicate that all water bodies in the geographic area of analysis meet current water quality standards and are not considered impaired (ADEC 2013b). The Alaska Department of Environmental Conservation (ADEC) indicates that available data are insufficient to

determine water quality attainment for Quartz Creek, Juneau Creek, and Cooper Creek (ADEC 2013b). Roadway runoff is the only known source of potential nonpoint pollution in the watershed. Pollution from roadway runoff has not exceeded regulatory limits within the project area (Stevens, personal communication 2006).

Specific information for groundwater quality in the geographic area of analysis is limited. However, from a Borough perspective, water from the water table aquifers is generally low in dissolved solids but high in iron. High levels of mineralization (primarily iron and hydrogen sulfide) cause staining and bad tastes from well water in some areas. Artesian aquifers that range in depth from 60 to 300 feet below the land surface typically exhibit the highest quality groundwater (KPB 2005b).

In accordance with the Safe Drinking Water Act as amended in 1986 and 1996, ADEC developed a Drinking Water Protection Program that includes wellhead protection area plans (ADEC n.d.). In 2002, source water assessments were conducted in Cooper Landing that identified wellhead protection areas within the project area. See Section 3.13.1.4 and Map 3.13-2 for additional detail.

Over the past few decades, several regulatory programs have been instituted that regulate storm water and impacts to water bodies. State of Alaska projects must obtain several water quality and water body permits—see Section 3.24 for additional information.

3.27.5.10 Air Quality and Climate Change

The geographic area of analysis for cumulative impacts for air quality is the Borough (see Map 3.3–1 and Map 3.27-1), with consideration for global impacts related to greenhouse gas emissions and climate change.

Since 1938, human development in the Borough has gradually increased in the form of roads, power transmission lines, homes, and businesses. The addition and improvement of roads for vehicle and truck traffic has led to an increase in vehicle use. However, there are no recorded instances of air quality standards being exceeded within the Borough.

3.27.5.11 Noise

The geographic area of analysis for cumulative impacts for noise encompasses the project area (see Map 3.27-1).

Since 1938, human development has gradually increased in the form of traffic and roads, power transmission lines, homes, and businesses, most of which have increased noise levels in developed areas. The increased population and tourism coupled with the addition and improvement of roads has led to an increase in vehicle use. As a result, traffic-related noise has increased over time. The level of noise varies by time of day and season and is reflective of active human use in the project area. In addition, sensitive noise receptors such as campgrounds and homes have increased over time. Much of the project area remains largely undeveloped and is considered quiet.

3.27.5.12 Visual Environment

The geographic area of analysis for cumulative impacts analysis for visual resources is the project area.

Since 1938, human development has gradually increased in the form of traffic and roads, power transmission lines, homes, and businesses, all of which have altered the visual environment. The Sterling Highway today is a State Scenic Byway. The project area is a major recreation destination, with world-class fishing, campgrounds, trailheads, and river floating. The project area also includes ample opportunities for viewing and photographing scenery from the highway, the Kenai River, and trails. Views within the project area are of moderate to high quality, encompassing mountains, forests, rivers, and streams as well as engineered facilities.

3.27.5.13 Floodplains

The geographic area of analysis for cumulative floodplains effects encompasses the Quartz Creek, upper Kenai River, and middle Kenai River watersheds within the upper Kenai Peninsula watershed (see Map 3.27-1).

Waterways have always flooded due to upstream glacial outbursts, downstream ice jams, snow and glacier melting, and periods of high precipitation, but formal floodplain delineation is relatively recent and covers only a small portion of the project area. The 100-year floodplain was originally mapped by the Federal Emergency Management Agency (FEMA) and was adopted by the Borough in 1981 and is, to this day, the Borough's officially adopted floodplain map. Within the project area, mapped floodplains exist for only the area between approximately MP 47 to 55 for a portion of the Kenai River, Russian River, and Cooper Creek (Map 3.19–1). The Borough Floodplain Development Ordinance (KPB 1988) requires that floodplain encroachments not result in any increase in flood levels during the occurrence of the base flood discharge. This no-net-rise policy applies to areas both upstream and downstream of any floodplain encroachment. Hydraulic and hydrologic studies would be required during design to satisfy existing floodplain requirements.

3.27.5.14 Wetlands and Vegetation

The geographic area of analysis for cumulative impacts for wetlands and vegetation encompasses the Quartz Creek, upper Kenai River, and middle Kenai River watersheds within the upper Kenai Peninsula watershed (see Map 3.27-1). With an area of more than 650 square miles, the geographic area of analysis has approximately 10,000 acres of wetlands of various types (not including lakes).

Since the 1950s, wetlands within the Kenai Peninsula lowlands (mostly outside the geographic area of analysis) have shrunk and dried, with invasion of lakes by woody and upland species (Klein et al. 2005), and this likely has occurred in the area of analysis as well. Vegetation types within the geographic area of analysis are consistent with the types found in the project area. Needle-leaved forests, broad-leaved forests, mixed needle-leaved and broad-leaved forests, shrub thickets, dry meadows, and wet meadows are the vegetation types that exist within these three watersheds. Historic wetland and vegetation losses due to development within the geographic area of analysis are small in comparison with the amount available within these three watersheds.

3.27.5.15 Wildlife

The geographic area of analysis for cumulative wildlife impacts focuses on Game Management Units (GMUs) 7, 15A, and 15B (see Map 3.27-1), with some variation by species.

The interagency working group identified nine mammal species that could be the most affected by the proposed project and/or that the group considered to be key indicators of potential effects

to terrestrial wildlife (HDR 2004a). The species selected were moose, brown bear, black bear, river otter, Dall sheep, mountain goat, Canada lynx, wolf, and wolverine (HDR 2004a). Seasonal habitats and use in the project area by all nine of the mammal species are summarized in Tables 3.22-2, 3.22-5, and 3.22-6. Section 3.22.1.1 includes information on the life history, habitats, and population trends of each of these species.

The interagency working group identified brown bear and moose as species of particular importance for evaluation of potential impacts (Ruediger 2004). For this reason, the cumulative impacts analysis for terrestrial wildlife, while generally addressing all nine mammal species, provides additional detail on brown bear and moose.

Birds are also discussed, with a specific focus on bald eagles due to protections under the Bald and Golden Eagle Protection Act.

Brown Bears

The brown bear population is reported and managed on a larger scale for the entire Kenai Peninsula, an area that encompasses all of GMUs 7 and 15, including GMU 15C. A recent DNA-based mark-recapture population estimate conducted by a USFWS and Forest Service interagency team estimated the Kenai brown bear population to be approximately 582 in 2010 (Morton et al. 2016). The Kenai brown bear population may be geographically isolated and genetically differentiated from the nearby Anchorage brown bear population. Although it shows lower genetic diversity than the mainland bear population, there is not enough evidence of isolation to cause concern (Jackson, Talbot and Farley 2008).

The lack of a complete population survey of brown bears on the Kenai Peninsula prevents quantitative assessment of historic population fluctuations and investigations on the effects of human-induced landscape changes. The Kenai brown bear population experienced population declines in the distant past (over 100 generations ago), but evidence of a genetic bottleneck is subject to interpretation (Morton et al. 2016). In addition, brown bear hunting regulations have been modified to prevent the over-harvest of Kenai bears several times in the past 30 years (Selinger 2011a). These modifications were not based on population data, and were, instead, enacted in an attempt to balance bear harvests with growing numbers of vehicle collisions and defense of life and property (DLP) bear mortality associated with increased human development on the Kenai Peninsula (Selinger 2011a).

Brown bears on the Kenai Peninsula use a wide variety of habitats, including rivers and streams, forests, and subalpine and alpine areas (Goldstein, Poe, et al. 2010), generally avoiding areas in proximity to roads during spring and summer (Suring, Farley, et al. 2006). Brown bears are likely to move back and forth across the Kenai Peninsula in a northwest-southeast direction over the Kenai Mountains and across the Kenai River within the project area. High-quality brown bear habitat and movement corridors have been identified north of the Kenai River in GMU 7. North-south landscape linkages have been identified in the Juneau-Cooper creeks and Round Mountain areas (Juneau Creek and Russian River), and east-west landscape linkages were identified along Bean Creek (Morton, Magness, et al. 2010). Brown bear population and habitat information for the project area is described in detail in Section 3.22, Wildlife.

Factors influencing the persistence of brown bears include: 1) the quality of available habitat, 2) the number of humans within that habitat, and 3) the relationship of those humans to brown bears (Mattson et al. 1996, McLellan 1998, Apps et al. 2004). Natural or human-induced landscape-

scale changes influence brown bear populations through habitat loss, changes in habitat suitability, changes in habitat use (e.g., displacement from habitat or disruption of movement patterns), or reduced survival (Goldstein, Suring and Preston 2004). These changes may result in fragmentation of brown bear habitat, modifications of brown bear habitat use, and decreased population sustainability (Goldstein, Suring and Preston 2004).

Moose

Moose population information for the greater project area is summarized in Section 3.22, Wildlife. There are no moose population surveys for GMU 7 due to heavy forest cover (McDonough 2010a). Other information indicates that the moose population in GMU 7 is stable with a "chronically low" density that supports less than 10 percent of the entire Kenai Peninsula moose harvest (see Table 3.22-4). The ADF&G population estimate for moose in GMU 15A was 1,600 in 2010, continuing a trend of a slow but steady decline since 1991 (Table 3.22-4 (2010a)). The 2010 moose population in GMU 15B was estimated at 960 animals and was believed to have been stable since 1999 (Table 3.22-4 (2010a)).

The factors most affecting the moose population on the Kenai Peninsula are declining habitat quality, predation, and mortality caused by vehicle collisions. Moose killed by vehicles within GMU 7 as a whole (which includes MP 45–55 of the Sterling Highway and 75 miles of the Seward Highway) ranged from 16 to 30 per year from 2002 to 2009 (averaging 24 per year; Morton, personal communications (2011a, 2011b, 2011c)). Weather is also considered a factor in GMU 7, where a high mortality rate for moose has been linked to consistent severe winters with heavy snowfall (McDonough 2010a).

Birds

Species that occur in the geographic area of analysis are common and widely distributed in Southcentral Alaska. Waterbirds, raptors, landbirds, and upland game birds occur in the project area and use habitat in the project area for nesting, brood rearing, wintering, and migration. Most bird species occurring within the geographic area of analysis are migratory, arriving or passing through in the spring and migrating south in late summer or fall to wintering grounds in North or Central America. Migratory birds are protected by the Migratory Bird Treaty Act. Several species of birds found in the geographic area of analysis are on USFWS, Forest Service, and Audubon conservation lists (see Table 3.22-8). No Threatened or Endangered species occur in the project area.

Specific attention is given to bald eagles due to protections under the Bald and Golden Eagle Protection Act. Surveys of the KNWR indicated that in 2001, 90 pairs of eagles were nesting in the KNWR and about 400 bald eagles were using the Kenai River and the Fox River (GMU 15C, outside the geographic area of analysis) valleys as winter habitat (USFWS 2010a). Nest surveys have also indicated that the proportion of nests where eaglets have successfully fledged has declined since the late 1980s (USFWS 2010a). The reason for the decline is unknown. Within the project area, there were 25 bald eagle nests identified in a 2014 aerial survey. Of these, 8 bald eagle nests are located within 660 feet of the existing highway (660 feet is USFWS's recommended disturbance buffer zone for eagle nests).

Human disturbance of nesting activities can lead to nest abandonment as well as disruption, destruction, or obstruction of roosting and foraging areas. The location of active nests near the highway indicates that some eagles in the area are likely habituated to highway noise and traffic.

3.27.6 Cause-and-Effect Relationships between Activities and Resources

The rest of this chapter describes the causes of impacts from the past, present, and reasonably foreseeable future actions, and effects expected from combining the proposed project with the other projects and developments.

As a result of the combined effects of human activities, the natural environmental is affected in ways that may be less obvious than that of a direct impact of an action on a resource. The following summarizes the relationships between the effects on the natural environment from human activity stresses:

- Housing and Relocation
  - Unintended consequences of development can lead to sprawl and potential burden on local governments related to the expansion of utilities or services to newly developed areas.
  - If human activities result in the removal of existing housing, the housing market may not be able to support relocation needs of individuals who have been displaced.
  - Visual resources can be affected through new development actions that change the landscape.
- Social and Economic Environment
  - Sudden changes in growth or transportation patterns can lead to new stresses on existing social services such as schools and fire protection. In addition, growth and new transportation patterns can alter community character.
  - A sudden influx of goods and services during construction can lead to an unstable economy and labor market.
- River Navigation – Changes to existing bridge configurations, new river obstructions, or increases in use of river services can reduce overall navigation within the Kenai River.
- Parks and Recreation – Unintended effects of human actions on parks and recreation resources can include overcrowding or interruption in the natural setting of resources. A new trailhead built as mitigation for effects to existing recreation resources could lead to more recreational day use and people in an area, which in turn could negatively affect natural resources in an area (e.g., trampling of vegetation and soil erosion) and disrupt wildlife use of habitat in that specific area. Building the Juneau Creek bridge for the Juneau Creek or Juneau Creek Variant alternatives could increase the amount of recreation day use, with people seeking to visit the Juneau Creek falls, which in turn could increase potential negative effects on vegetation and potential disruption of wildlife use of habitat in that specific area.
- Historic and Archaeological Preservation – Human actions can result in fragmentation of an existing historic district and cultural site degradation from streambank erosion, site development (e.g., grading, leveling, etc.), and vandalism.
- Wetlands, Water Bodies, and Water Quality
  - Human activities can cause a loss of wetland habitat and the related services they provide, such as sediment and nutrient removal and surface water runoff storage.

