3.13 Water Bodies and Water Quality

3.13.1 Affected Environment

3.13.1.1 Water Bodies

Water within the project area flows into the Kenai River from many drainage basins and enters through both streams and subsurface flow. The major water bodies within the project area are Kenai Lake and the Kenai River and its tributaries: Fuller Creek, the Russian River, Juneau Creek, Cooper Creek, and Bean Creek (see Map 3.13-1).

Kenai Lake. Kenai Lake is a narrow, 22-mile-long, glacially fed lake that serves as the headwaters of the Kenai River. Kenai Lake has a surface area of approximately 13,800 acres, an average depth of approximately 300 feet, and a maximum depth of 541 feet (Spafard and Edmundson 2000). The fjord-like lake was formed by glaciers, which scoured a deep channel before retreating and leaving the lake impounded behind a terminal moraine[1]. Kenai Lake is fed through glacial melt from the surrounding mountain streams. Major tributaries include the Trail River and the Snow River. Smaller tributaries include Quartz Creek, Ship Creek, Primrose Creek, Porcupine Creek, Ptarmigan Creek, and Victor Creek. Kenai Lake acts as a settling pond for some of the glacial sediment transported in from tributary streams, most notably the Snow River (Scott 1982). The shoreline of Kenai Lake is fairly uniform with few inlets or irregularities. Most of the shoreline is undeveloped, with the greatest development occurring near the inlet of the Snow River, near Quartz Creek, and near the lake outlet into the Kenai River (DNR 2008b). Currently, the Sterling Highway alignment parallels the Kenai Lake shoreline from Milepost (MP) 45 to the Cooper Landing Bridge (between Milepost [MP] 47 and 48), where Kenai Lake flows into the Kenai River.

Kenai River. The Kenai River travels 82 miles from its origin at the outlet of Kenai Lake to its mouth, where it drains into Cook Inlet. There are many habitat types along the Kenai River, including floodplains, wetlands, and vegetated riparian zones. The Kenai River contains coarse streambed material within a very stable channel. These features are the result of past glacial action. The seasonal and daily fluctuations in stream flow and suspended sediment are also a result of the glaciers within the watershed. Glaciers have influenced the river's development, channel stability, protective cover, water velocities, and bottom material and size, all of which are important to spawning and rearing salmon (Dorava and Scott 1998). Currently, the entire Sterling Highway alignment between MP 47 and 60 is near the Kenai River, often with little or no buffer between traffic and the river environment. The distance from the highway to the Kenai River ranges from being immediately adjacent, to a maximum approximate distance of 1,000 feet occurring in the western part of the project area. About 77 percent of the current alignment centerline is within 500 feet of the Kenai River bank.

Fuller Creek. Fuller Creek flows south from mountain lakes to the Kenai River. It is a perennial (year-round) stream in the Kenai National Wildlife Refuge that crosses beneath the Sterling Highway near MP 57. During unusually dry seasons, this stream has been known to go dry. The

[1] A moraine is any glacially formed accumulation of unconsolidated glacial debris (soil and rock) that occurs in currently glaciated and formerly glaciated regions.

streambed in the project area is 11 to 12 feet wide and is comprised of large gravels and small cobbles. The stream has moderate flow consisting of riffles, small pools, and cascades.

Russian River. The Russian River is a major tributary of the Kenai River, flowing north from a glacier-sculpted valley at elevation 700 feet at upper Russian Lake to the confluence of the Kenai River at elevation 350 feet (12 miles in length). Most of the length of the river is floodplain channel type with a shallow slope of less than 1 percent and only very low banks that provide some flood attenuation. The tributaries draining into the Russian River are steep, contained channels.

Juneau Creek. Juneau Creek originates north of the project area and flows south through a canyon and waterfall to join the Kenai River just west of the Cooper Landing community between MP 50 and 51. It is the major stream in the project area that drains areas north of the Kenai River. Salmon migrate up the lower river to the 128-foot-high Juneau Creek Falls, located about 3 river miles upstream from the Kenai River. Juneau Creek's lower reaches (below the falls) are within the project area. Within the project area, Juneau Creek habitat is characterized by riffles with small cascades and plunge pools with a bottom of small to large gravels and small cobbles.

Cooper Creek. Cooper Creek begins at Cooper Lake and flows 4.7 river miles north to the Kenai River, dropping 750 feet along the way. The upper creek has several falls, which are impassable to salmon. The lower 4-mile stretch of the creek has no substantial fish barriers (Dorava and Ness 1999). The stream is mainly riffle habitat with coarse gravels, cobbles, and boulders. The lower one-half mile is not as steep, flowing through an alluvial fan before its confluence with the Kenai River.

