Appendix G –
Essential Fish Habitat

G. ESSENTIAL FISH HABITAT ASSESSMENT

This assessment of Essential Fish Habitat (EFH) is for the Alaska Railroad Corporation (ARRC or the Applicant) proposed Northern Rail Extension (NRE). The assessment considers the Applicant's proposed action and a range of reasonable alternatives that have been included in the Surface Transportation Board (STB or the Board) Section of Environmental Analysis (SEA) Environmental Impact Statement (EIS).

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Section 305(b)(2) of the Magnuson-Stevens Act requires Federal agencies to consult with the National Oceanic and Atmospheric Administration National Marine Fisheries Service (Marine Fisheries Service) on all actions, or proposed actions, authorized, funded, or undertaken by the agency that may adversely affect EFH.

The EFH guidelines (50 Code of Federal Regulations [CFR] 600.06-600.930) outline the process for Federal agencies, the Marine Fisheries Service, and the Fishery Management Councils to satisfy the EFH consultation requirements under Section 305((b)(2)-(4)) of the Magnuson-Stevens Act. As part of the EFH consultation process, the guidelines require Federal agencies to prepare a written EFH assessment describing the effects of their actions on EFH.

This appendix provides an EFH assessment for STB actions related to the proposed project.

G.1 Description of the Proposed NRE

The Applicant proposes to construct and operate a single-track rail line in Interior Alaska starting south of the community of North Pole and ending south of the community of Delta Junction. The rail line would transport commercial freight, military supplies, and passengers. The Applicant would construct other facilities, such as communication towers, offloading structures, and a passenger platform in Delta Junction, to support rail line operations.

The rail line would generally follow the Tanana River, which is a relatively fast-moving river with a wide floodplain and a braided channel. The rail line would require one crossing of the Tanana River and crossings of the Delta River, the Little Delta River, Delta Creek, and potentially the Salcha River. The Tanana River bridge would be a dual-modal structure able to support both rail and military vehicular traffic. The Little Delta River, Delta Creek, and all other stream crossings on the west side of the Tanana River would have separate bridges for the track and vehicles. ARRC has not proposed vehicle access over the Salcha and Delta Rivers.

ARRC proposes a 200-foot-wide right-of-way (ROW) for the rail line. Rail line construction and operations activities would occur within this ROW unless otherwise noted. Thirteen rail alternative segments and five connector segments provide for several routing alternatives that extend approximately 80 miles from North Pole to Delta Junction. Table G-1 lists and Figure G-1 shows the segments evaluated in the EIS; Table G-1 also identifies the Applicant's preferred segments. Rail bridges and culverts would be required for crossing numerous EFH-bearing streams.

Table G-1
Rail Line Segments

Segments in the EIS	Applicant's Preferred Segments
North Common Segment	✓
Eielson Alternative Segments 1, 2 and 3	**Alternative Segment 3**
Salcha Alternative Segments 1 and 2	**Alternative Segment 1**
Connector Segments A, B, C, and D	**Connector B**
Central Alternative Segments 1 and 2	**Alternative Segment 2**
Connector Segment E	✓
Donnelly Alternative Segments 1 and 2	**Alternative Segment 1**
South Common Segment	✓
Delta Alternative Segments 1 and 2	**Alternative Segment 1**

G.2 Essential Fish Habitat

Congress defined EFH for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" and a catalog of streams used by federally managed salmon (Chinook [king] salmon – *Oncorhynchus tshawytscha*, coho [silver] salmon – *Oncorhynchus kisutch*, and chum [dog] salmon – *Oncorhynchus keta*) is maintained by the Alaska Department of Fish and Game (ADF&G) (Johnson and Weiss, 2007). Some streams crossed by the alternatives have been identified as probable salmon habitat, but have not been documented as EFH or as important for Chinook, coho, or chum salmon under Alaska Statute 16.15.871(a) (Johnson and Weiss, 2007).

All salmon in the Tanana River are considered to be from Yukon River stocks, because the Tanana River is a major tributary of the Yukon River. Chinook salmon arrive in the Tanana River as far as Fairbanks and areas upstream in early July and are known to spawn in the Salcha River (Table G-2; Eiler *et al.*, 2004). Chinook salmon from the Tanana River drainages comprise about 20 percent of the Yukon River Chinook salmon run (Eiler *et al.*, 2004). This run is one of the most productive Alaskan fisheries and is an important commercial and subsistence resource for both Alaska and Western Canada (Eiler *et al.*, 2004; Woodby *et al.*, 2005). In the project area, Chinook salmon spawn and rear in the Salcha River and rear in the Fivemile Clearwater River (Figure G-2; Johnson and Weiss, 2007).

Table G-2
Run Timing for Salmon that Move Through and/or Spawn in the Project Area[a,b]

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook salmon							■	■				
Coho salmon									▒	■	■	
Chum salmon							■	▒	▒	▒	■	

[a] Source: ADF&G, 2008
[b] Shading indicates run timing; darkest shading indicates peak availability.

Coho or silver salmon spawn in clearwater tributaries of the Tanana River, including the Fivemile Clearwater River, Kiana Creek, and unnamed tributaries to the Richardson Clearwater River (Figure G-2; Johnson and Weiss, 2007) during September through November (Table G-2). In addition to its importance as a commercial and subsistence resource, coho salmon is a popular sport fish.