  - Water quality degradation due to increased nonpoint-source pollution from new developments can occur.

- Wildlife
  - Human activities can create habitat loss, modification of habitat use, and habitat fragmentation from the cumulative effects of land clearing and development activities.
  - Increasing road density within wildlife habitat can increase mortality from vehicle collisions and DLP kills.
- Air Quality – Multiple new developments can create a cumulative effect of producing emissions that lower ambient air quality and add to regional and global atmospheric conditions such as global warming.

3.27.7 Magnitude and Significance of Cumulative Effects

The potential project-related impacts, combined with existing actions or anticipated RFFAs within the geographic boundaries for cumulative effects analysis for each resource, can indicate the potential stresses on a given resource.

Table 3.27-3 identifies those RFFAs that have the potential to add stresses to the resources being evaluated. The potential impacts of the RFFAs, combined with the existing conditions of the affected resources (which have been influenced by past and present actions), provide the context for determining the magnitude and significance of the cumulative effects of the Sterling Highway MP 45–60 Project. The following sections characterize the cumulative effects of past, present, and reasonably foreseeable future actions on each resource and describe how the magnitude and significance of those effects would change with the Sterling Highway MP 45–60 Project.

The following sections discuss the magnitude and significance of the cumulative effects for each resource.

Table 3.27-3. Existing actions or RFFAs potentially impacting resources

Existing Actions or RFFAs	Resources[a]	Primary Impact Location
Sterling Highway Maintenance and Bridge Replacement	1, 6, 9, 13,14,15	Project Area
Sterling Highway Rehabilitation and Passing Lanes, MP 58–79	15	Project Area
Sterling Highway MP 57 Erosion Protection (existing)	9, 13	Project Area
Senior Citizen Housing Development	1, 3, 4, 5, 8, 14, 15	Project Area
Cooper Creek Restoration	9, 13, 14, 15	Project Area
Chugach Electrical Association, Cooper Lake Hydroelectric Facility Projects (existing)	1, 5, 7, 8, 9, 14, 15	Middle Kenai River Watershed
CIRI Land Development (Tract A)	1, 5, 8, 14, 15	Project Area
CNF Bean North Vegetation Management (existing)	14, 15	Project Area
Cooper Landing Residential Development	1, 4, 5, 10, 14, 15	Project Area
State Land Management Unit 395 Residential Development	1, 4, 5, 10,14, 15	Project Area
Russian River Campground Entrance	7, 14	Project Area
Cooper Landing Walkable Community Project	3, 5	Project Area

[a] Resource key:
1 – Land Ownership and Land Uses
2 – Land Use Plans and Policy
3 – Social Environment
4 – Housing and Relocation
5 – Economic Environment
6 – River Navigation
7 – Park and Recreation Resources
8 – Historical and Archaeological
9 – Water Bodies and Water Quality
10 – Air Quality and Climate Change
11 – Noise
12 – Visual Resources
13 – Floodplain
14 – Wetlands and Vegetation
15 – Wildlife

3.27.7.1 Land Ownership and Land Uses

Cumulative Effects - No Build Alternative

The Sterling Highway Maintenance and Bridge Replacement RFFA would require a minor change in land ownership and land use because of new bridge and road construction. This would be limited to areas around these specific projects, and the potential exists of no requirement for new right-of-way associated with the bridge replacements. The development of subdivisions located in Cooper Landing and on State Management Unit 395, development of CIRI Tract A, the senior citizen housing development, and the reauthorized Cooper Lake Hydroelectric Project would convert open space (Borough, State, and Federal public lands) into developed areas; however, the conversion of land ownership has already been planned as part of these developments. The other RFFAs would not require any change in ownership type. Cumulative

effects on land ownership would not be substantial with the No Build Alternative in combination with past, present, and reasonably foreseeable future actions.

Road access from the existing Sterling Highway to Unit 395 would be part of development of Unit 395 and would mean an easement and road construction across CNF lands for about 5,500 feet. The Forest Service is obligated to provide reasonable access to inholdings under ANILCA. If the final easement were 100 feet wide, approximately 12.5 acres of CNF land (or land rights for access) would be acquired by the Kenai Peninsula Borough.

Also, there is an un-maintained road that takes off from the existing Forest Service road within Unit 395 and that traverses west through Unit 395 and across CNF land to within 0.36 mile of the Mystery Creek Wilderness boundary. USFWS anticipates that the section of the existing road within Unit 395 would be incorporated in a residential subdivision of Unit 395 or, if not, would be used as a recreation trail by future residents. The topography from the end of the unmaintained road to the boundary of the Wilderness area may provide the opportunity for access by ATV to the Wilderness area. ATV traffic in the Wilderness area could affect the area through noise and vegetation impacts and, if it occurred, would affect Wilderness qualities like the opportunity for a quiet setting. Managing any such impact would be an administrative impact to the USFWS.

Cumulative Effects - Build Alternatives

Federal, State, Borough, Native, and private lands would be required for the build alternatives, and these lands would be converted to roadway right-of-way. The build alternatives would convert 215–387 acres of land to public highway rights-of-way, depending on the alternative selected (see Section 3.1, Land Ownership). A total of 13,500 acres of land exists in the project area. At most, this would remove 3 percent or less of the total land area to roadway right-of-way.

The development of subdivisions located in Cooper Landing and State Management Unit 395, development of CIRI Tract A, the senior citizen housing development, and the reauthorized Cooper Lake Hydroelectric Project would convert open space (Borough, State, and Federal public lands) into developed areas; however, the conversion of land ownership has already been planned for as part of these developments. Road access from the existing Sterling Highway to Unit 395 would be part of development of Unit 395 under any of the build alternatives, the same as indicated above for the No Build Alternative.

The Forest Service, as a cooperating agency, requested that this document address the potential for providing access off the "old" highway and from the new highway, under the Juneau Creek alternatives, because of potential impacts to CNF lands. The EIS has assumed that it is reasonably foreseeable that access would be along or close to the existing Forest Service logging roads, but that could change if and when the Borough actually develops the access. Because the logging roads are not developed to the Borough's road standards, it is assumed that the roads would be upgraded to meet those standards. The responsibility to upgrade the roads (including any mitigation commitments) would be the Borough's. If one of the Juneau Creek alternatives were selected, and if the Borough requested access to Unit 395 directly from one of the Juneau Creek alternatives, it is possible that no additional impact to CNF lands outside of Unit 395 would occur for access. However, if access were to occur from the existing Sterling Highway, the 5,500-foot road to the southern boundary of Unit 395, if 100 feet wide, would require about 12.5 acres of CNF land, the same as under the No Build Alternative.

DOT&PF and FHWA have committed to reserving access rights along the segment built on a new alignment, in the same way that access rights are reserved along the Interstate Highway System in the Lower 48 states and along major highways in urban areas of Alaska (e.g., Seward Highway from Potter Marsh to 36th Avenue in Anchorage). No access rights would be reserved on Unit 395 or on CIRI Tract A, because the development plans for these parcels is not yet known, so it is not possible to pinpoint a location or design. However, DOT&PF and FHWA acknowledge the potential future desirability of access from either of the Juneau Creek alternatives to these parcels and have evaluated the most likely options.

If CIRI desired direct access to Tract A in the future, it is likely that a driveway or minor side road connection would occur within the highway right-of-way. It would be up to CIRI to construct the driveway or side road.

If the Borough desired access to Unit 395 in the future, DOT&PF would require that it be via ramps, presumed at either of the two grade-separated logging road crossings proposed on Unit 395. Preliminary engineering suggests that the ramps could be built mostly within the highway right-of-way provided for the Juneau Creek alternatives; however, some Borough land may be required. It is possible that the Borough would require two points of access for emergency access and evacuation (e.g., in case of wildfire), implying that a route across CNF may be necessary regardless of the ramps. Also, the Borough may desire connection via the "old" Sterling Highway for a combination of ease of access to Cooper Landing and the Kenai River for land owners, and for ease of access by emergency vehicles to Unit 395 from the community. Further discussion of the access issue appears in the subsections below, particularly in the Wildlife/Brown Bears section (3.27.7.15).

Regarding the Juneau Creek Alternative only, the land exchange between CIRI and DOI would occur, changing ownership of lands that are currently part of KNWR. Land ownership also would change near the mouth of the Killey River, where some CIRI land would become part of the KNWR. Development of the CIRI land transferred to KNWR is unlikely to occur under USFWS management.

The other RFFAs would not require any change in ownership type. Therefore, in combination with past, present, and reasonably foreseeable future actions, none of the build alternatives would have substantial cumulative effects on land ownership or uses. Impacts from ATV use in or near designated Wilderness from Unit 395 could occur with or without the development of the Sterling Highway project alternatives.

3.27.7.2 Land Use Plans and Policy

Cumulative Effects - No Build Alternative

The No Build Alternative would not alter any existing land use plans. The present action (CNF North Bean Vegetation Management) and the RFFAs generally are consistent with existing land use plans and policy. Therefore, the No Build Alternative, in combination with past, present, and reasonably foreseeable future actions, would not have substantial cumulative effect on land use plans and policies.

Cumulative Effects - Build Alternatives

All build alternatives would impact lands that have sensitive land uses or classifications, including private lands, the KRSMA and proposed additions to the KRSMA, Inventoried

Roadless Areas (IRAs), the Resurrection Pass Trail, and Federally designated Wilderness within the KNWR. Of these lands, Wilderness and IRAs came into being in the project area relatively recently and were delineated around existing roads and have not been substantially affected by past actions. For most of the build alternatives, no substantial changes to Wilderness and IRAs are foreseen based on RFFAs, although development of State Management Unit 395 could result in new roads on State lands; because the Forest Service typically considers a buffer around a road to be part of the roaded area, adjacent Forest lands within the IRA would be considerably closer to a "roaded" area, affecting the roadless character associated with the IRAs. Any changes within any sensitive land use classifications would be part of a cumulative effect. While the Juneau Creek Alternative would affect IRAs similarly to other alternatives, Wilderness would be affected differently. Selection of the Juneau Creek Alternative would induce the land exchange between CIRI and USFWS to occur, which would remove up to about 60 acres of KNWR and Wilderness lands in the project area and establish KNWR lands (potentially with Wilderness status) near the mouth of the Killey River. The potential for development on the CIRI land transferred to KNWR would be effectively eliminated. KNWR and Wilderness boundaries would need to be administratively adjusted, per terms of the agreement ratified by the Russian River Land Act.

For any build alternative, the *Kenai National Wildlife Refuge Comprehensive Conservation Plan, Chugach National Forest Land and Resource Management Plan*¸ *Kenai Peninsula Borough Comprehensive Plan,* and *Cooper Landing Land Use Classification Plan* may need to be amended in response to such changes.

The impacts of past, present, and future actions (RFFAs), combined with the impacts of the build alternatives, would result in a cumulative impact that would likely result in changes to land use planning documents that guide land management in the area; however, because the vast majority of land would remain in State and Federal ownership, there is not anticipated to be a substantial impact to land use plans and policy.

3.27.7.3 Social Environment

Cumulative Effects - No Build Alternative

Population and Social Groups. Past trends of slow population growth, and a shift toward an older, retiree population are likely to continue under the No Build Alternative. Completion of the senior citizen housing development would create an additional 30 housing units and a new senior center, which might increase the attractiveness of the area to additional retirees, continuing the trend of an increasingly aging population. Development of Unit 395 could result in 243 developable parcels. If half were developed, with 50 percent for permanent residents and 50 percent for weekend recreation cabins, Unit 395 development could increase the Cooper Landing population by 63, or approximately 20 percent more than the existing permanent population (calculation assumes 1.8 residents per household, which is the 2010 Census average household size in Cooper Landing). Other RFFAs would not likely affect population growth trends or demographic trends.

Community Character. The No Build Alternative would have an adverse cumulative impact on community character. Traffic projections for the No Build Alternative are based on an annual traffic growth rate of 1 percent, which includes traffic anticipated as a result of the RFFAs. The No Build Alternative would route all traffic through the length of the community on an undersized road. Even with implementation of *Walkable Community Project* (RFFAs) over time,

growing traffic would likely reduce quality of life. As traffic and congestion continued to grow, the highway would become more of a barrier to local vehicle, bicycle, and pedestrian movement. The increased traffic congestion as a result of the No Build Alternative and RFFAs would reduce the desirability and quality of life of Cooper Landing for visitors and residents. This in turn could result in relatively slower build-out of Unit 395 and other undeveloped properties slated for community development.

Community and Public Facilities. The effects of the No Build Alternative, when combined with the RFFAs, would result in adverse cumulative effects to community facilities and public services. Increasing traffic volume and congestion along the existing highway, especially during peak summer months, would result in more crashes, generate more emergency response needs, and make it more difficult to access existing public and private recreational facilities and services. The number of emergency response runs increased approximately 50 percent from 2001 to 2006 (Mecum 2006). Emergency responses are expected to increase as development and corresponding increased traffic result in more congestion in the corridor.

Cumulative Effects - Build Alternatives

Population and Social Groups. Past trends, as described under the No Build, would continue under the build alternatives. The development of lots in Unit 395 may occur slightly more quickly under the build alternatives, because the town center would be more accessible and useable under the build alternatives (see the discussion on Community Character below). Under either of the Juneau Creek alternatives, the highway right-of-way and a land buffer of 100 feet along each side of the highway (required by DNR's land transfer decision) would reduce the full build-out potential of Unit 395 by about 12 percent.