Bean Creek. Bean Creek is a relatively small stream that originates at the base of mountain slopes and in wetlands in the project area just east of Juneau Creek. The main stem of Bean Creek has moderate flow with a streambed composed of small to large gravels and small cobbles. The average channel width is 5 feet and the depth ranges from 8 to 10 inches. The channel averages 3 to 4 feet wide. The habitat is mainly riffles and pools.

3.13.1.2 Water Quality

Water quality in the Kenai River drainage in general is monitored by the Alaska Department of Environmental Conservation (ADEC). In 2006, the lower 19 miles of the Kenai River were listed by the State of Alaska as impaired under Section 303(d) of the Clean Water Act; however, the impairment area is entirely outside the project area. The impairment listing resulted from repeated exceeding of State of Alaska Water Quality Standards established for Total Aromatic Hydrocarbons (pollution from fuels), attributed to outboard motor use. The enactment of clean motor regulations in 2008 has resulted in reduced hydrocarbon pollution and attainment of petroleum hydrocarbon standards for all designated uses of the Kenai River, and the river continues to be monitored (ADEC 2010).

3.13.1.3 Ambient Conditions, Including Current Roadway Runoff or Other Nonpoint Source Pollution

Alaska's Nonpoint Source Pollution Control Strategy is used by ADEC to manage pollutants in Alaska that have no specific identified source, such as a pipe or specific building (this type of pollution is known as nonpoint source pollution). The strategy identifies potential sources of pollution and suggests approaches to manage those sources to prevent pollution of Alaska's waters.

No nonpoint pollution sources have been formally identified in the project area. Roadway runoff does occur when sand, deicing agents in the sand, and potential drips of oils and lubricants are carried with melt water or rain water into adjacent ditches or tributaries and consequently into the river system. The existing highway does not meet current storm water management standard practices for drainage and storm water runoff (HDR 2003a). However, no cases of nonpoint pollution that exceed permissible limits for roadway runoff have been documented within the project area (Stevens, personal communication 2006).

Critical Aquifer Protection Areas. The State of Alaska does not have any sole source aquifers; no critical aquifer protection areas are located within the Sterling Highway MP 45–60 Project area.

3.13.1.4 Wells and Wellhead Protection

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.). These plans were approved by the U.S. Environmental Protection Agency in April 2000. The program meets all Safe Drinking Water Act requirements through the integration of three components: source water assessments of public water systems, groundwater protection, and wellhead protection.

ADEC implemented assessments of public water systems, as required under a Federal Safe Drinking Water Act program called the Source Water Assessment Program. ADEC completed the community of Cooper Landing's source water assessments in 2002 for public facilities in the area (see Map 3.13-2). Assessments are not required to be conducted for private wells or wells that regularly serve fewer than 25 people and have fewer than 15 service connections.

Protection areas were developed and included in the source water assessment report for each identified public water drinking system as a requirement of the 1996 amendment to the Safe Drinking Water Act. Wellhead Protection Areas are those areas where water carrying potential contaminants could enter the groundwater system and affect a supply well. Protection areas around the drinking water sources are broken into zones for both groundwater and surface water. These zones identify the amount of time it takes a contaminant to get to a well and distance (in some cases), referred to as the time-of-travel. Several factors, including topography, permeability, and proximity to surface water, help define wellhead protection zones.

Two wellhead protection area types, Zones A and B, occur within the project area (Map 3.13-2). Zone A represents areas within a time-of-travel equal to or less than several months, which means that a contaminant release occurring within this zone could reach the public well in as soon as a few months. Zone B represents areas requiring 2 years or less time-of-travel. This means any release occurring within these zones could take as long as 2 years to reach the source and potentially enter the aquifer associated with the well. Restrictions on development within the wellhead protection areas need to be made at the community planning level; however, the Cooper Landing Advisory Planning Commission does not address any restrictions to development within wellhead protection areas (CLAPC 1996).

Private water sources are thought to exist throughout Cooper Landing but have not been documented. Most developed private lots presumably have a well, and some homes and cabins are said to use surface water sources. The recharge areas of many of the private wells are likely to overlap the wellhead protection areas indicated on Map 3.13-2. The areas around MP 49, both north and south of the Kenai River, are not covered by a wellhead protection area (as indicated by Map 3.13-2), but these areas are also likely to be important recharge areas, given their proximity within the community of Cooper Landing. Section 3.17, Hazardous Waste Sites and Spills, presents related information on water source protection.

3.13.2 Environmental Consequences

This section describes the potential effects of the project alternatives on water bodies and water quality in the project area. Included is a discussion of the locations, types, and extent of water body modifications anticipated with the project alternatives. To the extent practicable, water bodies were avoided during design of the build alternatives; however, each alternative requires construction of bridges and culverts to cross rivers, streams, and other water bodies.