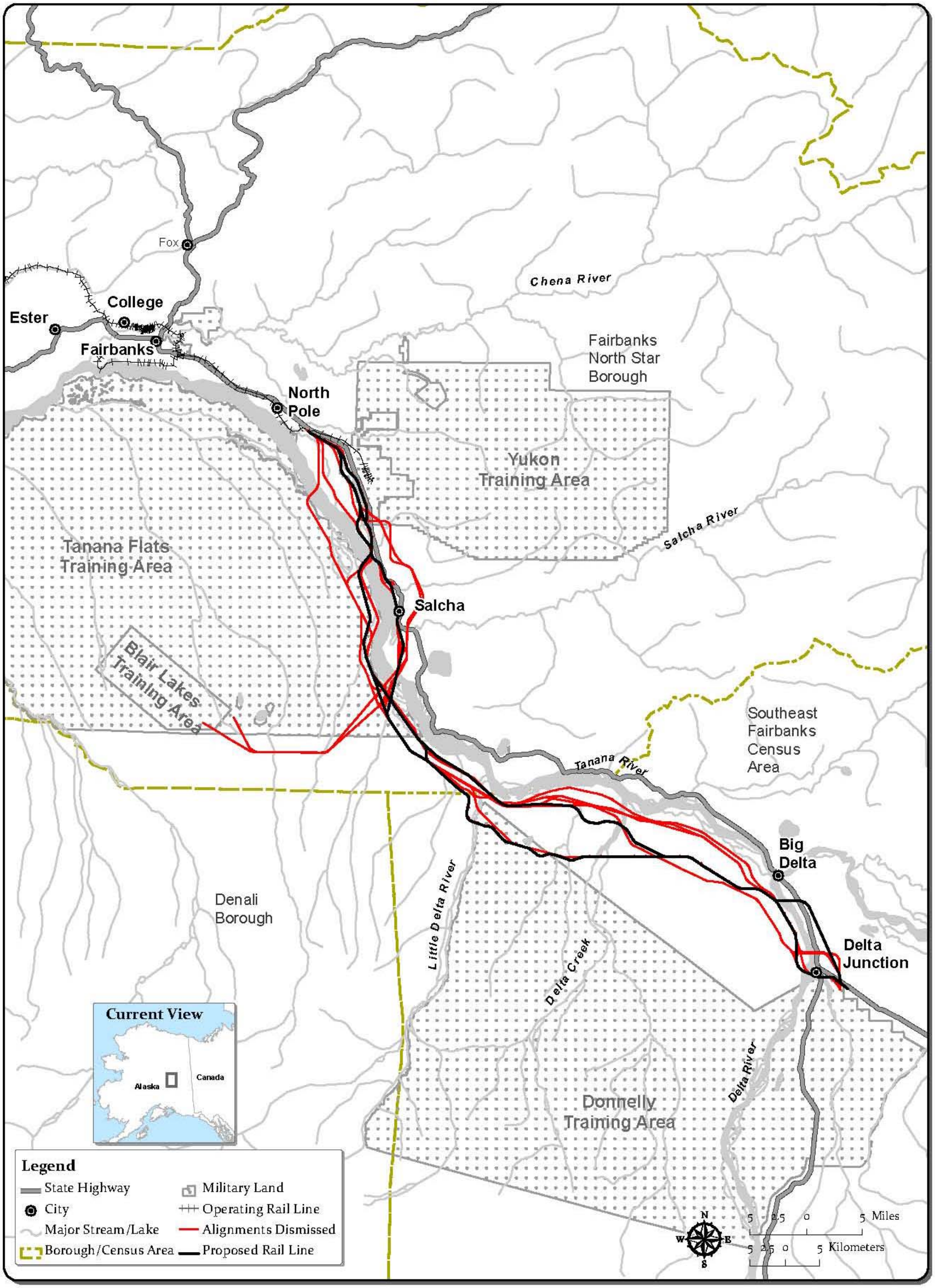

Figure G-1 – Overview Map of Alternative Segments Evaluated in the EIS

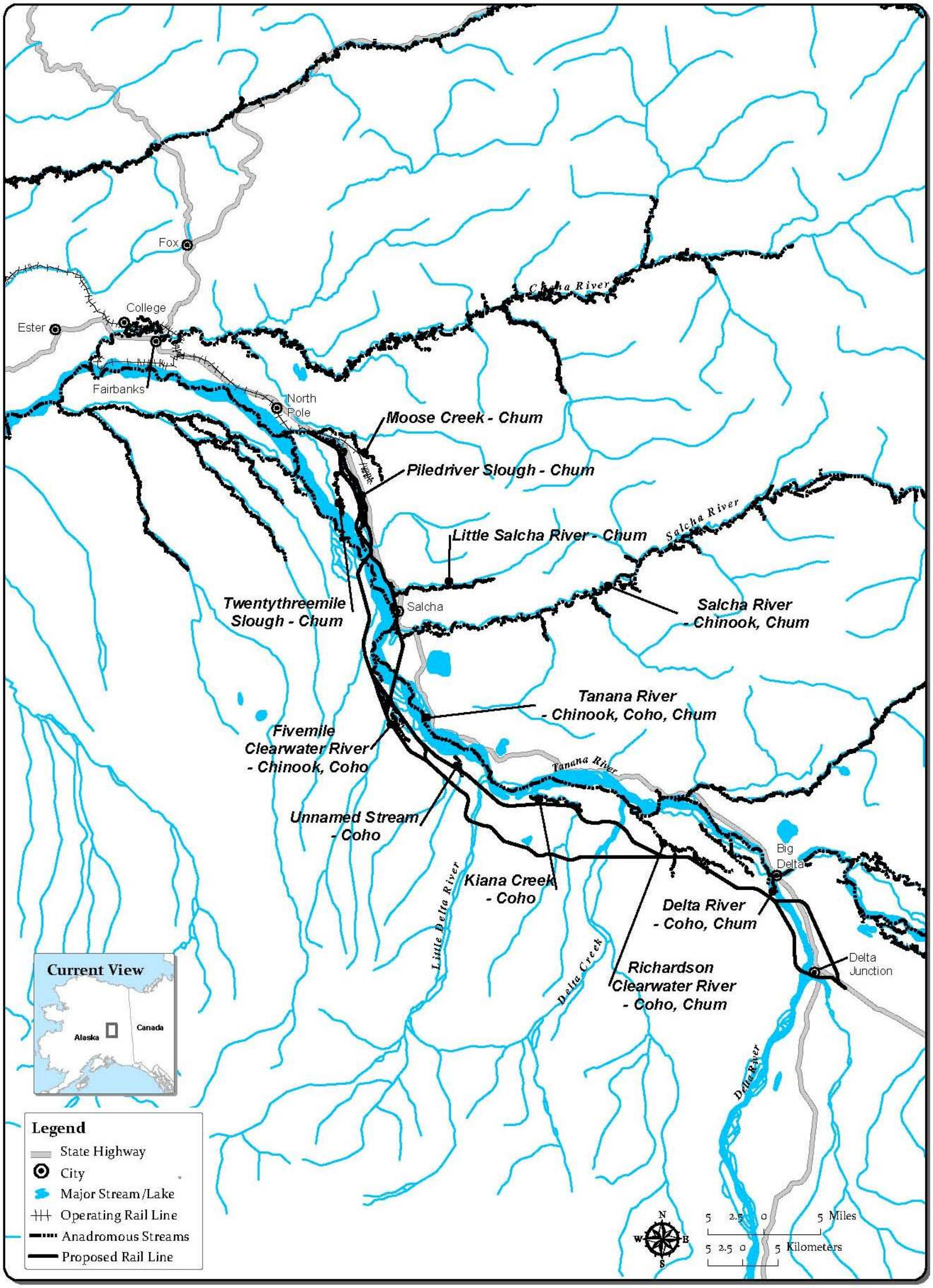

Figure G-2 – Waters Documented as Important for Chinook, Coho and Chum Salmon Under Alaska Statute 16.15.871(a) in the Project Area (Johnson and Weiss, 2007)

The summer run of chum salmon first arrives in the Fairbanks area in early July. The summer run of chum salmon generally uses north bank tributaries of the Tanana River such as Piledriver Slough, Moose Creek, Twentythreemile Slough, the Little Salcha River, and the Salcha River (Figure G-2). The fall run arrives during October and November (Table G-2) and generally uses the south bank tributaries such as the Richardson Clearwater River and the Delta River (Figure G-2). The Tanana River produces 30 percent of the Yukon fall chum salmon, an important resource to the people of the entire Yukon River. Many fall spawning chum salmon use the mainstem and side channels of the Tanana River as described by Barton (1992) and illustrated by recent telemetry data (Driscoll, 2008). Figure G-3 illustrates Alaskan commercial, subsistence, personal use, and sport harvests of Yukon River stocks of Chinook, coho, and chum salmon from 1970 to 2007. Table G-3 describes habitat use and life history traits for Chinook, coho, and chum salmon in the project area subject to EFH consultation.