Community Character. Improvements to the transportation system as a result of the build alternatives would make commercial, recreational, and residential areas more accessible for local residents by all means of travel. To varying degrees, the build alternatives would remove through-traffic from the center of the community, which may encourage positive social interaction within the community. The Cooper Creek Alternative would continue to route all traffic through portions of Cooper Landing, while the other build alternatives would route most of the traffic around the entire community. The G South Alternative or either of the Juneau Creek alternatives, coupled with implementing elements of the *Walkable Community Project* plan (RFFAs), would likely result in a quieter town center with greater ease of mobility between community destinations, which would improve quality of life and attractiveness of the community. In turn, this could result in more interest in staying in or moving to the community. This trend likely would occur under the Cooper Creek Alternative as well, but only for the western portion of the community. With increased development under the RFFAs and improved access within the community as a result of the build alternatives, the community and its social groups may be better able to interact, which would enhance community character, creating a beneficial cumulative impact.

An ongoing concern expressed in Kenai Peninsula Borough planning documents and in some public comments submitted for this project has been about induced development of new commercial areas and other development (sprawl) along the segments built on a new alignment. Were it allowed, there is potential that such development would compete with established businesses in Cooper Landing and would alter the character of the community in general by altering the commercial activity center of the community. This is most notably an issue for the

Juneau Creek alternatives that would pass through State Unit 395, which is slated to be conveyed to the Kenai Peninsula Borough for rural residential development.

It is anticipated that access would be via the Forest Service's existing West Juneau Road (originating just west of Schooner Bend Bridge on the existing highway) or a variation on that road's alignment. It is possible that the Borough would request use of the interchange option. If this occurred, the Borough could build the ramps to DOT&PF standards and have access. However, because the adopted Borough plans for this area specifically discourage sprawl and roadside development along any new alignment, because the State in conveying the land to the Borough intends to reserve a 100-foot buffer along each side of any highway to discourage such development, and because DOT&PF and FHWA have committed to reserving access rights and not allowing driveways or other side roads along the segments built on a new alignment, no commercial or residential development along the highway is anticipated to occur.

In the event that ramps for access to and from Unit 395 and the Juneau Creek alternatives were constructed in the future despite the Borough's adopted plans, it is likely that the development that would occur would be rural residential development, as planned. It is likely that the pattern of development would be slightly different because the access would be different, but the 100-foot buffer beyond the 300-foot highway right-of-way would prohibit roadside development. Similarly, the restriction against driveways off the highway would prohibit roadside development along these alternatives. Any development that did occur would be the same type of development regardless of alternative or access route. It is anticipated that such development would be focused primarily on rural residential and recreational property uses, likely with a few bed and breakfast establishments, similar to development accessed today off the existing highway via Bean Creek Road. Such development would not be expected to alter the character, feel, or business environment of Cooper Landing. Selection of either of the Juneau Creek alternatives would not lead to induced development on Unit 395 or elsewhere that would affect the existing community character of Cooper Landing.

Community and Public Facilities. The build alternatives would improve safety and mobility for residents in Cooper Landing, to the extent that the remaining segment of unimproved existing highway would become more like a minor arterial. It would carry approximately 30 percent of the total traffic volume and likely would retain the posted speed limits in force today, which are generally much lower than speed limits anticipated for the build alternatives. It also would have a much different roadway character than the build alternatives. Reducing traffic and congestion in the existing corridor within the community, and thereby improving vehicle and pedestrian access to facilities and public services within the community, would be a beneficial cumulative effect of the build alternatives. Emergency response times would improve as a result of lower traffic volumes and congestion on the existing highway. While development would increase under the RFFAs, the build alternatives would provide sufficient capacity to handle the forecasted additional traffic.

The RFFA regarding development of State Management Unit 395 is assumed to include a new access road. For most alternatives, this would be from the existing highway. For the Juneau Creek alternatives, access could be from the existing highway across CNF lands, directly from the new highway, or both, depending on the desires of the Borough and negotiations at that time between the Borough, the Forest Service, DOT&PF, and FHWA. If the only access were directly from the Juneau Creek alternatives, access for landowners within Unit 395 to Cooper Landing or to Kenai River access points would require traversing east or west via the new highway to an

intersection with the "old" highway and then doubling back. To get to the center of Cooper Landing at MP 48, for example, would entail driving about 7 miles east and doubling back about 1.5 miles, for a total of about 8.5 miles. If access were across CNF land to the existing highway, the total would be about 6 miles. Reaching Sportsman's Landing/Russian River Ferry at MP 55 would be little different under these two scenarios, particularly under the Juneau Creek Variant Alternative. The Juneau Creek Alternative would entail traversing farther west more than half a mile and doubling back for about the same distance. The time and distance differences would affect fire or emergency medical response times from Cooper Landing to Unit 395. Whether one or two access points would be desired is unknown, but local governments often desire redundant access for emergency response and for evacuation (e.g., in case of wildfire). Two access points appear less likely under the No Build, Cooper Creek, or G South alternative than under either of the Juneau Creek alternatives.

3.27.7.4 Housing and Relocation

Cumulative Effects - No Build Alternative

No direct or indirect housing and relocation impacts would be expected as a result of the No Build Alternative. The planned senior housing and residential development RFFAs do not anticipate adverse affects or require relocations to existing residents. Therefore, the No Build Alternative, in combination with past, present, and future actions (RFFAs), would not have cumulative effects on housing and relocation.

Cumulative Effects - Build Alternatives

Privately owned properties would be affected through implementation of the build alternatives due to right-of-way acquisition. The planned senior housing and residential development RFFAs do not anticipate adverse affects or require relocations to existing residents. Therefore, no cumulative adverse effects would occur with the build alternatives in combination with past, present, and reasonably foreseeable future actions. Development of Unit 395 would add housing units in the greater Cooper Landing area. For the Juneau Creek alternatives, the width of the highway right-of-way and associated State- and Borough-mandated buffers across Unit 395 would mean that less of the unit was available for housing development.

3.27.7.5 Economic Environment

Cumulative Effects - No Build Alternative

The No Build Alternative would not change the existing economic conditions or trends of Cooper Landing. No businesses would be relocated, and travel patterns would remain the same. Congestion and safety concerns could increase. The draw of the Kenai River and Russian River fisheries would be expected to continue, but some recreationists could choose to overnight or shop elsewhere, or even avoid the entire area if the trip became too cumbersome and the quality of the experience decreased.

While many of the RFFAs have the potential to have positive effects on the local economy, the No Build Alternative would not contribute to a cumulative long-term effect on the local economy. Construction activities associated with any RFFA, and with replacement of bridges and other work anticipated on the Sterling Highway under the No Build Alternative, would provide a short-term increase in goods and services purchased locally as a result of construction workers and related activities within the project area. Housing developments provide new

opportunities for full-time residents. The 2007 relicensing requirements for the Cooper Lake hydroelectric facility, required certain improvements, most of which have been completed, that would increase water temperature in Cooper Creek. This could create better habitat for fish, which could increase fish populations in the stream and improve opportunities for sport fishing in Cooper Creek. Development of senior citizen housing would generate more commerce and health care jobs and would strengthen the goods and services sector, creating a more diverse economy. Expected residential development in Unit 395 and the Cooper Landing subdivisions could stimulate growth in commercial enterprises and add to the Borough tax base.

The recent improvements to recreational facilities (e.g., parking at the end of Snug Harbor Road for snowmobilers) are anticipated to support the local economy by increasing recreational opportunities and use during the slow winter months. CIRI's Tract A development (potentially including a visitor center, research center, housing, and lodge) would increase tourism opportunities and generate additional clientele for the local guide services, shops, and restaurants.

The estimated cost of the No Build Alternative would be approximately $64.8 million over 20 years. This includes the replacement of three existing bridges. Construction costs would likely be shared between FHWA and DOT&PF. The State's estimated average annual operations and maintenance costs for the No Build Alternative are approximately $245,500. No long-term economic burden would exist for local governments or taxpayers within the geographic area of analysis.

Cumulative Effects - Build Alternatives

Implementing any of the build alternatives would potentially cause both beneficial and adverse economic impacts (see Section 3.5.2.2). Diverting traffic onto the new alignment would decrease congestion along the "old" highway, which likely would improve the travel experience for visitors, pedestrians, and residents, as well as local businesses that use the existing road in their daily business; however, individual businesses may lose business from travelers who would have made spontaneous stops to purchase goods and services.

The positive economic effects of the RFFAs could be affected by implementation of a build alternative. For example, under either of the Juneau Creek alternatives, the highway right-of-way and a land buffer of 100 feet along each side of the highway (required by DNR's land transfer decision) would reduce the full build-out potential of Unit 395 by about 12 percent, potentially affecting growth in the Cooper Landing area and therefore in the local economy. Increasing available housing associated with subdivision development could dampen housing prices and land values, unless demand was high, but generally would add to the Borough's tax base. While the build alternatives would have an adverse effect on some local business that would need to adapt to new travel patterns, the past, present, and reasonably foreseeable future actions are not anticipated to have adverse effects on the community economy as a whole and may have beneficial effects on the economy. Therefore, no substantial cumulative adverse effects would occur to the local economy.

The estimated project costs of the alternatives are presented below in Table 3.27-4 and in greater detail in Table 3.5–4. The table provides a comparison of total project costs of the Sterling Highway 45–60 Project alternatives plus other costs to DOT&PF. The "Project Cost" represents project development costs such as right-of-way acquisition, design, and construction management, the capital costs of construction of the alternatives, plus the costs of operations and

maintenance over the 20-year life of the project and periodic major activities such as replacement of guardrail and overlays of the pavement surface. It does not include costs associated with phasing the project over several years. These details are part of the initial financial plan proposed for the preferred alternative in Appendix H. The table also includes "Old" Highway Costs—costs associated with the remnant sections of the "old" Sterling Highway, which would require continued maintenance, and with RFFAs such as the Highway Maintenance and Bridge Replacement. The sum of the two figures provides the costs to DOT&PF of the combined "old" highway and new highway for each alternative. In this way the table reflects the cumulative cost of "old" highway maintenance, the bridge replacement RFFAs, and the cost associated with building and maintaining the new highway.

Construction costs would likely be shared between FHWA and DOT&PF. The State's total estimated annual operations and maintenance costs for the project area corridor (build alternatives and the "old" highway segments) range from $672,000 per year (Cooper Creek) to $779,300 per year (Juneau Creek Alternative). No long-term economic burden would exist for the local government or taxpayers within the geographic area of analysis.

Table 3.27-4. Costs by alternative

	No Build	Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Project Costs					
Total Costs[a]	$0	$332.3M	$335.8M	$304.3M	$312.6M
O&M[b] (per year)	$0	$593,400	$585,400	608,600	$611,700
"Old" Highway Costs[c]					
Total Costs	$64.8M	$8.4M	$41.8M	$56.8M	$56.2M
O&M (per year)	$245,500	$78,600	$91,300	$170,700	$160,100
Combined Costs for Project Area Corridor					
Total Costs	$64.8M	$340.7M	$377.6M	$361.1M	$368.8M
O&M (per year)	$245,500	$672,000	$676,000	$779,300	$771,900

[a] Total Project Costs reflect project development costs, direct construction costs, O&M over the 20-year life of the project and periodic major activities such as replacing bridges and guardrail, and repaving. It does not include costs associated with phasing the project over multiple years and contracts.

[b] O&M = Operations and maintenance, and includes annual costs such as snow plowing, crack sealing, and other basic maintenance.

[c] The remaining segment of "old" highway varies in length for each alternative, so costs vary for O&M tasks such as snow plowing or pavement patching. Total costs in this case include RFFAs such as bridge replacement projects. They are presented for reference for cumulative impact analysis and are not costs of the Sterling Highway MP 45-60 Project.

Notes: Many numbers are rounded and do not add up perfectly. Construction dollar figures represent 2015 dollars. Additional detail can be found in Table 3.5-4.

3.27.7.6 River Navigation

Cumulative Effects - No Build Alternative

Under the No Build Alternative, it is assumed that replacement bridges (Sterling Highway Maintenance and Bridge Replacement RFFA) would have the same clearance or better than the existing bridges. Therefore, it is assumed there would be no permanent impacts to river navigation on the Kenai River. As a result, the No Build alternative, in combination with past, present, and reasonably foreseeable future actions, would not have a cumulative effect on river navigation.

There would be construction-related impacts to river navigation through full or partial closures of the river channel to boating in the vicinity of the bridges. Impacts to river navigation would be short-term and temporary, and limited to the period when equipment, workers, and temporary structures would be located in the river. Pilings used to support the spans of temporary construction bridges at each bridge construction site would be placed to allow for continued navigation of the river, and sufficient vertical clearance would be provided at the temporary bridges for ease of navigation. For each bridge, it likely would take two seasons to build the bridge and remove the existing bridge.

Cumulative Effects - Build Alternatives

Original construction and past improvements to the Sterling Highway added bridges crossing the Kenai River. The Juneau Creek and Juneau Creek Variant alternatives would not include a new or replacement structure over any navigable waterways within the project area. However, similar to the No Build Alternative, it is assumed that replacement bridges would still be required by 2043. These bridges would have the same clearance or better than the existing bridges and, therefore, would have no adverse or cumulative impact to river navigation.

The Cooper Creek Alternative includes replacing all three bridges along the Sterling Highway as part of the project. These bridges would be built with the same horizontal and vertical clearances or better than the existing bridges, therefore there would be no adverse or cumulative impact to river navigation.