Impacts to water resources from roadway runoff are expected to be negligible in the project area due to the relatively low traffic volumes. Storm water research by the Federal Highway Administration found water quality impacts on receiving waters difficult to measure at locations with annual average daily traffic volumes below 30,000 vehicles per day (Driscoll et al. 1990). The predicted average daily traffic during peak summer months for the project area for the year 2043, ranging from approximately 9,000 to 10,500 vehicles per day, does not exceed 30,000 vehicles per day for all alternatives.

There are no sole-source or principal-source aquifers located within the State of Alaska; therefore, there will be no impact to sole source or principal source aquifers as a result of this project (EPA 2009).

3.13.2.1 No Build Alternative

Direct and Indirect Impacts

The No Build Alternative would maintain existing conditions and trends. With continued slow population and traffic growth in the project area, water bodies and water quality could be affected in minor ways. Under the No Build Alternative, the existing highway still would not meet current storm water management standard practices for drainage and storm water runoff, and vehicle pollutants and pollutants draining from the roadway would continue to affect water quality (HDR 2003a). Pollutants might include particulates, petroleum products, metals, solvents, and sodium chloride used as a deicing agent. No case of nonpoint source pollution exceeding limits is anticipated from roadway runoff.

Impacts to the Kenai River due to contamination from oil or other hazardous substance spills from truck/vehicle crashes are a concern of local businesses that depend on the Kenai River for their livelihood. Potential impacts to Kenai River water quality and aquatic life from hazardous material spills are more likely to occur where the roadway is narrow and winding, without shoulders, and close to the Kenai River, as it is under the No Build Alternative. The risk of vehicle crashes that would result in pollutants in the Kenai River or adjoining wetlands and connected waterways is discussed in Hazardous Waste Sites and Spills, Section 3.17.2.

3.13.2.2 Issues Applicable to the Build Alternatives

Direct impacts on water bodies and water quality would result from new and replacement bridges and culverts and from new roadway embankment placed in water bodies. Table 3.13-1 presents the number of new and replacement bridges, the number of culvert crossings, and the total number of stream crossings for the four build alternatives. New culvert crossings and bridge crossings would be likely to alter natural flow patterns and habitat in streams at the location of the crossing, and possibly upstream and downstream.

Table 3.13-1. Summary of direct and indirect impacts on water bodies under build alternatives

	Cooper Creek	G South	Juneau Creek	Juneau Creek Variant
Number of new bridge crossings (location)	1 (Cooper Creek)	2 (Juneau Creek; Kenai River)	1 (Juneau Creek)	1 (Juneau Creek)
Number of replacement bridge crossings (location)	2 (Kenai River)	1 (Kenai River)	0	0
Approximate number of small stream crossings[a,b]	57	73	63	63
Total water body crossings	**60**	**76**	**64**	**64**
Number of crossings, anadromous fish streams [c]	8	8	2	2
Percent length within 500 feet of Kenai River and major tributaries [d]	56	45	25	26
Percent length within 300 feet of Kenai River and major tributaries [d]	43	33	15	16

[a] The number of stream crossings does not include the bridge crossings listed above.

[b] Minor crossings of seeps and other small drainages were identified in the field for all other alternatives; however, portions of the Juneau Creek Variant have not yet been field-reviewed. Because the Juneau Creek Variant occupies the same hill slope as the Juneau Creek Alternative, the same number of small crossings is assumed.

[c] Includes crossings that would completely span the stream with bridges more than 100 feet above the water, i.e. Cooper Creek and Juneau Creek.

[d] The proximity of all traffic to the Kenai River would retain the risk that a spill on the highway could pollute the river, because the risk of a spill entering the Kenai river diminishes the farther from the Kenai River the spill occurs. The percentage of the alignment length within a 500-foot buffer zone of the Kenai River and its major tributaries (Kenai Lake, Cooper Creek, Juneau Creek, and Russian River) is one metric to assess the environmental sensitivity of each alternative to water quality risks associated with hazardous materials. A 300-foot buffer setback is advocated by the *Kenai River Comprehensive Management Plan*, and is also presented. For comparison, 77% of the existing highway/No Build Alternative lies within 500 feet of the Kenai River, and 56% lies within 330 feet. See Section 3.17 for additional discussion of spills and risk of pollutants reaching the Kenai River.

All build alternatives would result in an increase in storm water runoff because the project area would have less vegetation and more paved surfaces—a wider highway where rebuilt, and all-new highway in the segments built on a new alignments. For example, each of the alternatives would widen the highway along Kenai Lake where they have a common footprint. Impacts from storm water runoff would not be substantial enough to impact wells and wellhead protection.