Table G-3
Habitat and Ecology of Mid-Tanana River Basin Salmon

Common Name	Spawning Habitats/ Rearing Habitats	Overwinter Habitats	Ecology
Chinook Salmon	Spawn in fast deep water over gravelly or rocky bottoms of non-glacial tributaries of glacial rivers where they can dig redds; fry and juveniles use sloughs, backwaters, tributaries, braids, channel edges, terraces and off-channel habitat, brush piles, beaver houses, shallows along gravel bars	Overwinter as eggs or juveniles	Juveniles smolt and outmigrate in the spring following hatching and outmigration appears to occur soon after breakup peaking in mid to late May, extensive movement within the river system in the first year of life, adults return to spawn after 4-5 year marine residence
Coho Salmon	Spawn in gravel areas of clearwater habitats-usually spring-fed, juveniles use ponds, lakes and pools in streams and rivers or along stream margins usually amongst submerged woody debris and in scour pools	Juveniles overwinter near springs and in spring-fed streams, areas with upwelling are important for both egg and fry survival	Spend one to three years in streams and may spend up to five winters in lakes before migrating to the sea, adults return after 18 month marine residence
Chum Salmon	Spawn in small side channels, and areas of larger rivers with upwelling springs; fry emerge from the gravel in the spring and immediately outmigrate downriver, feeding on small insects and other detritus	Overwinter as eggs	Fry emerge from the gravel in early to mid April with peak outmigration occurring before the end of May, adults return to spawn after 3-5 year marine residence

G.3 Effects of the Proposed NRE on Essential Fish Habitat

The magnitude of the effects of proposed NRE construction and operations on fisheries resources would be influenced by the stream type, type of conveyance structure, type and timing of fish occurring within the stream, and timing of construction. The primary impacts of conveyance structures are loss and degradation of instream habitats due to instream placement of structures, alteration of stream hydrology and blockage of fish movements. Alterations of stream hydrology

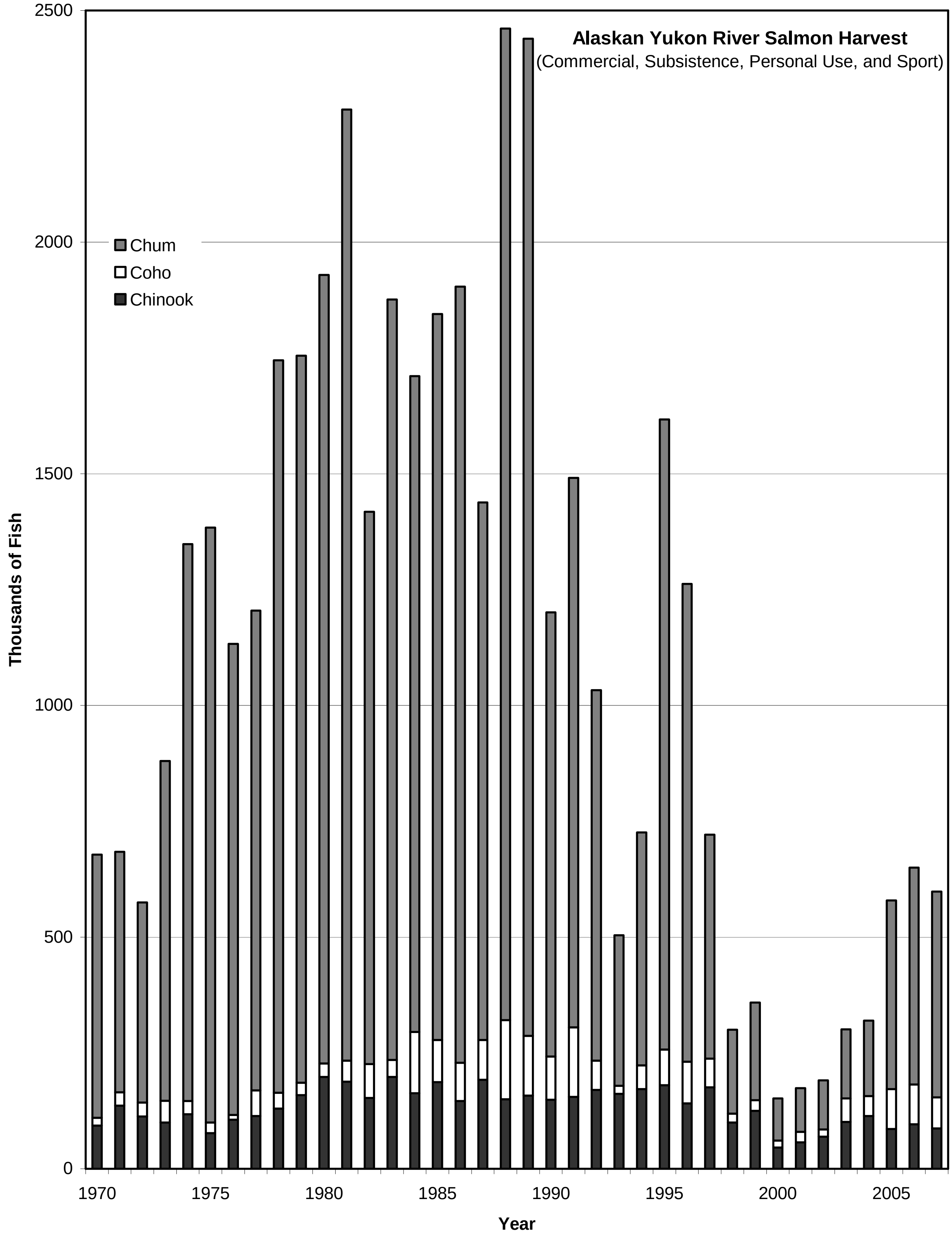

Figure G-3 - Alaskan Harvest of Yukon River Chinook, Coho and Chum Salmon During 1970 to 2007 (JTC, 2008)

caused by conveyance structures are discussed in Chapter 4. The primary impacts of instream gravel removal could be temporary or permanent habitat alteration depending on the amount of gravel removed and the gravel recharge rate. Most effects from proposed rail line construction and operations would include increased erosion and sedimentation (infiltration of fine particles into substrate interstices) due to riparian vegetation removal and loss or alteration of stream and riparian habitats.

G.3.1 Methodology

Effects to EFH from proposed NRE construction and operations were evaluated based on habitat use, habitat requirement, and seasonal movement of salmon within the project area. SEA completed field studies to assess proposed stream crossing locations for fish habitat and hydrology in the project area from September 18 through 30, 2005; July 5 through 8, 2006; October 27, 2006; and June 25 through 28, 2007 (Noel, 2007). The purpose of these field studies was to document fish habitat and hydrologic properties of a selection of stream crossings for proposed alternative segments. For the purposes of this assessment, all waters identified as containing or probably containing Chinook, coho or chum salmon based on Alaska Department of Fish and Game (ADF&G) data (ADF&G, 2005), SEA field surveys (Noel, 2007), and other historical reports have been included, while those waters documented as important for these species have been specifically identified as EFH (Johnson and Weiss, 2007).

G.3.2 Construction Impacts

Construction of the rail line would result in short-term disturbance and long-term habitat modification along the approximately 80-mile rail line. The following paragraphs describe the types of potential construction-related impacts to EFH and streams used by anadromous salmon that would be applicable to all of the alternative segments proposed for the NRE.

Loss or Alteration of Instream and Riparian Habitats

Installation of bridge pilings, bank armoring, and culverts would permanently remove streambed area that would otherwise be available for fish use. Loss of gravel bottoms, sandy shoal areas, stands of emergent vegetation, and other habitat would impact rearing, foraging, and spawning. Temporary loss of instream habitat would also occur if water is diverted from the channel to facilitate installation of bridge pilings, bank armoring, or culverts. Removal of gravel from glacial river beds would also cause a temporary alteration in the river bed. The pit formed for gravel removal would generally be refilled with gravel during the following spring breakup periods by bed load migration and would generally not result in permanent fish habitat loss or alteration.