The G South Alternative includes replacing the Schooner Bend Bridge and the construction of a new bridge crossing the Kenai River near MP 52. The Cooper Landing Bridge over the Kenai River and the Cooper Creek Bridge would be replaced as part of the Sterling Highway Maintenance and Bridge Replacement projects by 2043. All bridges would be built so that the vertical and horizontal clearances would be sized at the same dimensions or larger than the existing openings. The G South Alternative would cumulatively result in an additional bridge crossing of the Kenai River compared to the No Build and other build alternatives. However, there would not be substantial adverse impacts to river navigation.

All alternatives would cause construction-related impacts to river navigation through full or partial closures of the river channel to boating in the vicinity of the bridges. Impacts to river navigation would be short-term and temporary, and limited to the period when equipment, workers, and temporary structures would be located in the river. Pilings used to support the spans of temporary construction bridges at each bridge construction site would be placed to allow for continued navigation of the river, and sufficient vertical clearance would be provided at the temporary bridges for ease of navigation. For each bridge, it likely would take two seasons to build the bridge and remove the existing bridge.

3.27.7.7 Parks and Recreation

Cumulative Effects - No Build Alternative

The Sterling Highway, along its existing alignment, fragments habitat, serves as an opportunity for the spread of invasive species, and generates noise impacts. These issues contribute to the degradation of nature-based recreation values across the project area and especially recreation values of designated Wilderness in KNWR. Without highway improvements, traffic congestion would continue to worsen, and access to recreational resources in the project area would become increasingly inconvenient. Growing congestion could detract from the recreational experience. Recreation use trends have remained steady over the past 10 years (see Section 3.8). The No Build Alternative would not change recreational lands or lands proposed as additions to the KRSMA. Water-based recreation would not be altered.

The Forest Service is reconstructing the Russian River Campground entrance and access routes to improve access. This may relieve internal congestion that occasionally reaches from the fee station back onto the Sterling Highway. The recently completed snowmobile parking facility at the end of Snug Harbor Road (Cooper Lake Hydroelectric facility project) added a winter recreation/snowmobile enhancement to the area, and the land conveyance to CIRI may result in additional visitor facilities (recreation/tourist attraction) in the area.

Access to and within the Unit 395 residential development is anticipated to use the Forest Service logging road referred to as the West Juneau Road. The Forest Service currently closes this road to motorized vehicles except snowmobiles in winter. Since West Juneau Road likely would serve as the only access to the new subdivision, the road would be plowed and sanded by either the Borough or local residents. Snowmobile use of the road may no longer be feasible along developed road segments and possibly would not be legal, although access to the Resurrection Pass Trail likely would remain open for users who drove up the road and parked within the subdivision. If alternate winter trailhead parking were not provided, it is possible that recreational users would be induced by the subdivision project to park along the edges of subdivision roads, increase use of Bean Creek Trail, or attempt to use the Resurrection Pass Trailhead at MP 53.2 (the first 4 miles of the trail are not recommended for snowmobiles due to steep, narrow sidehills). The Unit 395 residential development would inhibit or alter use of winter access to the Resurrection Pass Trail. DOT&PF and FHWA cannot predict mitigation options that the Forest Service and/or Borough may pursue, but it is reasonable to assume that involved parties would seek to maintain appropriate access to the recreational resource. Other RFFAs identified in this document are not anticipated to have any direct or indirect effect on recreation resources.

Therefore, the No Build Alternative, in combination with other past, present, and future actions, would not have a cumulative adverse effect on parks and recreation.

Cumulative Effects - Build Alternatives

The build alternatives would have direct impacts on recreational resources, including changes to the overall recreational character of Cooper Landing and the upper Kenai River, the rerouting and shortening of trails, and the likely reclassification of recreation and preservation lands. Segments of the alternatives built on new alignments would provide access to recreational lands in portions of the project area that were previously difficult to access, and ease of travel may increase use of recreation resources. Access to recreation sites along the “old” highway segment

under each build alternative would improve as a result of through-traffic predominantly using the new alignment and reducing congestion on the "old" highway.

The impacts of any of the build alternatives would be part of a century-old trend that has increased access to the area and created more recreational developments, simultaneously providing access to natural settings and wilderness-type recreation, and gradually pushing back or eliminating wilderness-type settings in favor of less-wild but still largely natural settings. This means that naturalness, wildness, "outstanding opportunities for solitude or a primitive and unconfined type of recreation" (Wilderness Act), and spiritual values of nature would be further eroded, particularly under the Juneau Creek Alternative, which is the only alternative that would use land from a designated Wilderness area. Intersection lighting, a wider paved surface, and wider area cleared of forest under all alternatives would incrementally increase the sense of engineered rather than natural surroundings and infringe on the natural dark sky and views of stars. These changes would occur in a valley already impacted by traffic noise, visual presence of roads, and lights, but would add to the sense that the KNWR designated Wilderness areas and Forest Service non-designated natural and wild areas were less natural and wild. Opportunities for wilderness recreation and sense of solitude, "escape," and renewal would be reduced.

The build alternatives, in slightly different ways described in detail in Section 3.8, would alter transportation patterns and make travel easier, including both through-travel for recreation and access to local recreation destinations.

Similarly, all would adversely impact some elements of the recreational environment, such as natural vegetation, views, trails, and waterways valued as recreational resources. The alternatives would vary in their individual impacts to recreational resources and the recreational enhancements they would provide, but all the CNF, KNWR, and State of Alaska recreation resources would continue to exist and would be expected to remain popular and well used. Use patterns would change somewhat, but recreation would be expected to remain a primary component of human activity in the project area.

Cumulative effects of RFFAs are mostly identical to those discussed for the No Build Alternative, above. Snowmobile access to the Resurrection Pass Trail that would be altered by the plowing and sanding of the road to the Unit 395 residential development would be provided by a winter trailhead pullout under the G South Alternative (Bean Creek Trailhead). Under any build alternative, it is not clear whether parking and access for snowmobiles from within the subdivision would be provided, as discussed above under the No Build Alternative. If no replacement winter access were provided, some loss of recreation access would occur. But access would remain under all alternatives through the Bean Creek Trail, and under the Cooper Creek and G South alternatives via a rebuilt pullout at Resurrection Pass Trail, and under the Juneau Creek alternatives via the existing pullout at Resurrection Pass Trail. Under the Juneau Creek alternatives only, if access to Unit 395 were provided via ramps off the new highway rather than off the existing highway, the West Juneau Road may continue to connect the existing highway and Unit 395 for recreational access. Use likely would decrease for snowmobile access to Resurrection Pass Trail, because the route would no longer provide through-passage for snowmobiles, but use may increase overall as property owners walk, bicycle, or use ATVs or snowmobiles (depending on Forest Service motorized use policies) between the Kenai River and their homes or cabins.

Overall, the build alternatives, in combination with other past, present, and reasonably foreseeable future actions, would not have a substantial cumulative adverse effect on parks and recreation.

3.27.7.8 Historic and Archaeological

Cumulative Effects - No Build Alternative

The No Build Alternative would not disturb or bury known or unknown historic properties in the project area. Activities anticipated to occur as part of the RFFAs, such as routine highway maintenance, bridge construction, and repaving, could disturb, dig up, or bury historic properties adjacent to the highway. Private and commercial development, and continued updates to Federal, State, and Borough land use planning could impact unidentified and known historic properties. Continued development along and adjacent to the existing highway corridor, as described in current local land use plans, would increase the potential for impacts on both unidentified and known historic properties.

As a result of the RFFAs, increased development and access to currently inaccessible areas from development of residential areas (e.g., senior citizen housing, CIRI Tract A development, and Cooper Landing subdivisions), recreation facilities (e.g., Snug Harbor Road snowmobile parking), and Cooper Lake Hydroelectric projects (e.g., adding water to Cooper Creek, upgrading access road) would increase the potential for disturbance of historic and prehistoric sites currently protected because of their remote locations.

Gradual development would likely continue to occur in subdivisions and undeveloped areas within the Cooper Landing area, and this increased human activity could result in potential destruction of unidentified historic properties. At the same time, the Tribal entities and Federal and State land management agencies are likely to continue to identify and protect cultural resources. The research center planned by CIRI would aid in formally protecting cultural resources in the area.

The No Build alternative, combined with past, present, and reasonably foreseeable future actions, has the potential to have a cumulative effect on historic and archaeological resources. Other RFFAs, such as the Cooper Lake Hydroelectric project, will be studied by FERC and would address impacts to cultural resources from that project. These measures would minimize the potential cumulative impacts on historic and archaeological resources.

Cumulative Effects - Build Alternatives

All build alternatives would adversely affect some known historic properties. Potential for additional impacts from RFFAs are similar to those described above for the cumulative effects under the No Build alternative. These include the potential for disturbing, digging up, or burying undocumented historic properties adjacent to the highway from activities such routine highway maintenance, bridge construction, and repaving. Increased development and access to currently inaccessible areas from development of residential areas and recreation facilities would increase the potential for disturbance of historic and prehistoric sites currently protected because of their remote locations.

The impacts of past, present, and reasonably foreseeable future actions, combined with the impacts of the build alternatives, would result in an adverse cumulative effect on historic properties. As most historic properties in the project vicinity are buried archaeological sites,

there is not anticipated to be a cumulative indirect (visual) effect to cultural resources. The Forest Service, in its role as cooperating agency, has stated its concern that while there may not be extensive visual impacts to individual historic properties, there may be a broader, cumulative impact to archaeological values of the historic districts, cultural properties or trail systems. See Section 3.27.7.13 for additional discussion of cumulative impacts to the visual environment.

FHWA, in consultation with SHPO, Tribal governments and organizations, the Russian River Lands Act Memorandum of Understanding Group, land managing agencies, and other identified Section 106 consulting parties, is developing an agreement document to address adverse effects to identified historic properties, in accordance with Section 106 of the NHPA. When the selected alternative is identified, mitigation will be implemented to provide protection against future project area disturbances or impacts on documented and undocumented sites. Measures outlined in Section 3.9.2 and Chapter 4 will mitigate project-related impacts and will benefit the overall understanding of historic and cultural resources in the project area, thereby lessening overall cumulative impacts.

3.27.7.9 Water Bodies and Water Quality

Cumulative Effects - No Build Alternative

The No Build Alternative does not have any direct or indirect impacts on water bodies and water quality. The No Build Alternative would not affect surface water quantity or groundwater quality and quantity. However, the existing highway does not meet current storm water design standards for drainage, storm water runoff, and vehicle pollutants, and pollutants draining from the roadway would continue to affect water quality (HDR 2003a). As population and traffic grow, runoff from roadways would increase and contribute to additional nonpoint pollution and would introduce runoff into Cooper Creek and other Kenai River tributaries. In addition, the risk of vehicle crashes that would result in pollutants in the Kenai River or adjoining wetlands and connected waterways would remain high.

Development associated with the RFFAs could affect water bodies by encroaching on rivers, streams, and possibly Kenai Lake; modifying topographic features in the watershed with site grade changes; changing stream channels with culvert and bridge crossings; and altering runoff volumes. River-bank stabilization with the Sterling Highway MP 57 Erosion Protection Project and bridge construction and removal under the Sterling Highway Maintenance and Bridge Replacement RFFA, including culvert installation activities and river-bank stabilization, may result in short-term sedimentation and turbidity increases to the Kenai River and other streams in the project area. Riparian restoration work for the CNF Cooper Creek Restoration project may result in short-term sedimentation and turbidity increases. Impacts to water quality during highway construction could occur from earth-moving activities, temporary increases in nonpoint source pollutant runoff, and debris generation. Spills, leaks, and minor loss of construction material into the water are possible, which could temporarily affect water quality. No measurable adverse long-term impacts to the water courses and the quality of the water are expected as a result of construction activities. Due to the ongoing potential for nonpoint source water pollution associated with the No Build Alternative, combined with the potential for encroachment on water bodies by RFFAs, a cumulative effect on water bodies and water quality would occur.

The impacts of the RFFAs would be minimized through the Borough requirements that residential and commercial development is set back from streams and vegetation clearing and grading activities is limited adjacent to water bodies (Ordinance 2013-18). This should minimize

future development impacts and therefore cumulative impacts on water bodies along the Kenai River and within the project area.

Cumulative Effects - Build Alternatives

All build alternatives involve crossing water bodies and result in an increase in impervious surfaces, which would increase runoff, including runoff into water bodies. Bridge construction and removal, culvert installation activities, and river-bank stabilization may result in short-term sedimentation and turbidity increases to the Kenai River and other streams in the project area. Impacts to water quality during highway construction could occur from earth-moving activities, temporary increases in nonpoint source pollutant runoff, and debris generation. Spills, leaks, and minor loss of construction material into the water are possible, which could temporarily affect water quality. Short-term impacts from the curve improvements at MP 45 could include the release of debris into surface water and nearby Kenai Lake.

However, the new roadway sections would be designed and constructed to meet the current standards for storm water drainage and storm water runoff. DOT&PF is committed to maintaining a functioning drainage system despite global climate change that may alter precipitation and drainage patterns over time. Because micro-climates can vary from drier to wetter in the changing climate, DOT&PF would monitor its culverts to determine whether alterations are needed to support changes in flows.

The risk of pollutants reaching the Kenai River through spills resulting from vehicle crashes would be reduced, as each build alternative would have a greater percentage of roadway set further away from the Kenai River compared to the No Build and existing highway. In addition, removing through-traffic from segments close to the river would help to mitigate any adverse effects associated with an increased impervious area.