All build alternatives would be designed to maintain existing surface water courses and would incorporate grass-lined ditches and swales. However, a new and wider highway would alter local drainage patterns in small ways. Replacement Kenai River bridges proposed for the Cooper Creek and G South alternatives would be expected to have only minor long-term additional impacts to the Kenai River, such as additional shading of river and riparian habitat under the bridge and minor changes to the river flow around bridge piers. Replacement bridges could result in fewer piers in the water, and DOT&PF has committed to bridge designs that include no more piers in the water than exist today.

Widening of the existing highway would require fill along the edge of the Kenai River (a longitudinal encroachment) for all build alternatives, primarily at the western end of the project where all alternatives share the same alignment. There are five longitudinal encroachments needed for the Cooper Creek Alternative, four for the G South Alternative, and one for the Juneau Creek Variant Alternative (see Section 3.19, Floodplains, and Map 3.19-1). Once placed and armored with large rock to minimize erosion, only minor siltation of the river would occur in these areas. Stabilized river banks would be different than natural river banks, which erode or accumulate material and allow the river course to change over time, usually in response to floods. Rock armoring in the river's edge would be designed to be unchanged by flood flows, and the river energy would be transferred in minor ways to other, unprotected parts of the river's banks. Because the areas of fill are principally areas where there already is fill and armoring, these changes are expected to be minor. The amount of fill would be minimized through the use of steeper slopes and retaining walls where feasible.

In addition, the build alternatives vary in risk of vehicle crashes that could result in direct impacts to water bodies and water quality from pollutant discharges. See Section 3.17.2 of Hazardous Material Sites and Spills for methodology determining spill risk and a discussion of impacts to surface and subsurface migration pathways and sensitive resources (including downgradient residences). The amount of road length of the main highway close to the Kenai River varies by alternative. In general, in regard to the varying risk of pollutants entering the river or contaminating drinking water sources, each of the build alternatives would improve the highway to meet current standards, reducing the risk of crashes overall, and more of the resulting highway (including most area traffic) would be located away from the Kenai River. This would result in reduced risk of spills directly into the Kenai River and allow more time for spill cleanup before spills reached the river. Table 3.13-1 and the descriptions below present these variations.

Construction Impacts

Areas actively under construction may have bare soil exposed, which is more prone to erosion. 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. Sources of nonpoint source pollutants would include dirt, dust, small pieces of rubber and metal, engine oil and fuel, grease, heavy metals, antifreeze drippings, and miscellaneous solid litter and debris from construction equipment. Spills, leaks, and minor loss of construction material into the water are possible, which could temporarily affect water quality. Major spills could impact wells and wellhead protection areas months or years later if not cleaned up quickly; construction contractors operate under requirements to report and clean up spills in a timely manner. Limbs, brush, and other vegetation debris generated from clearing for construction-related activities are assumed to be disposed of in permitted upland disposal sites on public lands, but could be disposed of on private land with appropriate permit approvals. As such, sediment, ash, and debris will not enter riparian areas.

Mitigation

Water quality impacts will be minimized by the use of best management practices (BMPs) and the implementation of an approved Storm Water Pollution Prevention Plan (SWPPP). No long-term water quality impacts are expected as a result of the construction or removal of temporary bridges and culverts.

To minimize impacts to water bodies and water quality, all construction activities would comply with the Alaska Pollutant Discharge Elimination System Construction General Permit. The DOT&PF would prepare and provide the contractor with a project-specific Erosion and Sediment Control Plan. The contractor would be required to prepare a SWPPP and a Hazardous Material Control Plan (HMCP), which would be submitted to the DOT&PF for approval prior to construction. The SWPPP would identify all receiving waters and specify the structural and procedural BMPs to be used during construction to prevent erosion and untreated runoff from reaching nearby water bodies. BMPs would be developed in accordance with the DOT&PF's *Alaska Storm Water Pollution Prevention Plan Guide* (DOT&PF 2011d) and ADEC's *Alaska Storm Water Guide* (ADEC 2011a). The HMCP would establish procedures for responding to accidental spills. If leaks or spills should occur, contaminated material and soils would be contained and disposed of offsite in an approved DOT&PF/ADEC location. In general, to prevent sediment and chemical water quality impacts during construction, all vehicles, trucks, and heavy equipment would be kept within construction limits and operated in a manner that would limit unnecessary ground disturbance, and all equipment would be routinely inspected and serviced to prevent leaks and accidental spills. In addition, the following BMPs would be undertaken if deemed necessary and appropriate, considering the chosen build alternative.

General construction-related BMPs to be employed:

- Clearing limits would be clearly demarcated prior to construction to ensure impacts would be confined within the project footprint for areas that are near water bodies and wetlands.
- Regular visual inspection of all slopes would be performed to monitor for slope erosion.
- No vehicles or equipment would be fueled or serviced within 100 feet of wetlands or fish-bearing streams, with the exception of "low-mobility" equipment used for pile driving, drilled shaft construction, or other bridge construction. A plan would be provided detailing the process for fueling this equipment within 100 feet of wetlands or fish-bearing streams. Fuel trucks and service vehicles would be equipped with adequate materials (e.g., absorbent pads, booms, etc.) to immediately contain and commence clean-up of spilled fuels and other petroleum products if necessary. Fuel would be stored a minimum of 100 feet from any wetland or water body.