Riparian vegetation would be removed as a result of bridge, culvert, and access road construction. Trees and other woody vegetation provide protection to fish habitat by filtering runoff, shading the stream, and providing large woody debris and other organic matter to the stream. Riparian clearing would also eliminate important streambank habitats such as undercut banks. Removal of riparian vegetation and disturbance to streambanks could result in erosion, sediment loading and turbidity, elevated water temperatures, reduced productivity, and a reduction in habitat complexity.

Mortality from Instream Construction

Instream construction activities could cause direct mortality of fish when equipment or materials are placed in the stream bed. Small, larval, or juvenile fish could become stranded in pools created when equipment is driven through the stream. Pools could then subsequently drain or dry, resulting in desiccation of the fish. Fry are particularly vulnerable because they are weak swimmers and are susceptible to stranding by wave action created as equipment is driven through or along the stream bed. Large fish would be expected to avoid vehicle wheels and ruts. Redds, eggs, and fry within or downstream of the construction site could be impacted by sedimentation, excessive vibration, and scour (Banner and Hyatt, 1973; Crisp, 1990). Water diversions and temporary dewatering could also impact fish embryos and pre-emergent fry (Becker *et al.*, 1982; Holland, 1987) through desiccation or freezing.

Blockage of Fish Movement

In-stream construction activities would impact fish movements during construction where water diversions created temporary physical barriers to fish passage or altered stream flows sufficiently to create either high-water or low-water conditions that would prevent fish passage. Water diversions and culverts could physically restrict access to spawning habitat, and turbidity created during construction could also trigger avoidance behavior that would lead to a behavioral blockage of movements (Bisson and Bilby, 1982; Warren and Pardew, 1998). These impacts would be expected to be temporary during bridge construction. Ice-bridge stream crossings can alter timing of spring breakup and create ice jams with high flows that restrict movements of resident fish and out-migrating salmon.

Improperly installed conveyance structures could impede fish passage by increasing the velocity or decreasing the depth of water flowing through the structure. Culverts could pose a physical barrier (as with a hung culvert) if not installed properly. Conveyance structures blocking or impeding fish passage could result in a loss of access to spawning and rearing habitat, which could reduce fish productivity. Water diversions could also create temporary physical barriers to fish passage or alter stream flows sufficiently to create either high-water or low-water conditions that would prevent fish passage, potentially restricting access to rearing and spawning habitat.

Bridges and culverts can also create choke points where the downstream movement of ice is restricted. Culverts often freeze solid and are very slow to melt due to the insulation of road or rail embankments. Fish that migrate to upstream spawning or foraging areas in the spring can be blocked by frozen culverts.

Degradation of Water Quality

Clearing of the ROW, grading and placement of conveyance structures, and construction of new access roads would expose soil to the erosive forces of wind, rain, and surface runoff during the construction period. Such erosion would deliver sediment into streams, which would degrade water quality and fish habitat. Increased turbidity from suspended sediment would degrade spawning and rearing habitat for a variety of species (Wood, 2004; Grieg *et al.*, 2005). Sedimentation can smother eggs and newly hatched fry, reducing survival (Wood, 2004; Grieg *et al.*, 2005). High turbidity could also trigger avoidance behavior, affect foraging success in fish that rely on sight for feeding (Barret *et al.*, 1992), and clog gills.

Small fuel or oil leaks from construction equipment could contribute to water quality degradation during construction. Spills and leaks could enter the water either directly as equipment crossed the stream or indirectly with runoff from the bridge or adjacent roadbed or railbed.

Alteration of Stream Hydrology and Breakup

The hyporheic zone is a region beneath a stream bed where there is mixing of shallow groundwater and surface water. Hyporheic flow and warm groundwater upwelling are important factors in salmonid egg development, and provide a warm-water refuge for overwintering fishes (Brown and Mackay, 1995; Baxter and McPhail, 1999). Construction activities would cause changes in flow patterns through the hyporheic zone by dislodging fine sediments during excavation and vegetation clearing (which can infiltrate the hyporheic zone and clog interstitial spaces) and by vibrations from construction equipment (which can cause substrates to settle and become compacted) (Sear, 1995; Huggenberger *et al.*, 1998). Permanent alterations in subsurface flows could result from the changes in permafrost distribution, bank and substrate armoring, instream support structures, and changes in channel morphology associated with bridges and culverts (Sear, 1995; Hanrahan, 2006). Subsurface structures that stabilize bridges can alter flow patterns within the hyporheic zone. Warm-water upwelling can also prevent a stream from freezing, thus allowing fish to overwinter in areas that would otherwise be unavailable.

Ice bridges used during winter construction of conveyance structures could alter spring breakup timing and create ice jams that redirect flows. Fish species moving upstream or downstream could experience difficulty passing areas where ice bridges had been constructed. In extreme cases, this could lead to the formation of ice dams that limit flow downstream of the bridge. Downstream habitat could be dewatered, which can be particularly problematic for anadromous salmonids whose eggs and fry over-winter in glacial streams such as the Tanana River. Water tends to back up behind ice dams that can result from stream constriction at bridges and culverts, and once the ice dam is breached, a large volume of water can be released over a short period. This sudden flush of water can scour downstream substrates, radically altering channel morphology, eliminating redds, and causing high mortality in overwintering sac-fry.

Noise and Vibration Impacts

Noise and vibration caused by pile driving and culvert installation during bridge construction could impact egg mortality and hatch timing in areas at and near stream crossings. Vibrations could be of sufficient magnitude to negatively impact the development of salmonid eggs in redds near bridges and culverts. Vibration could disrupt egg membranes and lead to egg death. Salmonid eggs are especially susceptible to disruption just after laying and fertilization prior to hardening. Exposure to vibration could affect fish by disrupting their sense of hearing and the function of the lateral line, a sensory organ that detects vibration (Hastings *et al.*, 1996; McCauley *et al.*, 2003). Noise and vibration from winter construction activities could also trigger avoidance behavior, displacing fish from overwintering habitat, especially near the Tanana River bridge crossings.

G.3.3 Operations Impacts

Maintenance activities such as clearing drainage ditches and management of vegetation in the ROW could cause some increase in sedimentation and turbidity over background levels in streams. Water quality could be negatively affected in the unlikely event of a release of hazardous materials from a train derailment or collision. However, the likelihood of a release is low because ARRC anticipates few shipments of hazardous materials, and railcars used for transportation of hazardous materials are designed to withstand various types of impacts.

G.3.4 Impacts by Alternative Segment

The ADF&G Anadromous Fish Catalog (Johnson and Weiss, 2007) identifies specific streams and stream crossing sites that contain EFH; project-specific field studies (Noel, 2007) characterized those streams and stream crossing sites. Central Alternative Segment 1, Donnelly Alternative Segment 1, and both Delta alternative segments would not cross streams containing EFH. The remaining alternative segments would cross streams containing EFH and would potentially cause impacts. The following paragraphs describe notable site-specific impacts on EFH and other salmon habitats.

North Common Segment

North Common Segment would cross Piledriver Slough (334-40-11000-2490-3315, Johnson and Weiss, 2007), once part of Chena Slough, which flowed northwest through Fairbanks and then back into the Tanana River. Construction of the Moose Creek Dike in 1945 split Chena Slough into Chena Slough and Piledriver Slough, and resulted in sloughs that are mostly groundwater-fed systems with low discharge and low sediment loads (Ihlenfeldt, 2006). At present, Piledriver Slough is a clearwater stream that flows for approximately 21 miles parallel to and between Richardson Highway and the Tanana River adjacent to Eielson Air Force Base. Piledriver Slough supports some spawning of chum salmon (Johnson and Weiss, 2007).