Impacts and minimization measures associated with the RFFAs are identical to those discussed under Cumulative Effects – No Build Alternative. Therefore, the build alternatives, combined with the past, present, and reasonably foreseeable future actions, would have a cumulative impact on water bodies and water quality. These cumulative impacts would be minimized through the Borough requirements that development to be set back from streams and vegetation clearing and grading activities be limited adjacent to water bodies (Ordinance 2013-18). Best management practices should avoid and minimize short-term construction impacts to water quality.

3.27.7.10 Air Quality and Climate Change

Cumulative Effects - No Build Alternative

Under the No Build Alternative, traffic congestion would continue to exist, resulting in decreasing air quality in localized areas. Development RFFAs that would increase residential development would increase local traffic due to the addition of residential dwellings. Construction activities associated with the bridge construction and repaving projects, as well as other development RFFAs, would result in temporary impacts to air quality from increased dust and particulate matter contained in vehicle and equipment emissions. Dust from dirt, rock, and other fine materials can become airborne when being transported in uncovered trucks and when vehicles cross dry, unpaved dirt surfaces. Ambient carbon monoxide (CO) and nitrogen oxides (NO_x) levels are expected to increase during construction, but are not expected to exceed air quality standards.

Therefore, the No Build Alternative, combined with past, present, and reasonably foreseeable future actions, has the potential to have a cumulative effect on air quality. However, National Ambient Air Quality Standards are unlikely to be exceeded and therefore the effect would be minimal.

Several mitigation measures would be used to minimize adverse air quality impacts during construction, as required by the Alaska Pollutant Discharge Elimination System Construction General Permit. The specific best management practices proposed and their frequency of use would be determined by the contractor, and outlined in the project Storm Water Pollution Prevention Plan.

Cumulative Effects - Build Alternatives

None of the build alternatives are anticipated to have direct or indirect impacts on the project area exceeding NAAQS. Similar to the No Build Alternative, local traffic increases associated with RFFAs may have a cumulative effect on air quality.

Project Greenhouse Gas (GHG) Emissions Contribution to Global Climate Change

The EPA, in its comments on the Draft SEIS, requested that climate change issues be evaluated consistently with the Council on Environmental Quality (CEQ) December 2014 revised draft guidance for Federal agencies' consideration of GHG emissions within NEPA documents. That guidance states that quantification of GHG emissions is not warranted if the project is likely to cause a change in GHG emissions of less than 25,000 metric tons of GHG emissions per year, unless that quantification is easily accomplished. That threshold is approximated at about a 200,000-vehicle-miles-traveled (VMT) change per day using 2035 vehicle emission rates (Houk, personal communication 2015). This project, with an approximate design year average daily traffic (ADT) of 4,000 vehicles per day across a 14-mile-long project corridor, would be approximately 56,000 VMT per day *in total*. The build alternatives would not increase ADT, and would only incrementally increase roadway length (0.6–0.7 mile). Typically, construction emissions associated with a new roadway account for approximately 5 percent of the total 20-year lifetime emissions from the roadway (although this can vary widely with the extent of construction activity and the number of vehicles that use the roadway). Even including construction emissions, it is highly unlikely that any of the build alternatives would lead to an increase of 25,000 metric tons of GHG emissions per year compared to the No Build Alternative.

The project is anticipated to reduce congestion and crash rates. The improvements would reduce delay and idling, which would be considered a benefit in terms of GHG emissions. On the other hand, each of the build alternatives would increase the road grade compared to the No Build Alternative, which would increase emissions. Construction and maintenance of the roads also would generate GHG emissions. Earth-moving and related construction activities involve a considerable amount of energy and result in GHG emissions. The manufacture of the materials used in construction also would contribute GHG emissions. The FHWA Infrastructure Carbon Estimator tool projected about 1,000 metric tons of GHG emissions per year over 20 years for constructing/reconstructing 30 lane miles of highway and three bridges.

The CEQ released final guidance in August 2016 and then rescinded the guidance in March 2017. However, based on the small scale of the project changes to GHG emissions, FHWA maintains that it is not meaningful or useful to compare GHG emissions among alternatives. In general, FHWA has concluded that GHG changes from the project build alternatives would not

play a meaningful role in a determination of the environmentally preferable alternative or the selection of the preferred alternative. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" (40 CFR 1502.22(a)) or to making a decision in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts [23 CFR 771.105(b)]. This determination is not to be confused with ignoring the contribution of the transportation sector toward U.S. GHG emissions. See the Mitigation for Global GHG Emissions section below for details of broad-scale policy and procedures underway by both Federal and State groups to address reducing GHG emissions.

Mitigation for Global GHG Emissions

To help address the global issue of climate change, the U.S. Department of Transportation (USDOT) is committed to reducing GHG emissions from vehicles traveling on our nation's highways. USDOT and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward lower carbon intensive fuels. The agencies have jointly established new, more stringent fuel economy and GHG emissions standards for model year 2012–2025 cars and light trucks, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on September 15, 2011, the agencies jointly published the first fuel economy and GHG emissions standards for heavy-duty trucks and buses.[1] Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce carbon dioxide emissions in future years. These emissions standards, implemented in concert with national fuel economy standards, are a major factor in mitigating the impacts of the increase in VMT. The EPA projects that vehicle energy efficiency (and thus GHG emissions) on a per-mile basis will improve by 28 percent between 2012 and 2040 (Houk, personal communication 2015). This improvement in vehicle emissions rates is more than sufficient to offset the increase in VMT associated with the project.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly carbon dioxide emissions—and to assess the risks to transportation systems and services from climate change. In an effort to assist states and metropolitan planning organizations in performing GHG analyses, FHWA has developed a *Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process.* The Handbook presents methodologies reflecting good practices for the evaluation of GHG emissions at the transportation program level, and will demonstrate how such evaluation may be integrated into the transportation planning process. FHWA has also developed a tool for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and in meeting state GHG reduction targets and goals. To assist states and metropolitan planning organizations in assessing climate change vulnerabilities to their transportation networks, FHWA has developed a draft vulnerability and risk assessment conceptual model and has piloted it in several locations.

[1] For more information on fuel economy proposals and standards, see the National Highway Traffic Safety Administration's Corporate Average Fuel Economy website: http://www.nhtsa.gov/fuel-economy/.

At the State level, project planning activities are key to reducing GHG from highway projects, and mitigation of GHGs. To this end, Alaska created the Alaska Climate Change Sub-Cabinet in 2007 under Administrative Order 238. This resulted in the formation of the Climate Change Mitigation Advisory Group. The Mitigation Advisory Group, tasked with analyzing mitigation options to reduce GHG emissions in Alaska, submitted its Mitigation Advisory Group Final Report in 2009. Chapter 7 of the report identified measures to mitigate emissions resulting from transportation and land use patterns. Suggested measures included: reducing idling times for diesel and gasoline vehicles, requiring DOT&PF-approved congestion management plans for all high-traffic-volume construction projects, and promoting the use of alternative fuel vehicles. Alaska also has initiated activities to prepare infrastructure in the state for current and future impacts of climate change.

Even though project-level mitigation measures will not have a substantial impact on global GHG emissions because of the exceedingly small amount of GHG emissions involved, the following measures during construction will have the effect of reducing GHG emissions:

- To reduce impacts associated with construction delays and changes in traffic flow, the contractor would be required to create and execute a Transportation Management Plan (TMP), which would minimize construction-related congestion and would maintain traffic flow throughout the construction site.
- To reduce impacts associated with construction equipment, unnecessary idling of construction vehicles, trucks, and heavy equipment would be prohibited.
- The construction contractor would be required to routinely maintain and service all construction vehicles, trucks, and equipment to ensure they are in proper working condition, and therefore running as efficiently as possible.
- To reduce energy used to retrieve construction materials, construction equipment and material would be located as close to project construction sites as possible to reduce hauling distances and energy consumption.

These activities are part of a program-wide effort by FHWA to adopt practical means to avoid and minimize environmental impacts in accordance with 40 CFR 1505.2(c).

In summary, this document does not incorporate a quantified analysis of the GHG emissions or climate change effects of each of the alternatives because the potential change in GHG emissions is very small in the context of the affected environment. Because of the insignificance of the GHG impacts, those impacts will not be meaningful to a decision on the environmentally preferable alternative or to a choice among alternatives. As outlined above, FHWA is working to develop strategies to reduce transportation's contribution to GHGs—particularly carbon dioxide emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue. Finally, the construction best practices described above represent practicable project-level measures that, while not substantially reducing global GHG emissions, may help reduce GHG emissions on an incremental basis and could contribute in the long term to meaningful cumulative reduction when considered across the Federal-aid highway program.

3.27.7.11 Floodplains

Cumulative Effects - No Build Alternative

Past construction of the Sterling Highway placed the highway facility within what is now understood and mapped as the Kenai River and Kenai Lake floodplain. The No Build Alternative would not change existing encroachments. The Sterling Highway MP 57 Erosion Protection Project is addressing embankment erosion from the river moving closer to the highway after a fall 2012 flood, and the proposed Cooper Creek Restoration Project would enhance floodplain function along Cooper Creek. Existing and updated regulatory processes established within the Borough Flood Management Program and by other resource agencies at the time of project design and permitting would prevent impacts from RFFAs. Design and placement of the replacement bridges would improve flood carrying capacity. While bridge construction activities may require work platforms to be temporarily placed within the 100-year floodplain, such temporary actions would be evaluated and require approval through the permit process. Therefore, the No Build Alternative, in combination with other past, present, and reasonably foreseeable future actions, would not have a cumulative adverse effect on floodplains.

Cumulative Effects - Build Alternatives

Each of the build alternatives would have varied impacts to floodplains within the project area. Only the bridge replacements as part of the Sterling Highway Maintenance and Bridge Replacement RFFA would involve activities in the regulated floodplain. The design of the replacement bridges would improve flood carrying capacity. Mitigation of impacts resulting from the encroachment and fill in the floodplains would be established during the Borough floodplain development permit review process, including any other applicable permit reviews required for bridge construction. The design would be accomplished in compliance with floodplain regulations and policies that exist at that time. Therefore, the build alternatives, in combination with other past, present, and reasonably foreseeable future actions, would not have a substantial cumulative adverse effect on floodplains.

3.27.7.12 Noise

Cumulative Effects - No Build Alternative

Under the No Build Alternative, the existing highway corridor would be affected by modest increases in traffic noise between 2012 and 2043 due to annual increases in traffic volumes. Existing traffic noise measurements show that two sensitive noise receptors currently experience highway traffic noise above DOT&PF noise impact thresholds. An additional three receptors would be impacted by 2043 (see Appendix D, *Highway Traffic Noise Assessment*).

Besides highway traffic, sound is also generated in the project area by aircraft, boats on Kenai Lake, snowmobiles, and all-terrain vehicles. Homeowners, businesses, and land management agencies undertake semi-industrial activities such as cutting trees and firewood or building and maintaining facilities. All of these noise-generating activities are associated with past actions that developed and are still developing the area.

The RFFAs identified and discussed in Section 3.27.4 are not anticipated to substantially alter vehicle traffic volumes, roadway alignments, or vehicle mix enough to have a noticeable affect on traffic noise in the project area. RFFAs that would result in further development within the

project area would result in new noise sources, mostly minor or intermittent (e.g., chainsawing, lawn mowing, and home repairs), in new locations.

Repaving, bridge replacement, and other maintenance activities on the existing highway would create temporary noise effects beyond the usual highway traffic noise. Bridge replacement could include placing new piers, which could involve the noise of pile driving. Both the Cooper Creek and Schooner Bend bridges are located close to campgrounds and recreation trails.

Traffic noise associated with the No Build Alternative, in combination with past, present, and reasonably foreseeable future actions, would not have substantial cumulative effect. Construction phasing and mitigation measures would be used to minimize construction noise impacts on sensitive properties.

Cumulative Effects - Build Alternatives

The build alternatives would increase traffic noise levels at certain noise-sensitive receptors and would decrease noise levels at other sensitive receptors, as described in Section 3.15. The other sources of sounds would be as described above for the No Build Alternative.

Noise measurements and noise modeling in the project area suggest that traffic on the existing highway is a substantial generator of noise near the highway, but that low sound levels predominate at a distance from the existing highway. The proposed realignments under the build alternatives would alter the locations of project area traffic and would place a second road alignment on portions of the landscape, splitting traffic onto two alignments that each would generate sound. This would spread traffic noise, mostly at low levels, over a broader area.

The noise measurements taken in the project area for this project measured the totality of sound generated from all sources. The noise modeling focused on traffic noise. Between them, the indication is that sound levels mostly are low to moderate in the project area. Because the project is not expected to induce a higher volume of traffic, overall traffic noise is not expected to increase substantially. However, the locations where traffic noise is generated would change. Also, each build alternative includes a segment built on a new alignment that would cause vehicles to climb to higher elevations than the existing highway and then descend; climbing and descending generate more sound from laboring engines and the potential use of compression brakes in trucks than result from travel on relatively flat terrain.

As indicated under the No Build Alternative, RFFAs that would result in further development within project area subdivisions would result in new noise sources, mostly minor or intermittent (e.g., chainsawing, lawn mowing, and home repairs), in new locations.

Depending on location within the project area, therefore, the cumulative sound generated from all sources would be more likely to increase than decrease, but could decrease in some areas. Under most build alternatives, decreases would occur at most locations within the heart of the Cooper Landing community. The Cooper Creek Alternative would have fewer community locations with decreases than the other alternatives. Under all alternatives, locations near proposed development (e.g., Unit 395, CIRI Tract A) and near segments of highway built on a new alignment would experience increases in sound levels. Overall, the sound levels and noise associated with the build alternatives, in combination with past, present, and reasonably foreseeable future actions, would not have substantial cumulative effect.