Spill-response equipment would be readily available, and construction personnel would be trained in spill response and would be able to contain accidental leaks of oil or fuel from construction equipment.

To limit sediment disturbance from construction activities:

- BMP erosion and sediment control measures, such as furrow ditches, check dams, and detention basins, would be used.
- Cut and fill slopes would be seeded as soon as possible with fast-growing annual species (to establish root mass) and with native species (for long-term growth and soil stabilization).
- Topsoil would be applied to the surface of road slopes to aid in the reseeding process.

To minimize erosion, temporary water quality impacts from construction activities, and introduction of suspended sediment and siltation:

- Coarse rock rubble would be used to stabilize toes of slopes at stream crossings to prevent the erosion of fine-grained material into adjacent waters and wetlands.
- Roadside swales would be designed to detain surface water to allow sediment-laden water to clear before being discharged.

To mitigate the long-term impact of increased storm water runoff, each alternative would incorporate storm water design treatment features, and BMPs would be designed into the project. All alternatives would be designed to maintain existing surface water courses and would incorporate grass-lined ditches and swales to reduce sediment. Alterations to surface drainage and hydrology that could adversely affect nearby water bodies would be avoided or minimized through incorporation of appropriately designed, sized, and constructed culverts under the roadway to maintain stream flows.

BMPs that would be employed to protect water quality include:

- Designing and constructing the roadway with a low-profile embankment to minimize the fill footprint
- Using rocks to stabilize toes of slopes to limit the erosion of fine-grained material into adjacent waters and wetlands
- Using plant species indigenous to the area for vegetating road slopes wherever possible to protect the integrity of the natural plant communities
- Using non-invasive annual grasses (such as annual rye) to provide rapid, initial soil cover to prevent runoff of fine-grained material into adjacent wetlands
- Designing roadside swales to keep surface water within the natural drainage basins to allow sediment-laden water to clear before its discharge to downstream waters
- Contouring reconstructed stream banks at stream crossings (both culverts and bridge crossings) to approximate original conditions
- Reseeding reconstructed stream banks with native seed and annual rye to minimize erosion, as recommended in the Alaska Department of Natural Resources' *A Revegetation Manual for Alaska*

Impacts to water bodies and water quality would likely result from in-water construction in the Kenai River. During construction, standard best practices and supplementary permit stipulations would be followed to prevent stream bank erosion, siltation or pollution of water, and disruption of Kenai River recreation. These would include measures such as:

- Keeping tracked or wheeled equipment out of the Kenai River
- Stabilizing exposed earthwork during construction, protecting vegetation to the extent possible, and revegetating exposed or damaged areas following construction
- Ensuring that any imported rock material for placement in and along the Kenai River was clean
- Fueling and serving equipment only at distances of more than 100 feet from wetlands and waters, except for low-mobility equipment such as pile drivers, and specifying detailed fueling procedures and spill contingency plans
- Retaining adequate spill containment and cleanup equipment and supplies on site
- Avoiding use of preservatives or chemicals that could pollute the Kenai River

3.13.2.3 Cooper Creek Alternative

Direct and Indirect Impacts

The Cooper Creek Alternative would require three major water body crossings, including replacement of two existing bridges over the Kenai River (the Cooper Landing and Schooner Bend bridges) and a large new bridge over Cooper Creek (see Map 2.5-2 in Chapter 2, Alternatives). In addition, several smaller creeks would be crossed with culverts, as shown in Table 3.13-1, above. In-water work would be required for the replacement and construction of bridges over the Kenai River. Pile driving, augering, or both would be necessary for placement of bridge pier foundations. No long-term water quality impacts are expected as a result of bridge construction.

The Cooper Landing Bridge crossing the Kenai River (Map 2.5-2) would require piers to be placed below ordinary high water of the Kenai River. It is located where Kenai Lake flows into the Kenai River. The new bridge piers would be aligned to minimize impacts to water flow. The piers could affect water flow locally, but would not alter general flow patterns of the Kenai River or ice movement. Any portion of the existing bridge not incorporated into the new bridge would be removed after completion of the new bridge, including piers and abutments. If existing piers were not incorporated into the new bridge and could not be removed, they would be cut off below the level of the streambed.