Tables G-4 and G-5 list and Figure G-4 shows EFH that would be affected by construction of the North Common Segment. Piledriver Slough (Crossing 1) is an entrenched tributary of the mainstem Tanana River with pool and riffle habitat. The substrate of this clearwater stream is dominated by silt with sand and gravel (Noel, 2007, Record 1). Blockage of fish migration at Piledriver Slough would be of consequence to in-migrant adult chum salmon headed to spawning habitats and out-migrant chum salmon fry headed to marine rearing habitats that would pass beneath the potential bridge. Out-migration of chum fry would coincide with spring breakup during April and May and could be hindered by ice jams that could result from channel constriction at the proposed bridge site.

Table G-4
EFH-bearing Streams North Comment Segment Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
1	Piledriver Slough	Slough	EFH	65	Bridge	100

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-5
Fish Species, Life Stages, and Habitats that Would Be Affected by Construction and Operation of North Common Segment[a]

	Life Stage				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Piledriver Slough (Crossing 1)									
Chum Salmon	X	X		X	X		X		X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

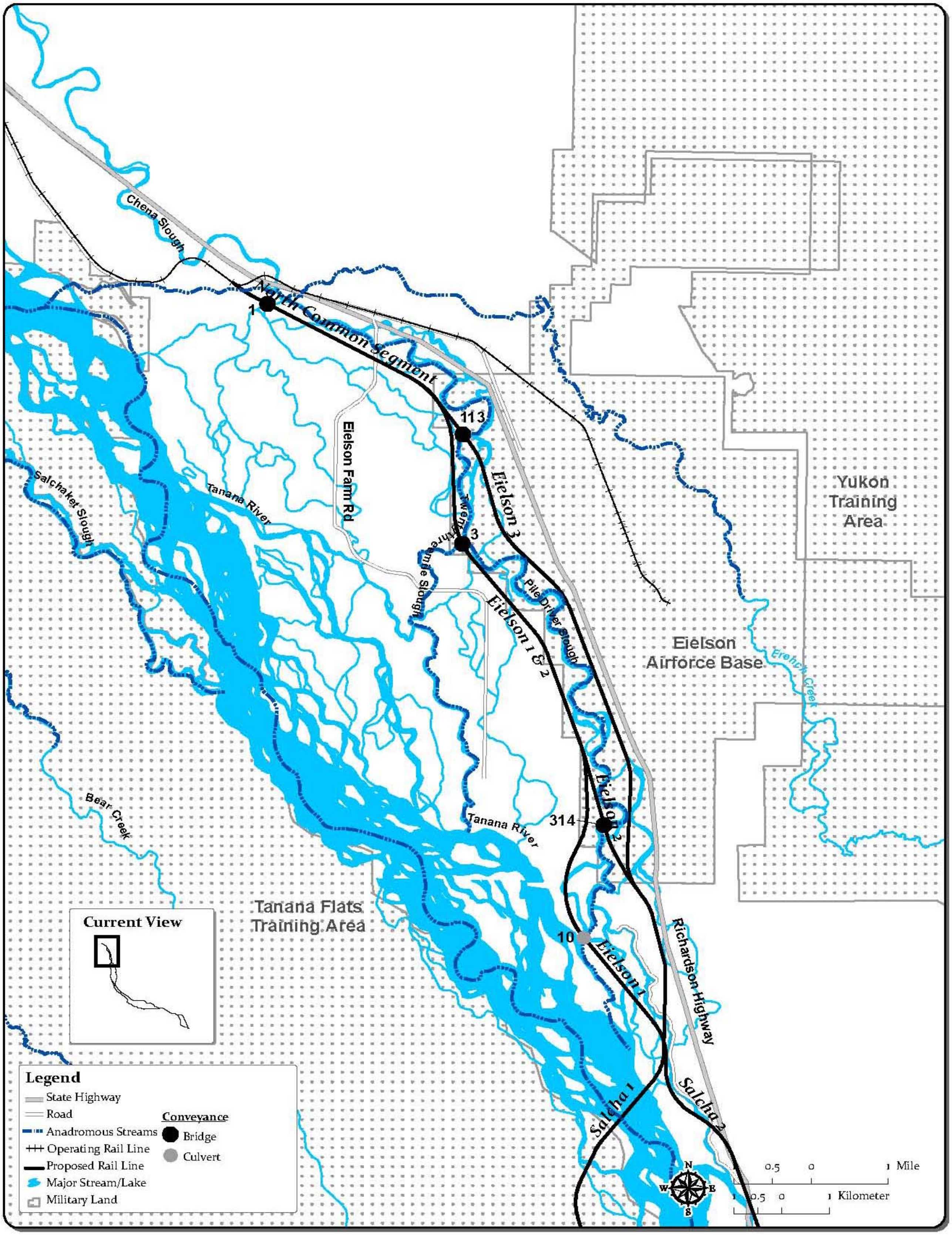

Figure G-4 – EFH-Bearing Streams Crossed by the North Common Segment and Eielson Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

Piledriver Slough is blocked from receiving direct flow from the Tanana River, so stream flows are maintained by precipitation and surface water/groundwater exchange. Any changes in the local hydrology could have corresponding impacts on spawning or overwintering habitat within this reach.

Eielson Alternative Segments

Each of the Eielson alternative segments would cross Piledriver Slough. Eielson Alternative Segment 1 and Eielson Alternative Segment 2 would cross Twentythreemile Slough (334-40-11000-2490-4010, Johnson and Weiss, 2007) near where it flows into Piledriver Slough (Figure G-4). Twentythreemile Slough flows for about 6 miles and is used by chum salmon (Johnson and Weiss, 2007).

EFH that would be affected by construction of the Eielson alternative segments are listed in Tables G-6 and G-7. In the last several years, the quality and quantity of favorable fish spawning and rearing habitat in Piledriver Slough has declined. Fish passage has been restricted by undersized culverts, beaver dams, and filling in of gravel riffles/pools with sediment.

Table G-6
EFH-Bearing Streams the Eielson Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Eielson 1 & 2						
3	Twentythreemile Slough	Slough	EFH	100	Bridge	100
Eielson 1						
10	Piledriver Slough	Slough	EFH	30	Culvert	3 x 10
Eielson 2						
314	Piledriver Slough	Slough	EFH	105	Bridge	330
Eielson 3						
113	Piledriver Slough	Slough	EFH	80	Bridge	300

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-7
Fish, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Eielson Alternative Segments[a]

	Life Stage				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Twentythreemile Slough (Crossing 3), Piledriver Slough (Crossings 10, 314, 113)									
Chum salmon	X	X		X	X		X		X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Recent flooding in the Salcha area has also caused water to back up and block culverts, damage road crossings, and deposit excess sediment in Piledriver Slough and tributary sloughs. These processes have had negative effects on local fish populations. The slough has become braided, increased its width/depth ratio, and is now reduced in the quantity and quality of habitat available for chum salmon (Ihlenfeldt, 2006). The U.S. Fish and Wildlife Service (USFWS) has been working to improve fish habitat in Piledriver Slough by working to repair improperly placed culverts and to replace some culverts with bridges (Ihlenfeldt, 2006).