DOT&PF would use construction phasing and mitigation measures to minimize construction noise impacts on sensitive properties from a build alternative and the Sterling Highway Maintenance and Bridge Replacement RFFA.

3.27.7.13 Visual Environment

Cumulative Effects - No Build Alternative

The RFFAs would introduce additional cuts, fills, lighting, and linear elements where there are presently few. River users would be unlikely to have views of RFFA development due to topography or visual limitations posed by vegetation. Unit 395 residential development and access roads would potentially affect the visual quality and characteristics of the West Kenai River Uplands landscape (Landscape Unit 8; see Section 3.16 and Map 3.16-1).

No direct impacts are anticipated to visual resources under the No Build Alternative. Therefore, the No Build alternative, in combination with past, present, and reasonably foreseeable future actions, would not have substantial cumulative effect on visual resources.

Cumulative Effects - Build Alternatives

All build alternatives would impact Key Views by introducing new cuts, fills, additional street lights, and manmade elements (unusual line and form) in previously more-natural settings. New roadway alignments would provide new views, and reducing traffic on the segments that would become the "old" Sterling Highway under each alternative would improve the scenic quality of that segment. See Section 3.16 for details. These effects would be combined with visual effects of past actions and RFFAs. Unit 395 residential development and its access roads (or potential interchanges for access under the Juneau Creek alternatives) would create new cleared areas and visual patchwork, mostly when viewed from high elevations.

The overall cumulative impact would be that the visual effects of roads (linear elements through the landscape) and associated cuts and fills, once contained to a smaller area, would occur over a greater area. Bridge replacement activities, both those under the build alternatives and those performed as part of the Sterling Highway Maintenance and Bridge Replacement projects, would involve the use of large cranes that would be onsite for many months for pile driving and girder placement. This equipment would be visible at a distance and could cause temporary impacts to visual resources.

The Forest Service, in its role as a cooperating agency, has noted that visual effects on individual historic sites may contribute to a cumulative effect on values associated with cultural properties, trail systems, and archaeological districts. See Section 3.27.7.8 for this discussion.

Past, present, and reasonably foreseeable future actions, combined with the build alternatives, would have an adverse cumulative effect on visual resources in the geographic area of analysis (project area).

3.27.7.14 Wetlands and Vegetation

Cumulative Effects - No Build Alternative

Direct impacts to wetlands associated with construction of the original (existing) Sterling Highway are not known. The existing highway indirectly impacts approximately 60 acres of wetlands and ponds located within 300 feet of the existing highway (see Section 3.20.2.2).

Impacts on water quality and water bodies from storm water runoff and hazardous materials are described in Section 3.27.7.9, and are applicable to wetlands.

Culvert placement or replacement as part of repaving projects with the Sterling Highway Maintenance and Bridge Replacement RFFA would address identified hydrologic connectivity problems (if any). A small amount of wetlands exist in the locations of the RFFAs. State Management Unit 395 residential development contains approximately 82 acres of wetlands. The Birch and Grouse Ridge subdivisions contain approximately 77 acres of wetlands. CIRI Tract A contains less than 0.1 acre of wetlands. These approximately 160 acres of wetlands represent 1.6 percent of wetlands within the geographic area of analysis (3.6 percent of mapped project area wetlands); however, it is anticipated that only a small portion of these wetlands would be impacted as a result of development. Minor amounts of wetland impacts are expected from widening of the Sterling Highway from MP 58–79. The CNF Cooper Creek Restoration Project is anticipated to improve the riparian corridor along the lower 0.75 mile of Cooper Creek to enhance salmon habitat. RFFA development, including the Russian River Campground Entrance Improvements, senior citizen housing, State Management Unit 395 residential development, and CIRI land development, may remove vegetation within the project area. Specifically, access to Unit 395 under the No Build Alternative would remove an approximately additional 4 acres of forest and understory vegetation for improving the West Juneau Road on CNF lands. See also the Wildlife/Brown Bear discussion for loss of habitat. There are no anticipated changes or additional impacts to wetland resources or vegetation from the No Build Alternative. Therefore, the No Build Alternative, in combination with past, present, and reasonably foreseeable future actions, would have a minimal additional cumulative effect on wetlands and vegetation.

Cumulative Effects - Build Alternatives

The build alternatives would directly impact between 10 and 39 acres of wetlands (see Table 3.27-5). An additional 16 to 172 acres of wetlands would be indirectly impacted due to a reduction in wetland function in areas adjacent to direct wetland impacts. The totality of these impacts represents less than 5 percent of the wetlands within the geographic area of analysis. See Section 3.20.2 for more details on the changes to wetland functions and impacts to habitat and hydrology.

Table 3.27-5. Wetland and vegetation impacts by alternative

	Approximate Area of Impact (acres)[a]			
Wetland Type	**Cooper Creek**	**G South**	**Juneau Creek**	**Juneau Creek Variant**
Direct wetland impacts (total wetlands and ponds filled)	10.1	27.4	39.2	38.6
Indirect impacts to new alignment	16	87	172	160
Vegetation impacts	190	211	262	257

[a] See Section 3.20, Tables 3.20-5, 3.20-6, and 3.20-7.

Culvert placement/replacement would occur during scheduled pavement improvements under the Sterling Highway Maintenance and Bridge Replacement RFFA, if deemed necessary. Such improvements would maintain or improve hydrologic connectivity along sections of the "old" highway.

The build alternatives, in combination with past, present, and reasonably foreseeable future actions (60 acres of indirect wetland impacts from the existing highway, and some portion of the approximately 160 acres present within RFFA projects) would have a limited cumulative effect on area wetlands.

Vegetation impacts of the build alternatives range from approximately 190 to 262 acres (see Table 3.27-5). Within the geographic area of analysis, a rough estimate of upland areas is 356,700 acres (total watershed areas minus wetlands and lakes). The impacted area is a fraction of the available vegetated areas. On a smaller scale, approximately 85 percent of the project area is uplands (approximately 4,500 aces). The build alternative impacts represent a loss of approximately 0.06 percent of the total vegetated areas.

Access to Unit 395 under any alternative would result in loss of approximately 4 additional acres of forest and understory vegetation along the West Juneau Road on CNF lands, the same as under the No Build Alternative. For the Juneau Creek alternatives, if access were provided via ramps off the new highway, additional vegetation loss on Unit 395 (not on CNF lands) is estimated at 6 acres if one access point were provided, and 12 acres if two access points were provided.

The footprints of the Juneau Creek and Juneau Creek Variant alternatives overlap the 705-acre habitat enhancement effort from the CNF Bean North Vegetation Management Project. Clearing for the highway would further reduce hazardous fuels and provide a stronger fire break (aims of the Bean North project) but also would result in a loss of investment into improved forest health and improved moose habitat in those areas. The Cooper Creek and G South alternatives would not directly impact these habitat improvement areas.

To minimize impacts to wetlands, any project would be designed to avoid and minimize effects to wetlands when possible, and unavoidable impacts would be mitigated via the U.S. Army Corps of Engineers compensatory mitigation ruling (see Section 3.20.2.3).

The CNF Cooper Creek Restoration Project would improve the riparian corridor along the lower stretch of Cooper Creek; however, most RFFAs would involve the removal of small amounts of vegetation from large vegetated areas. Other RFFAs include development of natural areas. In most cases, previously vegetated areas would not be revegetated but would be replaced with structures. While the extent of the vegetative impacts are not known at this time, the impacts at this location are not anticipated to be large in comparison to the amount of this type of vegetation within the geographic area of analysis (nor within the project area).

The impacts of past, present, and reasonably foreseeable future actions, combined with the impacts of the build alternatives, would not have a substantial cumulative adverse effect on wetlands and vegetation.

3.27.7.15 Wildlife

Brown Bears

Cumulative Effects - No Build Alternative

Impacts to brown bears under the No Build Alternative would result from continued bear-vehicle collisions along the existing highway, and decreased habitat connectivity associated with bear avoidance of crossing the existing highway. This impact would increase in magnitude as traffic volumes continued to rise. See Section 3.22.3.1 for more details.

Despite the large runs of salmon in the Kenai River and other streams, the estimated population density is closer to the lower densities of Interior Alaska bears (non-salmon-dependent populations) than to the higher densities associated with salmon-dependent coastal brown bear populations elsewhere in Alaska (Morton et al. 2016). Human disturbance and development from past and existing projects, including forest clearing in areas with high-quality habitat on the Kenai Peninsula, may help explain this lower density (Suring, Barber, et al. 1998). The stability of the population is unknown, however the increased harvests of brown bear in 2013 and 2014 suggest that the population may have declined. The Forest Service, in its role as a cooperating agency for this EIS, has indicated their concerns about the size and stability of the brown bear population. The consequences of bear mortality resulting from vehicle collisions or DLPs as a result of the RFFAs or project alternatives are more substantial if the population is low.

Most RFFAs identified in this analysis would result in the loss of bear habitat, habitat fragmentation and decreased habitat connectivity, avoidance of habitat near human developments, and increased potential for bear-human encounters and a corresponding increase in DLP bear mortality. The Cooper Lake Hydroelectric Project/Stetson Creek diversion enhancements to water temperature in Cooper Creek and the proposed Cooper Creek Restoration Project enhancements are designed to restore and improve salmon habitat, and may increase the quality of bear habitat along the lower Cooper Creek corridor. An increase in bear use would increase the potential for bear-human encounters and conflicts near the campground and trails. The Sterling Highway Maintenance and Bridge Replacement RFFA provides an opportunity to reconstruct the existing bridges to improve wildlife access and reduce vehicle-wildlife collisions. USFWS, in its role as cooperating agency for this EIS, has commented that the cumulative fragmentation of the KNWR by continual improvements of the Sterling Highway and by associated residential development is of great concern. RFFAs that result in increased human development in bear habitat would cause the greatest impact to brown bears. The development of Unit 395, in particular, could result in the loss and fragmentation of habitat of approximately 595 acres of high quality brown bear habitat (Areas 11 and 16 on Map 3.22–1). Development of the CIRI Tract A also would impact areas identified by agencies as important habitat for brown bears (Area 17 on Map 3.22–1).

Increased human development would result in habitat loss and fragmentation, a decline in adjacent habitat quality, impediments to bear movement, displacement of bears, and behavioral changes of bears in the area. These developments could reduce the amount and availability of food resources and could affect population sustainability. A large proportion of the lands surrounding the project area are managed by the Forest Service, USFWS, and the National Park Service. Given the potential of these areas to provide important food resources for bears, the exact effects of project-related habitat disturbance on food resources and bear populations are unclear. Increased human

activity and new developments would displace brown bears from existing habitat and result in behavioral changes, such as avoidance.

In areas where increased human development is anticipated, brown bear movement could be reduced, and the remaining pieces of habitat would be of reduced value because of fragmentation, edge effects, and increased human disturbance. These impacts would continue the trend of decreasing brown bear habitat effectiveness on the Kenai Peninsula relative to undeveloped conditions (Suring, Barber, et al., Analysis of Cumulative Effects on Brown Bears on the Kenai Peninsula, Southcentral Alaska 1998). Furthermore, as road density and housing structures in brown bear habitats increase, the probability of occurrence of female brown bears with cubs in these areas would likely decrease (Goldstein, Suring and Preston 2004). The decline in use of the high-quality habitat within the project area by female brown bears could in turn affect reproduction due to the relationship between high-quality habitat and reproductive abundance in brown bears, and consequent population stability (Goldstein, Suring and Preston 2004).

Road construction associated with residential development, including expansion of current residential facilities such as the proposed senior citizen center expansion, also would result in decreased habitat effectiveness, and could result in increased mortality from bear-vehicle collisions, although these roads would be posted at a relatively low speed. The probability of human interactions resulting in DLP kills would likely increase as road and trail density increases (Goldstein, Suring and Preston 2004).

An access road to the Unit 395 across CNF via a route based on West Juneau Road would represent additional cumulative impact—particularly loss and fragmentation of habitat. The existing road is a narrow logging road (nominally one lane) with no traffic per se. A subdivision access road likely would be two lanes wide with traffic year round, albeit at relatively low levels. The improved road may need to be up to 1 mile long on CNF lands to achieve reasonable grades for the 300-foot climb from the existing highway to Unit 395. If tree clearing were 50 feet wide (30 feet wider than the existing cleared area), the loss of habitat would be about 4 acres. While a road already exists, making it wider and particularly introducing regular traffic would further fragment habitat and extend habitat avoidance areas.

Increased traffic over time on the Sterling Highway, coupled with the Sterling Highway MP 58–79 Project (wider paved surface, passing lanes), has the potential to constrain north-south movement of brown bears on the Kenai Peninsula. Concerns about constraining wildlife movements and severing the Kenai Peninsula into two distinct parts have been raised by KNWR managers (Morton 2007). If barriers to brown bear movements between bear habitats develop, populations may become isolated and could lose viability over time. This potential is exacerbated by the relatively low genetic diversity currently seen in Kenai Peninsula brown bears as compared to mainland brown bear populations (Morton et al. 2016). Furthermore, DLP kills may increase if bears need to thread their way through increasingly developed areas (ADF&G 2000). However, the MP 58–79 Project will include wildlife passage measures, such as underpass crossings of the highway, that are intended to maintain connections across the highway. The effectiveness of such crossings would not be known for many years.

For a genetically robust brown bear population, such as those found in the rest of Alaska, the existing conditions in combination with the RFFAs would likely have minimal adverse impacts. However, given the relatively low population connectivity and unique ecology of the Kenai

Peninsula population of brown bears, the impacts of past and existing conditions (as well as the No Build Alternative) in combination with the RFFAs could have substantial adverse effects on the abundance, distribution, ecology, and movement characteristics of brown bears at both local and GMU scales.