The Schooner Bend Bridge across the Kenai River would be replaced by a bridge located approximately 80 feet downstream from the existing structure (Map 2.5-2). The existing bridge would remain in use during construction and then would be removed after completion of the new crossing. The existing bridge has three piers below ordinary high water in the Kenai River, and the new bridge would have no more piers than the existing bridge below ordinary high water. Piers could affect water flow locally, but would not alter general flow patterns of the Kenai River or ice movement. If fewer piers were placed, there would be less risk of ice floes jamming at the piers and creating floods.

The Cooper Creek Bridge would be located approximately one-half mile upstream of the existing highway bridge over Cooper Creek (Map 2.5-2) and would cross the canyon on tall piers. No impacts to Cooper Creek would be expected because the bridge would clear span the creek; no piers or fill would be placed below ordinary high water.

The Cooper Creek Alternative includes culvert crossings of approximately 57 smaller streams and drainages (including Fuller Creek), resulting in the replacement of about 47 culverts and the installation of about 10 new culverts. All fish stream culverts would be sized to meet the Alaska Department of Fish and Game-DOT&PF Memorandum of Agreement (ADF&G and DOT&PF 2002) requirements for fish passage. Section 3.21.2.2 of Fish and Essential Fish Habitat discusses effects on resident and anadromous fish streams, and presents fill volumes estimated for culverts in Fuller Creek and three unnamed creeks. Because of better knowledge and design standards, replacement culverts in general are expected to lead to better management of water flows and, where applicable, for better fish passage than existing culverts. Therefore, this would be an improvement to the existing condition. As discussed in Section 3.13.2.2, new culvert crossings would be likely to alter natural flow patterns and habitat in streams at the location of the crossing, and possibly upstream and downstream. However, these impacts would be minimized through proper culvert sizing and placement.

The Cooper Creek Alternative would construct 3.5 new miles of highway built on a new alignment, and most traffic is expected to follow the new alignment. About 59 percent of the highway would be located more than 330 feet from the Kenai River. Improvement of the highway to current standards throughout would reduce the risk of crashes, and the greater separation would reduce the risk that any spilled substance would enter the Kenai River (see Section 3.17, Hazardous Waste Sites and Spills).

An increase in storm water runoff would be a long-term impact resulting from a new and wider highway. Impacts from the runoff would alter local drainage patterns in small ways and are the same as those described above for all build alternatives.

Five locations of longitudinal encroachments of the Kenai River would be required, as discussed in Section 3.13.2.2.

Construction Impacts

Construction impacts to water quality are the same for all build alternatives and are detailed in Section 3.13.2.2.

Mitigation

Water bodies and water quality mitigation and commitments mostly are common to the construction of all alternatives and are described above in Section 3.13.2.2.

The Cooper Creek Alternative's two replacement bridges over the Kenai River would be designed to minimize permanent impact to river hydraulics, fish passage, and navigability. In part, this would be accomplished by minimizing the number of in-water piers. The DOT&PF has committed to minimizing the number of piers, using fewer piers if possible and in both cases constructing the new bridges with no more piers in the river than currently exist. All parts of any replaced bridge, and any temporary construction or detour bridge would be removed from the river if not used in a new bridge at the same site. If existing piers were not incorporated into the new bridge and could not be removed, they would be cut off below the level of the streambed.

3.13.2.4 G South Alternative

Direct and Indirect Impacts

The G South Alternative would require three major water crossings, including a new bridge over the Kenai River, a replacement bridge for the Schooner Bend Bridge, and a new crossing over Juneau Creek. In addition, culvert crossings of several smaller creeks would be required. The new bridge over the Kenai River would have two to three piers placed below ordinary high water. The bridge would not be expected to alter general flow patterns of the Kenai River substantially. Impacts on the Kenai River with the replacement of the Schooner Bend Bridge would be the same as those described for the Cooper Creek Alternative. The Juneau Creek crossing would have no piers placed below ordinary high water.

The G South Alternative includes culvert crossings of approximately 73 smaller streams and drainages (including Bean and Fuller creeks), resulting in the replacement of 39 culverts and the installation of 32 new culverts (drainages were combined into one culvert where possible). Section 3.21.2.2 in Fish and Essential Fish Habitat discusses effects on resident and anadromous fish streams and presents estimated fill quantities for culvert crossings of Fuller Creek, Bean Creek, and two unnamed creeks.

Three locations of longitudinal encroachments of the Kenai River would be required, as discussed in Section 3.13.2.2.

The G South Alternative would construct 5.6 miles of highway built on a new alignment, and most traffic is expected to follow the new alignment. About 67 percent of the highway would be located more than 330 feet from the Kenai River. Improvement of the highway to current standards throughout would reduce the risk of crashes, and the greater separation would reduce the risk that any spilled substance would enter the Kenai River (see Section 3.17, Hazardous Waste Sites and Spills).

Construction Impacts

Construction impacts to water quality are the same for all build alternatives and are detailed in Section 3.13.2.2.