Each Eielson alternative segment would cross Piledriver Slough in a different location. Eielson Alternative Segment 3 would cross Piledriver Slough (Crossing 113; Noel, 2007, Record 117) nearest the outflow of the slough where it receives flow from Moose Creek and rejoins the Tanana River. Eielson Alternative Segment 2 would cross Piledriver Slough (Crossing 314; Noel, 2007, Records 42 and 154) before its confluence with Twentythreemile Slough. Eielson Alternative Segment 1 would cross Piledriver Slough (Crossing 10; Noel, 2007, Record 22) just north of where it would connect to the Tanana River; however, the connection is blocked by fill in the channel. Of these crossings, the crossings farther downstream (Crossings 314 and 113) have the largest flows from groundwater exchange and would have the largest affect on anadromous fish habitats. Based on SEA field investigations, riffles are dominated by gravel substrates, while stream margins and pools are primarily covered in organic debris, and emergent vegetation was abundant (Noel, 2007, Records 42, 117, 154). Groundwater upwelling is evident, and there is evidence of salmon spawning (Noel, 2007, Records 42, 117, 154). Eielson Alternative Segment 1 and Eielson Alternative Segment 2 would also cross Twentythreemile Slough (Crossing 3; Noel, 2007, Record 40) just above its confluence with Piledriver Slough. There is an inactive beaver dam that had been breached near the crossing at the confluence, resulting in substrates primarily composed of organic debris and silt at the crossing, with a heavy vegetation mat (Noel, 2007, Record 40). However, there are gravelly areas upstream and juvenile salmonids, likely Chinook or coho salmon, were observed at this site. These species are reported to use the Piledriver Slough, Moose Creek, and Twentythreemile Slough system occasionally.

Clearing of the rail line ROW would increase erosion and thereby sedimentation, which would potentially lead to reduced egg survival. Bridges and culverts could also cause channel constrictions, inhibiting in-migrating chum salmon, or where ice dams might form during spring break up, inhibiting out-migration of chum salmon fry.

Salcha Alternative Segments

Both the Salcha alternative segments would cross the Tanana River. Chinook salmon, summer and fall run chum salmon, and coho salmon are found in the Tanana River during migration. Juvenile rearing (Chinook and coho), and fall-run chum salmon spawn in the mainstem and side channels of the Tanana River in the project area.

Salcha Alternative Segment 2 would cross both the Little Salcha River and the Salcha River (Figure G-5). The Salcha River (334-40-11000-2490-3329, Johnson and Weiss, 2007) supports Chinook salmon and summer-run chum salmon. The Salcha River salmon travel about 950 miles from the Bering Sea to the mouth of the Salcha River. By the time they reach the Salcha River, salmon are in full spawning colors, and the flesh is beginning to deteriorate. To maintain a Chinook salmon run on the Salcha River, the ADF&G has set an escapement (number of returning salmon) of between 3,300 and 6,500 fish. The Little Salcha River (334-40-11000-2490-3325, Johnson and Weiss, 2007) is a clearwater stream that flows into the Tanana River, and about 6 miles of this river supports chum salmon.

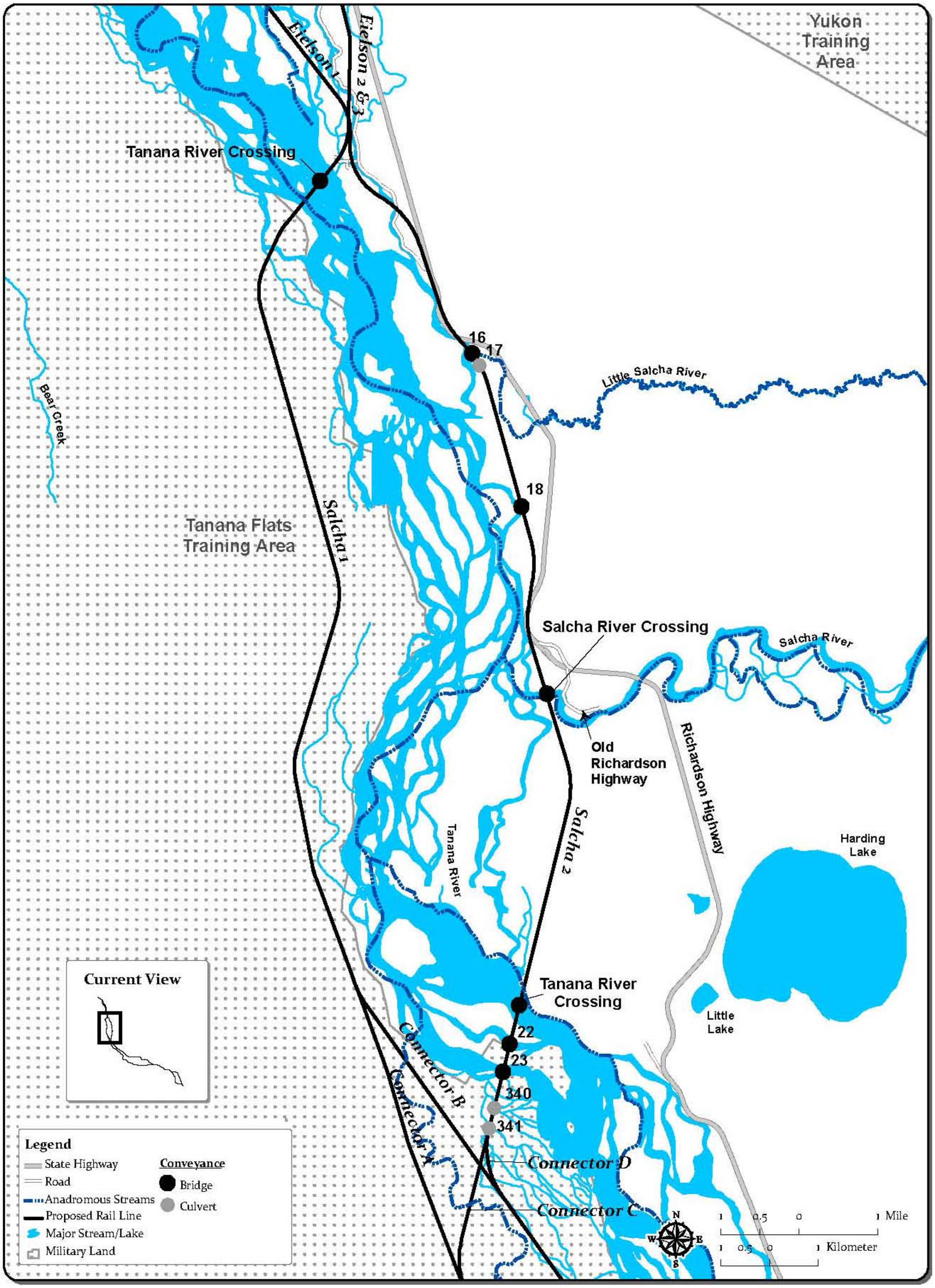

Figure G-5 – EFH-bearing Streams Crossed by the Salcha Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

Tables G-8 and G-9 list EFH the Salcha alternative segments would cross.

The bridges crossing the Tanana River would include bank armoring, rock revetments and levee construction upstream from the bridges and channel plugs for side channels on the east and west

Table G-8
EFH-bearing Streams the Salcha Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Salcha Alternative Segment 1						
	Tanana River	Stream	EFH	3,800	Bridge	3,600
Salcha Alternative Segment 2						
16	Little Salcha River	Stream	EFH	65	Bridge	160
17	Unnamed	Overflow	Anadromous	20	Culvert	3 x 10
18	Unnamed	Slough	Anadromous	15	Bridge	390
	Salcha River	Stream	EFH	195	Bridge	2,500[b]
	Tanana River	Stream	EFH	1,500	Bridge	4,000
22	Unnamed	Slough	EFH	130	Bridge	4,000
23	Unnamed	Slough	EFH	150	Culvert	3 x 10[b]
340	Unnamed	Stream	Anadromous	10	Culvert	10
341	Unnamed	Stream	Anadromous	20	Culvert	2 x 10

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.
[b] The conveyance size is a SEA estimate based on proposed lengths of similar crossings. The final conveyance distance will be determined during final design.