Cumulative Effects - Build Alternatives

Direct and indirect impacts on brown bears under the build alternatives would include loss of habitat from roadway development; bear displacement from, and avoidance of, remaining habitat; and a decrease in habitat connectivity. All build alternatives are likely to contribute to a cumulative impact on brown bear mortality through changes in the probability of DLP kills and vehicle collisions over the No Build scenario.

As discussed for the No Build Alternative, human disturbance and development from past and existing projects may contribute to the lower density of Kenai Peninsula brown bears compared to other salmon-dependent coastal brown bear populations in Alaska (Morton et al. 2016). Most RFFAs would adversely affect brown bears, resulting in additional loss of bear habitat, habitat fragmentation and decreased habitat connectivity, avoidance of habitat near human developments, and increased potential for bear-human encounters and a corresponding increase in DLP bear mortality. The Cooper Creek Restoration Project enhancements to salmon habitat may increase the quality of bear habitat along the Cooper Creek corridor. An increase in bear use would increase the potential for bear-human encounters and conflicts near the campground and trails. The Sterling Highway Maintenance and Bridge Replacement RFFA provides an opportunity to reconstruct the bridges on the "old" highway segments to improve wildlife access and reduce vehicle-wildlife collisions. Any of the build alternatives, in conjunction with the Sterling Highway MP 58-79 Project, have the potential to add constraints to the north-south movement of brown bears on the Kenai Peninsula. Wildlife crossing structures in both projects are meant to mitigate these impacts. Unit 395 residential development would directly impact high value brown bear habitat and increase road density.

The Forest Service, as a cooperating agency, requested that this document address the potential for providing access to State Management Unit 395 from the "old" highway and from the new highway, under the Juneau Creek alternatives, because of potential impacts to CNF resources. The access could occur from the existing Sterling Highway under all alternatives, including the No Build Alternative. Impacts of road construction across CNF lands to access Unit 395 would be the same as those described for the No Build Alternative—particularly, loss and fragmentation of habitat.

For the Juneau Creek alternatives only, if access were instead provided via ramps off the new highway, the vegetation loss is estimated at 6 acres if one access point were provided, and 12 acres if two access points were provided. It is also possible the Borough would pursue one access point via ramps and a second access point via West Juneau Road to the "old" highway. The habitat losses associated with ramps would be adjacent to the highway mostly within the highway right-of-way but possibly partially on adjacent State and Borough lands intended to be reserved as a green buffer along the highway through Unit 395.

The Juneau Creek alternatives and associated 100-foot-wide buffer strips along each side of these alternatives where they crossed Unit 395 would mean there would be less land available within Unit 395 to subdivide and make available for settlement, compared to the No Build, Cooper Creek, or G South alternatives. Reduced settlement (fewer people on the land) would

lead statistically to less potential for defense of life and property kills of wildlife and to less traffic, noise, and human activity in the vicinity of the subdivision.

Of the build alternatives, the Cooper Creek Alternative over its entire length would likely have the least incremental cumulative impact on brown bears because it would include the shortest length of roadway built on a new alignment (3.6 miles), would result in the smallest increase in road density, and would not bisect new areas identified by agencies as key brown bear habitat.

The G South Alternative would contribute a greater amount to impact on brown bears. The G South Alternative would bisect the lower Juneau Creek drainage, an area identified by the interagency working group as important habitat for brown bears. The increase in road density under the G South Alternative is predicted to be moderate (greater than the road density predicted for the Cooper Creek Alternative but less than that of the Juneau Creek and Juneau Creek Variant alternatives). This alternative would be a new east-west impediment to brown bear movement, with 5.6 miles of new highway roughly parallel to the existing barriers of the Sterling Highway and the Kenai River. There are currently no infrastructure barriers to bear movement on the north side of the Kenai River between about MP 50 and MP 53. Unit 395 development would not require any land reservations for the G South Alternative; therefore, it could be developed to its full extent.

Because of the length of the segment built on a new alignment (10 and 9 miles, respectively), the Juneau Creek and Juneau Creek Variant alternatives would contribute more to the cumulative effect on brown bears. These alternatives would leave a large area of important habitat intact in lower Juneau Creek; however, the combination of the new highway with Unit 395 residential development would fragment the bench lands west of the creek. This area is probably more important for moose and black bears than for brown bears, but the fragmentation would affect brown bears as well. Impacts would include loss of high-quality habitat; displacement from, and avoidance of, remaining habitat; and the constriction of brown bear movements leading to decreased habitat connectivity. The USFWS identified that either of the Juneau Creek alternatives, in combination with Unit 395 residential development, would have the greatest overall impacts on brown bears (and other wide-ranging wildlife species) of any of the build alternatives due to greater habitat alteration, fragmentation of movement corridors, and increased mortality from vehicle collisions and DLP kills.

Under all build alternatives, mitigation measures would reduce impacts. DOT&PF undertook a wildlife movement and mitigation study that aided in determining locations of wildlife crossings and other measures to accommodate wildlife movement, and DOT&PF has committed to providing them. In addition, DOT&PF would reserve access rights for the segment of each build alternative built on a new alignment, so only the limited number of side roads or driveways noted in Chapter 2 would be permitted. This would prevent strip development along the new highway and would prevent any housing or business development occurring as a result of the project. This would prevent the project build alternatives from inducing the growth changes that would cause further habitat fragmentation and wildlife movement constriction as an indirect result of the project (see Section 3.22 for details), although such impacts are considered reasonably foreseeable regardless.

The impacts of past, present, and reasonably foreseeable future actions, combined with the impacts of the build alternatives, would result in a cumulative impact on brown bears, adversely impacting local abundance, distribution, ecology, and movement patterns. The cumulative

impact of the build alternatives over the No Build Alternative is anticipated to be relatively small. It is anticipated that bear mortality as a result of vehicle collisions and DLPs would be greater under the build alternatives, but mitigation such as wildlife crossings is meant to minimize any increases and could result in decreases in collisions. The Forest Service, in its role as a cooperating agency for this EIS, has commented their concerns about the size and stability of the brown bear population. The consequences of bear mortality resulting from vehicle collisions or DLPs as a result of the build alternatives in combination with the RFFAs are more substantial if the population is low.

However, the limited data on current and historic population size and distribution for Kenai Peninsula brown bears complicate an assessment of the effects of past development activities on brown bears, and, consequently, limits the ability to appraise the potential effects of future development activities.

Moose

Cumulative Effects - No Build Alternative

Impacts on moose under the No Build Alternative would result from continued moose-vehicle collisions along the existing highway, decreased habitat connectivity due to physical and traffic impediments to highway crossings, and avoidance or reduced use of habitats along the highway corridor as traffic increased over time.

As a result of the RFFAs that include incremental growth of human developments in Cooper Landing, some degree of moose displacement, habitat fragmentation and avoidance, and decreased habitat quality would occur. Development of Unit 395, in particular, would result in the loss and fragmentation of habitat within approximately 595 acres in an area identified by agencies as important moose habitat (see Area 13 on Map 3.22–1). Road access to Unit 395 across CNF would be part of the cumulative impact—particularly loss and fragmentation of habitat. The discussion above in the Brown Bears subsection applies equally to moose. Road widening as part of the Sterling Highway MP 58–79 Project would further decrease habitat connectivity by increasing the physical impediment to crossing the highway. The recent CNF Bean North vegetation management project would have potentially positive effects on moose through improvements to moose forage. The Sterling Highway Maintenance and Bridge Replacement RFFA provides an opportunity to reconstruct the existing bridges to improve wildlife access and reduce vehicle-wildlife collisions. Positive effects would be unlikely to mitigate the overall adverse cumulative effects of development. The impacts of the No Build Alternative and the RFFAs have the potential to adversely affect the local abundance and distribution of moose in the geographic area of analysis.

Cumulative Effects - Build Alternatives

Direct and indirect impacts on moose under the build alternatives would include permanent habitat loss, fragmentation, and alteration; avoidance of habitat near the highway corridor; and increased moose-vehicle collisions. New segments of roadway likely would be a partial barrier to moose movement. DOT&PF would retain access rights along the segment of each of the build alternatives that would be built on a new alignment, so no additional side roads or driveways would be permitted. This would prevent strip development along the new highway, preventing further habitat fragmentation and wildlife movement constrictions associated with this project (see Section 3.22 for details).

Combined with the RFFAs, the build alternatives would contribute to a cumulative effect on moose, including adverse effects on the local abundance, distribution, and movement characteristics of moose.

Of the build alternatives, the Cooper Creek Alternative would likely have the least incremental cumulative impact on moose because it would include the shortest length of new roadway (3.6 miles) and would not impact important moose habitat near Bean Creek and west of Juneau Creek. The new highway segment would occur south of the river near existing development in Cooper Landing. Wildlife movement in this area already is influenced by the existing highway, community development, and the river.

The G South Alternative would contribute to a greater cumulative impact on moose due to its location (crossing important moose habitat near Bean Creek and Juneau Creek) and length of the new road (5.6 miles). The Bean North Vegetation Project created moose habitat enhancement zones north and west of the alternative's crossing of Juneau Creek, which may draw moose close to the proposed highway. There are currently no infrastructure barriers to moose movement on the north side of the Kenai River between about MP 50 and MP 53. The addition of collision threats and a movement barrier where there were none before would impact moose.

The Juneau Creek and Juneau Creek Variant alternatives would contribute to the greatest cumulative impact on moose due to their length of new roadways (10 and 9 miles, respectively) and locations (crossing important moose habitat near Bean Creek and Juneau Creek). The Juneau Creek alternatives would overlap with the moose habitat enhancement zones created by the CNF Bean North Vegetation Project, resulting in a loss of that habitat investment as well as potentially increasing conflicts with moose in those areas. There are currently no infrastructure barriers to moose movement on the north side of the Kenai River between about MP 50 and MP 53. The addition of collisions threats and a movement barrier where there were none before would impact moose. Under any alternative, if access to Unit 395 development were across CNF, the access road would represent cumulative impact—particularly, loss and fragmentation of habitat. This would be the same as indicated above under the No Build Alternative. Under the Juneau Creek alternatives, it is possible the Borough or Forest Service would propose direct connection from the highway to Unit 395. This would result in a loss of an additional 6 acres of land if one interchange were built, and 12 acres if two interchanges were built. The discussion above in the Brown Bears subsection applies equally to moose. In general, the Juneau Creek alternatives and Unit 395 development together would bisect and fragment the topographic bench area west of Juneau Creek that is considered good moose habitat.

DOT&PF completed a wildlife movement study to aid in the design of wildlife undercrossings and other mitigation measures to accommodate wildlife movement across the build alternatives in important areas. These crossings are intended to minimize collisions between motor vehicles and wildlife and retain connections between habitat areas.

As discussed for the No Build Alternative, most RFFAs would adversely affect moose habitat and movement. The Sterling Highway Maintenance and Bridge Replacement RFFA may provide an opportunity to reconstruct the bridges on the "old" highway segments to improve wildlife access and reduce vehicle-wildlife collisions. The impacts of past, present, and reasonably foreseeable future actions, combined with the impacts of the build alternatives, would adversely affect the local abundance and distribution of moose in the project area, resulting in a cumulative impact; however, the increase in cumulative impact is anticipated to be relatively small in

comparison to the No Build Alternative. The cumulative impacts of the build alternatives and the RFFAs would have very little impact on moose abundance, distribution, or ecology at the GMU level.

Other Mammals

Cumulative Effects - No Build Alternative

Few new impacts on wolves, lynx, wolverines, river otters, black bears, Dall sheep, and mountain goats would be anticipated for the No Build Alternative. Impediments to movements and some animal-vehicle collisions would continue, and may increase, as future traffic volumes rise. Increased traffic and human use could reduce prey species (for wolves, lynx, and wolverines) and increase DLP kills of black bears. Increased displacement from habitats adjacent to the highway could occur for some species.

Most RFFAs would result in loss of habitat, habitat fragmentation, and decreased habitat connectivity; avoidance of habitat near human developments; increased potential for bear-human encounters and a corresponding increase in DLP kills (for black bears); and increased wildlife-vehicle collisions. The development of Unit 395 and the CIRI Tract A areas, in particular, would result in the loss of habitat in areas identified by agencies as important habitat for black bears (Area 16 and 17 on Map 3.22–1). Impacts to Dall sheep and mountain goats are likely to be minimal, as these species generally inhabit the higher elevation areas away from current and reasonably foreseeable human development. The development of the Birch and Grouse Ridge Subdivision could impact riparian habitat used by river otters near Bean Creek. However, the Sterling Highway Maintenance and Bridge Replacement RFFA may provide an opportunity to reconstruct the bridges to improve wildlife access and reduce vehicle-wildlife collisions.

The impacts of the No Build Alternative in combination with the RFFAs could adversely affect the local abundance, distribution, and movement characteristics of other wildlife.

Cumulative Effects - Build Alternatives

Direct and indirect impacts to wolves, lynx, wolverines, river otters, and black bears as a result of the build alternatives would contribute to a cumulative effect on these species from permanent loss of habitat, habitat fragmentation, and displacement of animals from habitat (especially for wolves, lynx, and wolverines). These impacts could contribute to lower population sizes, impediments to movements across the new highway, and direct mortality resulting from vehicle collisions (especially of wolves, lynx, and black bears) or DLP kills for black bears. River otters could be affected by project-related changes to rivers and streams, especially near Bean Creek (G South and the two Juneau Creek alternatives). Direct impacts on black bears would be similar to impacts reported for brown bears, including habitat loss, habitat fragmentation, behavioral changes due to human activity, and injury or mortality from traffic collisions and DLP kills. Increased traffic and human use could reduce prey species (for wolves, lynx, and wolverines), and increase poaching of black bears. Because Dall sheep and mountain goats generally inhabit the higher elevation areas away from the proposed build alternatives, direct and indirect impacts on them would likely be minimal.