Mitigation

Water bodies and water quality mitigation and commitments mostly are common to the construction of all alternatives and are described above in Section 3.13.2.2.

The G South Alternative's replacement of Schooner Bend Bridge would be designed to minimize permanent impacts to river hydraulics, fish passage, and navigability. In part, this would be accomplished by minimizing the number of in-water piers. The DOT&PF has committed to minimizing the number of piers, using fewer piers if possible, and constructing the new bridge with no more piers in the river than currently exist. All parts of the replaced bridge, and any temporary construction or detour bridge, would be removed from the river. The new bridge over the Kenai River would be designed to minimize piers in the river and to minimize permanent impacts to river hydraulics, fish passage, and navigability.

3.13.2.5 Juneau Creek and Juneau Creek Variant Alternatives

Direct and Indirect Impacts

The Juneau Creek and Juneau Creek Variant alternatives would require one major stream crossing over Juneau Creek and culvert crossings of several smaller creeks. The Juneau Creek crossing would be a clear span; no piers or fill would be placed below ordinary high water of Juneau Creek or near the creek. No adverse effects to Juneau Creek are expected. The Juneau Creek and Juneau Creek Variant alternatives include culvert crossings of approximately 63 smaller streams and drainages (including Fuller Creek), resulting in the replacement of 20 culverts and the installation of 41 new culverts (drainages were combined into one culvert in some instances). Section 3.21.2.2 in Fish and Essential Fish Habitat discusses effects on resident and anadromous fish streams.

The Juneau Creek Alternative would require no longitudinal fills on the Kenai River. For the Juneau Creek Variant Alternative, one longitudinal encroachment of the Kenai River would be required, as discussed in Section 3.13.2.2.

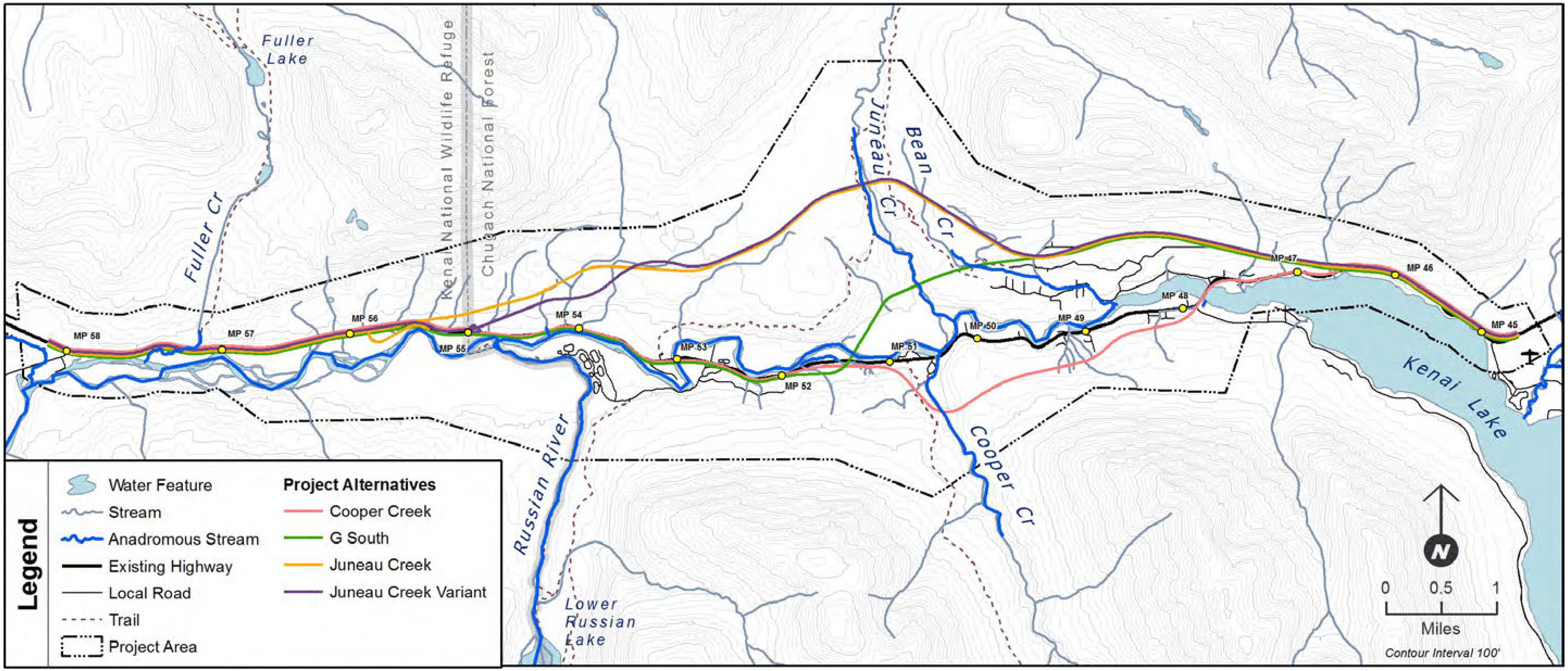
The Juneau Creek Alternative would construct 10 miles of highway built on a new alignment, and the Juneau Creek Variant Alternative would construct 9 miles of highway built on a new alignment. Most traffic is expected to follow the new alignment. About 85 percent of these alternatives would be located more than 330 feet from the Kenai River. Improvement of the highway to current standards throughout would reduce the risk of crashes, and the greater separation would reduce the risk that any spilled substance would enter the Kenai River (see Section 3.17, Hazardous Waste Sites and Spills).