Table G-9
Fish, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Salcha Alternative Segments[a]

	Life Stage				Habitats				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Tanana River and Side Channels (Crossings 17, 18, 22, 23)									
Chinook salmon			X	X		X	X	X	X
Chum salmon	X	X		X	X		X		X
Coho salmon				X					X
Little Salcha River (Crossing 16)									
Chum salmon	X	X		X	X		X		X
Salcha River									
Chinook Salmon			X	X	X	X	X	X	X
Chum salmon	X	X		X	X		X		X
Unnamed Streams and Sloughs (Crossings 340, 341)									
Coho Salmon			X	X		X	X	X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Salmon use the Tanana River as a migratory route to upstream spawning habitats (Table G-9). Habitat at the stream margins used by larval and juvenile salmon would be altered by construction and maintenance of the bridge and ROW.

Side channels of the Tanana River (Noel, 2007, Crossings 16, 17, 18, 22, and 23) are dominated by gravel and cobble, with groundwater upwelling at the channel margins. These areas provide migration habitat for all three salmon, potential summer foraging and rearing habitats for Chinook and coho salmon, and spawning habitat for fall-run chum salmon (Barton, 1992; Driscoll, 2008; Noel, 2007, Records 48, 35, 36, 158, 159). Shot-rock revetments and channel plugs would be placed across the upstream connections of the side channels at Crossings 22 and 23, which would result in these side channels becoming groundwater-fed, clearwater sloughs following the same process as Piledriver Slough. Finally, sediment transport needed to replenish downstream spawning and rearing habitats could be inhibited by localized changes in stream hydraulics and depositional patterns. Passage of river flow is critical for anadromous fish use of side-channel habitats. Blockage or filling of side channels would cause significant habitat alteration, resulting in the eventual loss of salmon spawning. Similarly, modified side channels of the Tanana River near Fairbanks exhibit lower dissolved oxygen levels, reduced flows, substrates of finer particle size, and increased pH, hardness, water temperature, specific conductance, and cover (Mecum, 1984), conditions generally unsuitable for salmonids. These changes would reasonably be expected to alter fish use of affected channels by shifting habitats from a riverine to a more littoral character. The channel modification illustrated in Figure 2-17 would result in the creation of a major new channel, redirecting all the flow from the existing side channel and likely leading to the destruction of the portions of the vegetated island that are not protected by the shot-rock revetment. The potential for instability of this channel alteration is high, given the highly permeable nature of the gravels supporting the Tanana River bars, as discussed in Chapter 4.

Salcha Alternative Segment 2 would have nine crossings, including crossings of the Tanana River, the Little Salcha River, and the Salcha River. Five of these crossings are EFH (Table G-8). Salcha Alternative Segment 2 would include running the railbed through a side channel of the Tanana River at the confluence of the Little Salcha River (Crossing 16). This side channel has been identified as EFH and supports fall chum salmon spawning habitat (Barton, 1992; Driscoll, 2008). The Little Salcha River also supports chum salmon spawning (Johnson and Weiss, 2007).

The railbed and bridge at the Little Salcha River confluence would create a potential choke point where ice dams could form during spring breakup, which could inhibit out-migration of chum salmon fry. Salcha Alternative Segment 2 Crossing 18 is a side channel of the Tanana River that connects to the Little Salcha River outflow. Flow into this channel is limited during low-flow periods due to the presence of a large gravel berm at the inflow of the channel. During periods of low flow, the channel contains large clear pools, which contain juvenile salmonids in high densities (Noel, 2007, Record 36). During high flows, the pools would be connected to the mainstem by a series of pools and riffles of gravel with some cobble and silt. Salcha Alternative Segment 2 would cross the Salcha River about 1 mile above its confluence with the Tanana River. The crossing would pass over a shallow glide in a meander bend of the river (Noel, 2007, Record 47). Fall chum salmon spawning occurs in this area (Driscoll, 2008), and Chinook salmon must pass through this crossing to reach upstream spawning habitats. As with a bridge at the Little Salcha River, there is potential for negative impacts on upstream migration of Chinook and chum salmon. This site could also be a potential choke point where ice dams could form during spring break up, which could inhibit out-migration of chum salmon fry.

Central Alternative Segments and Connectors

Tables G-10 and G-11 list EFH the Central alternative segments and connectors segments would cross. Central Alternative Segment 2 would cross an unnamed slough with probable salmon habitat.

Table G-10
EFH-bearing Streams the Central Alternative Segments and the Central Connectors would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Central 1						
none						
Central 2						
38	Unnamed	Overflow	Anadromous	30	Bridge	75
Connector A						
85	Unnamed	Stream	Anadromous	80	Bridge	40
Connector B						
27	Unnamed	Slough	Anadromous	90	Culvert	2 x 10
86	Fivemile Clearwater	Stream	EFH	105	Bridge	160
Connector C						
342	Unnamed	Stream	Anadromous	35	Bridge	90
343	Unnamed	Slough	Anadromous	20	Culvert	2 x 10
344	Unnamed	Overflow	Anadromous	20	Culvert	2 x 10
345	Fivemile Clearwater	Stream	EFH	135	Bridge	135
346	Unnamed	Stream	Anadromous	30	Culvert	3 x 10
396	Unnamed	Stream	Anadromous	80	Bridge	40
Connector D						
501	Unnamed	Stream	Anadromous	35	Bridge	90
502	Unnamed	Stream	Anadromous	4	Culvert	2 x10
503	Unnamed	Stream	Anadromous	20	Bridge	90
504	Unnamed	Stream	Anadromous	20	Bridge	90
Connector E						
351	Fivemile Clearwater	Stream	Anadromous	65	Bridge	115

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-11
Fish Species, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Central Alternative Segments and Central Connectors[a]

	Life Stage				Habitat				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Fivemile Clearwater River (Crossings 86, 345) and Tanana River Side Channels (Crossing 38)									
Chinook Salmon			X	X		X	X	X	X
Coho Salmon			X	X		X	X	X	X

Table G-11
Fish Species, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Central Alternative Segments and Central Connectors[a] (continued)

	Life Stage				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Unnamed Streams (Crossings 27, 85, 342, 501, 502, 503, 504, 343, 344, 346, 396)									
Coho Salmon			X	X		X	X	X	X
Unnamed Stream (Crossing 351)									
Coho Salmon			X	X		X		X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Connectors B, C, and E would cross the Fivemile Clearwater River, which provides migration and rearing habitat for Chinook and coho salmon. Connectors A and D would cross unnamed streams that provide migration and rearing habitat for coho salmon. The connectors vary widely in length and number of stream crossings.

Central Alternative Segment 1 would not cross streams that provide EFH, but for this alternative to be connected to other alternative segments, connector segments that would cross EFH streams could be required.

Central Alternative Segment 2 would cross an unnamed slough with probable Chinook and coho salmon habitat (Tables G-10 and G-11). The channel at Crossing 38 appears to periodically receive flow from the Tanana River. This stream would likely serve as a temporary refuge during high-flow events and as a migration route for adult and juvenile Chinook and coho salmon to and from habitats in the Fivemile Clearwater River and its tributaries (Figure G-6).