Of the build alternatives, the Cooper Creek Alternative would likely have the smallest cumulative impact on wolves, lynx, wolverines, and river otters because the alternative would cross a limited amount of high-value habitat for these species. Cumulative impacts on wolves, lynx, and wolverines are likely to be greater under the G South, Juneau Creek, and Juneau Creek

Variant alternatives because these alternatives would result in the loss of high-value, undisturbed habitat located north of the existing highway. This includes bisecting Juneau Creek drainage, an area identified by the interagency working group as an important movement corridor for wildlife. The G South, Juneau Creek, and Juneau Creek Variant alternatives would also have a larger cumulative impact on river otters through impacts to several riparian areas.

Cumulative impacts to black bears are anticipated to be similar among the four build alternatives. The Cooper Creek, Juneau Creek, and Juneau Creek Variant alternatives each cross two areas of predicted use for black bears (Areas 2 and 10 for Cooper Creek, Areas 2 and 16 for the Juneau Creek and Juneau Creek Variant Alternatives; see Map 3.22–1), while the G South Alternative crosses just one black bear use area (Area 2 on Map 3.22–1).

As discussed for the No Build Alternative, most RFFAs would result in the loss of habitat, habitat fragmentation and decreased habitat connectivity, avoidance of habitat near human developments, and increased potential for bear-human encounters and a corresponding increase in DLP bear mortality. The Sterling Highway Maintenance and Bridge Replacement RFFA may provide an opportunity to reconstruct the bridges on the "old" highway segments to improve wildlife access and reduce vehicle-wildlife collisions.

The impacts of past, present, and reasonably foreseeable future actions, combined with impacts of any of the build alternatives, would result in a cumulative impact on wolves, lynx, wolverines, and river otters, adversely impacting local abundance, distribution, and movement. The impacts of past, present, and reasonably foreseeable future actions, combined with the impacts of any of the build alternatives, would result in a cumulative impact on black bears. The build alternatives in combination with past, present, and reasonably foreseeable future actions would not have substantial cumulative effects on Dall sheep or mountain goat populations. For all mammals discussed, any increase in cumulative impacts is anticipated to be relatively small in comparison to impacts from the No Build Alternative.

Birds

Cumulative Effects - No Build Alternative

The No Build Alternative would have minimal direct impacts on birds or habitat. Therefore, the No Build alternative, in combination with past, present, and reasonably foreseeable future actions, would not have cumulative effect on bird populations.

Cumulative Effects - Build Alternatives

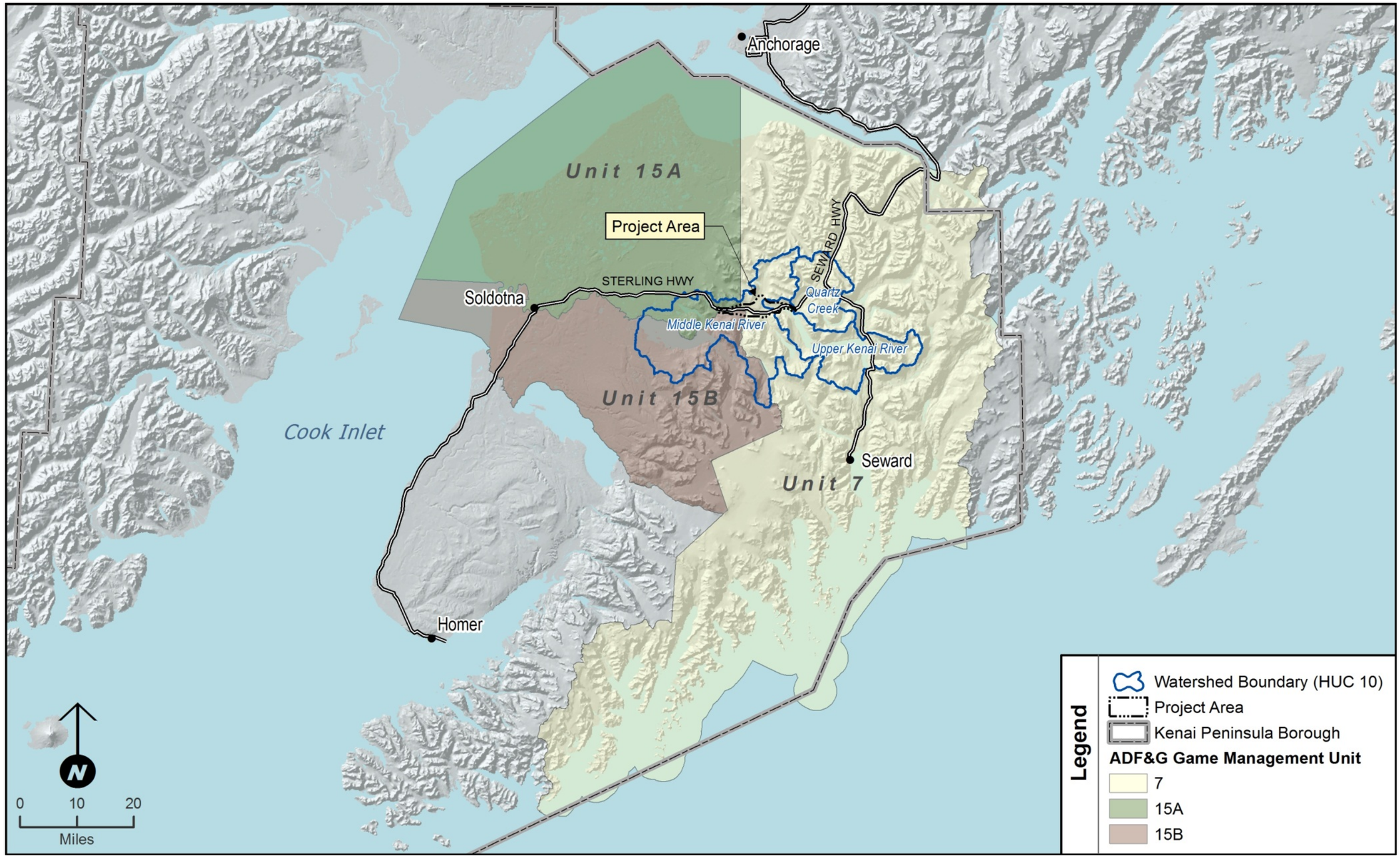
Direct impacts to birds in the project area would include a permanent loss of habitat, disturbance from human activity along the roadway, direct mortality from collisions with vehicles, and disturbance and displacement of birds due to construction activities. Direct and indirect impacts specific to bald eagles are similar to those discussed for other bird species. The loss of habitat would include the potential reduction in food sources (including decrease in available hunting areas and reduced availability of prey base), cover, breeding habitat, and perching sites. The removal of riparian habitat used by bald eagles for breeding and foraging could reduce roosting and foraging habitat in the area. Given the high degree of nest site fidelity shown by bald eagles (Jenkins and Jackman 1993), it is anticipated that the project build alternatives would have moderate impacts to bald eagle nesting activity in the project area.

Of the build alternatives, the Cooper Creek Alternative would likely have the least incremental cumulative impact on birds because it would include the shortest length of roadway built on a

new alignment (3.6 miles) and would impact the least amount of vegetated habitat (188 acres). The G South Alternative (5.6 miles) would impact 202 acres of vegetated habitat, while the Juneau Creek and Juneau Creek Variant alternatives (10 and 9 miles, respectively) would impacts 269 and 256 acres of vegetated habitat, respectively. Habitat loss as a result of the build alternatives ranges from 1.3 to 1.9 percent of mapped vegetated habitat within the project area. Improvements to sections of the existing highway would remove some riparian habitat that could eliminate bald eagle nesting and roosting habitat in this area. The Juneau Creek Variant Alternative would require the removal of one inactive bald eagle nest along its proposed alignment.

Most RFFAs, and particularly those associated with incremental growth in Cooper Landing, would result in some degree of bird displacement, habitat fragmentation, and habitat avoidance from areas with increased human access and activities. This potential fragmentation would be in addition to habitat loss, fragmentation, and displacement from past development activities. In addition, road construction and improvement activities, such as the proposed project, may allow for future increases in human activity and traffic which would result in further disturbance and displacement of bird species. Some species are likely to be displaced from preferred habitats. Depending upon the species, displaced birds would relocate to other adjacent suitable habitat areas. Habitat loss or human disturbance in riparian areas adjacent to the Kenai River would have the greatest effect on bald eagles because the upper Kenai River area has been identified as one of the more important wintering areas for bald eagles in Southcentral Alaska (Bailey, et al. 2008); however most RFFAs would not be located adjacent to the Kenai River, and substantial segments of each build alternative would be located away from the river. The current vegetation management project in the CNF would have potentially positive and adverse effects on bird species. Positive effects would not likely offset the adverse cumulative effects of development.

The habitat fragmentation and loss associated with the project build alternatives, in combination with past, present, and reasonably foreseeable future actions, would result in moderate potential disturbance and displacement of birds in the project area. The availability of vegetated habitat elsewhere within the geographic area of analysis may provide potential alternative habitat for some species. In addition, because the majority of the bird species found in the project area are migratory, the cumulative impacts associated with the project build alternatives, in combination with past, present, and reasonably foreseeable future actions, may have effects reaching beyond the geographic area of study.



Map 3.27-1. Boundaries used for cumulative impact analysis

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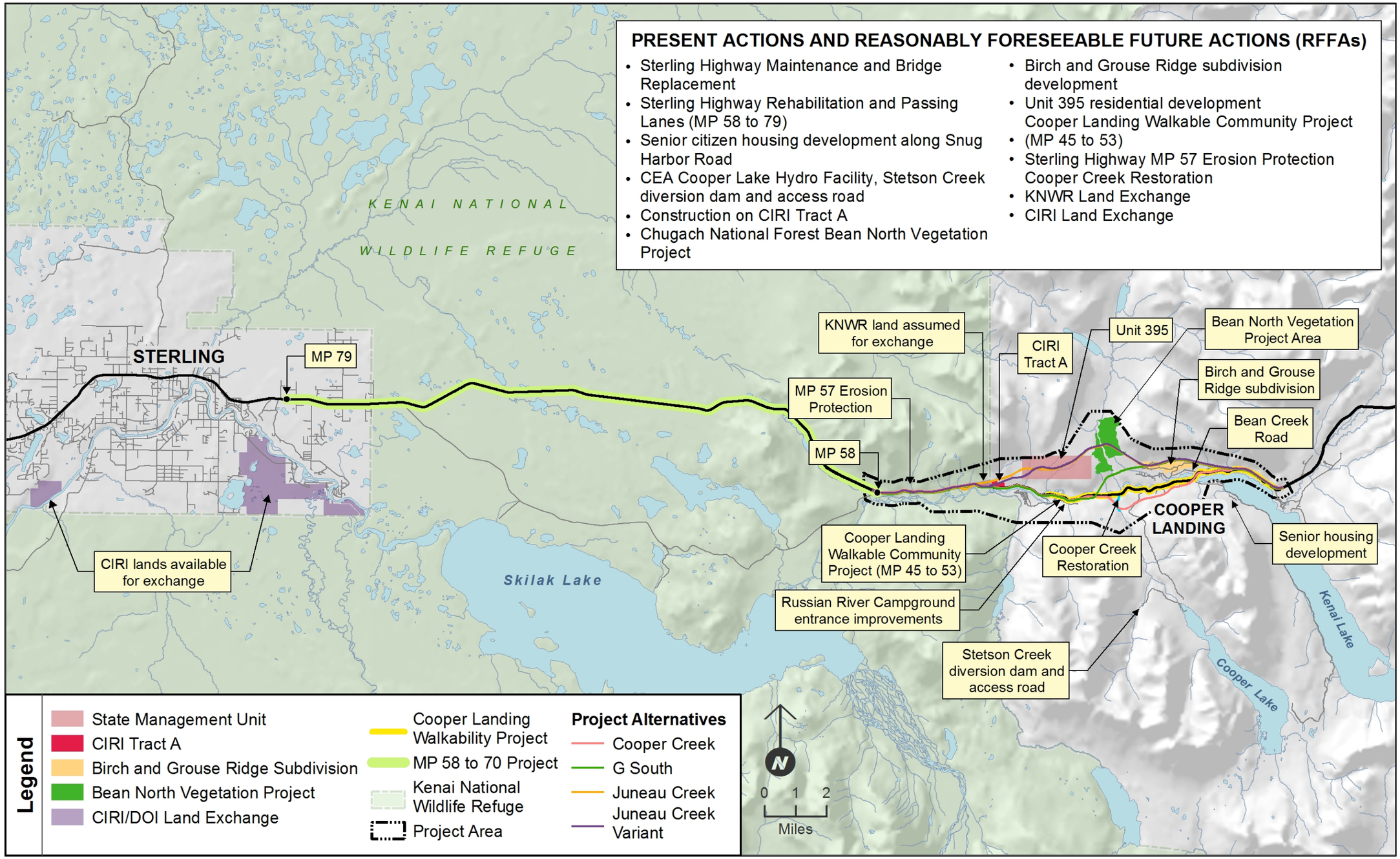

Map 3.27-2. Present and reasonably foreseeable future actions [Updated]

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