Construction Impacts

Construction impacts to water bodies and water quality are of the same type for all build alternatives and are detailed in Section 3.13.2.2.

Mitigation

Water bodies and water quality mitigation and commitments mostly are common to the construction of all alternatives and are described above in Section 3.13.2.2. DOT&PF has committed to building the new bridge over Juneau Creek without access into the base of the canyon, in part to protect Juneau Creek from temporary or permanent fill or channel realignment.



Map 3.13-1. Water bodies in the project area

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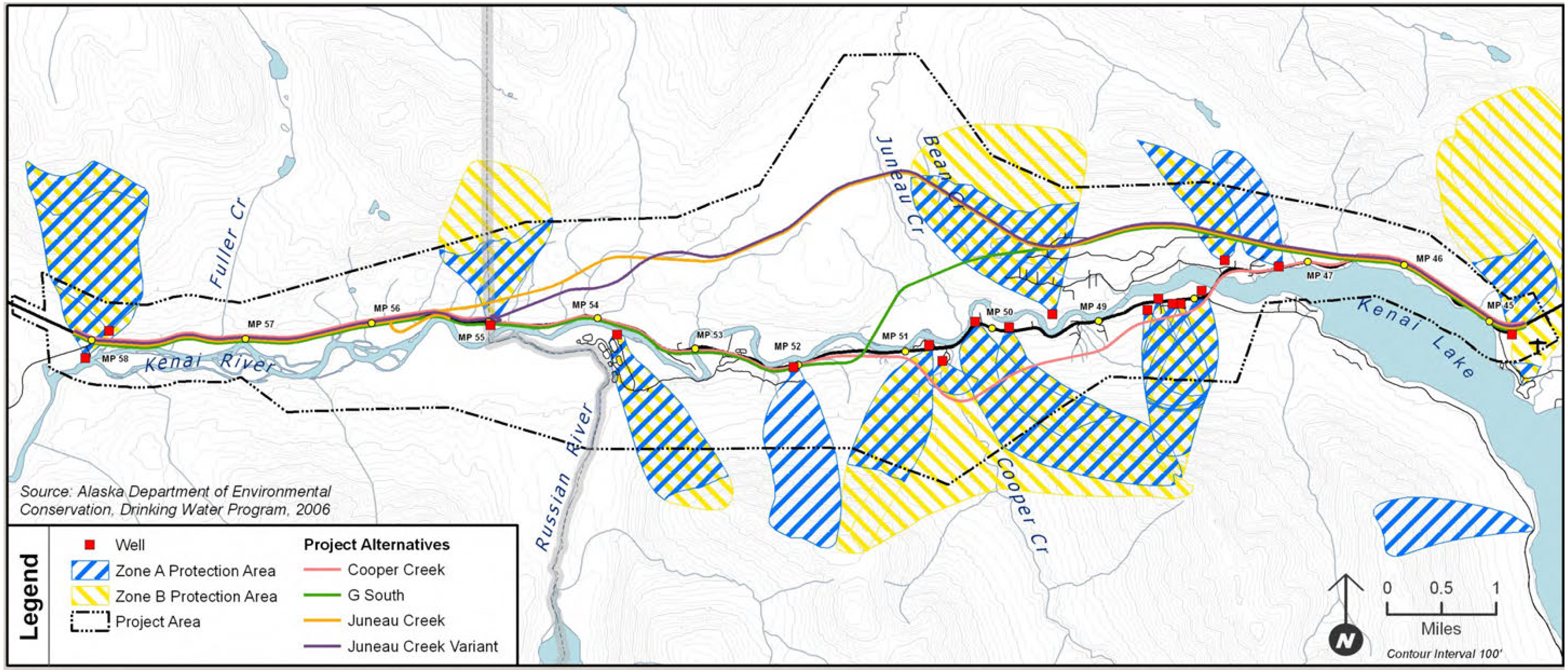

Map 3.13-2. Wellhead protection zones in the project area

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