Connector A would cross an unnamed stream at Crossing 85 that likely provides some habitat for coho salmon, although this stream is not cataloged.

Connector B would cross the Fivemile Clearwater River (Crossing 86), which serves as a migratory corridor for Chinook and coho salmon. The crossing site is a broad straight channel with heavily armored substrates, which are not likely to be suitable for salmonid spawning habitat (Noel, 2007, Record 55). The bridge on the Fivemile Clearwater River and the culvert at Crossing 27 could act as choke points where ice dams could form during spring breakup, thereby inhibiting movements between spawning habitats and rearing habitats.

Connector C would cross the Fivemile Clearwater River and several tributaries (Crossings 342, 343, 344, 345, 346, and 396) that might serve as migratory corridors for Chinook and coho salmon.

Connector D would cross streams (Crossings 501, 502, 503, 504) that likely provide habitat Chinook and coho salmon.

Connector E would cross the Fivemile Clearwater River at Crossing 351, upstream of the cataloged section, where substrates consist of sand and organic debris (Noel, 2007, Record 86).

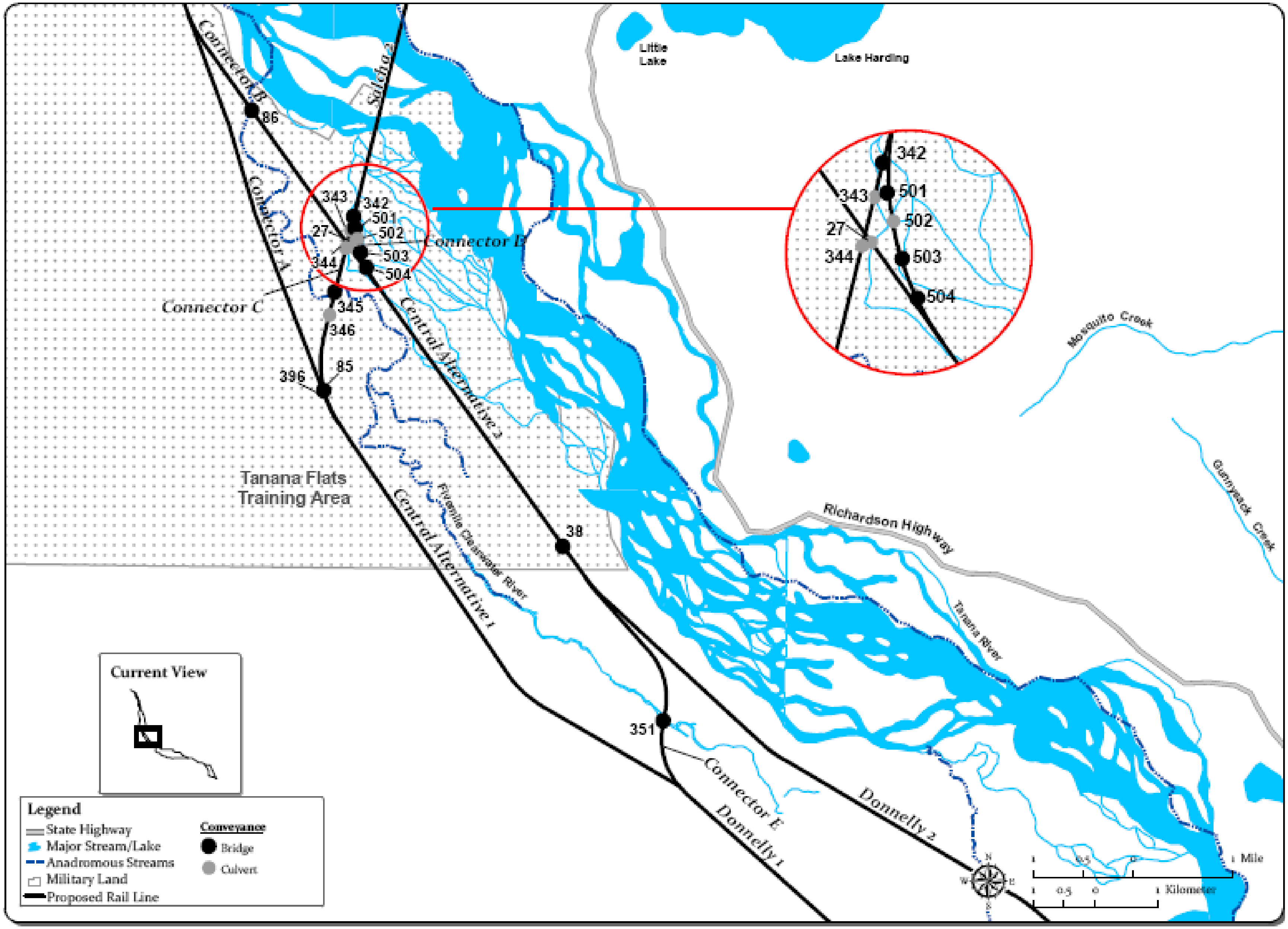

Figure G-6 – EFH-Bearing Streams Crossed by the Central Alternative Segments and Central Connectors (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

Donnelly Alternative Segments

Both Donnelly alternative segments would cross the Little Delta River, Kiana Creek, and Delta Creek (Figure G-7). The Little Delta River is a glacial tributary of the Tanana River that runs north for 24 miles before joining the Tanana River. There is little documentation of fish presence in reaches of this river. Kiana Creek (334-40-11000-2490-3362, Johnson and Weiss, 2007) is a clearwater tributary of the Tanana River whose confluence lies approximately 4 miles upstream of the Little Delta River/Tanana River confluence. The first 7 miles of Kiana Creek support coho salmon during rearing (Johnson and Weiss, 2007), and it is likely that there are spawning areas upstream of the rearing areas. Additional coho rearing habitat has been documented east of the cataloged reach of Kiana Creek (Noel, 2007, Records 68 and 69). Delta Creek is a glacial tributary of the Tanana River whose confluence lies about 7 miles upstream from the mouth of Kiana Creek. Resident fish species have been documented near the mouth of Delta Creek, but no anadromous fish habitat is known to occur within this stream.

Donnelly Alternative Segment 1 would not cross any streams supporting EFH or anadromous fish. Tables G-12 and G-13 list EFH Donnelly Alternative Segment 2 would cross.

Table G-12
EFH-bearing Streams the Donnelly Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Donnelly 1						
none						
Donnelly 2						
40	Unnamed	Stream	Anadromous	75	Culvert	3 x 10
41	Unnamed	Stream	EFH	18	Bridge	40
252	Unnamed	Wetland	Anadromous	85	Culvert	4
100	Kiana Creek	Stream	Anadromous	35	Bridge	80

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-13
Fish, Life Stages, and Habitats that Could Be Affected By Construction and Operation of the Donnelly Alternative Segments[a]

	Life Stages				Habitat				
Fish Presence	Eggs	Fry/ Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Unnamed Streams (Crossings 40, 41), Kiana Creek and Tributaries (Crossings 100, 252)									
Coho Salmon			X	X		X		X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Donnelly Alternative Segment 2 would cross the lower reach of Kiana Creek at Crossing 100. Crossing 252 is at a tributary of Kiana Creek that is downstream of Crossing 100. A Tanana River tributary (Crossing 40) draining a large wetland between the Donnelly alternative segments also provides coho salmon rearing habitat (Noel, 2007, Record 68, 69). Another Tanana River tributary (Crossing 41) provides coho salmon habitat. Upper reaches of this watershed appear to depend on precipitation to maintain summer flows during at least a portion

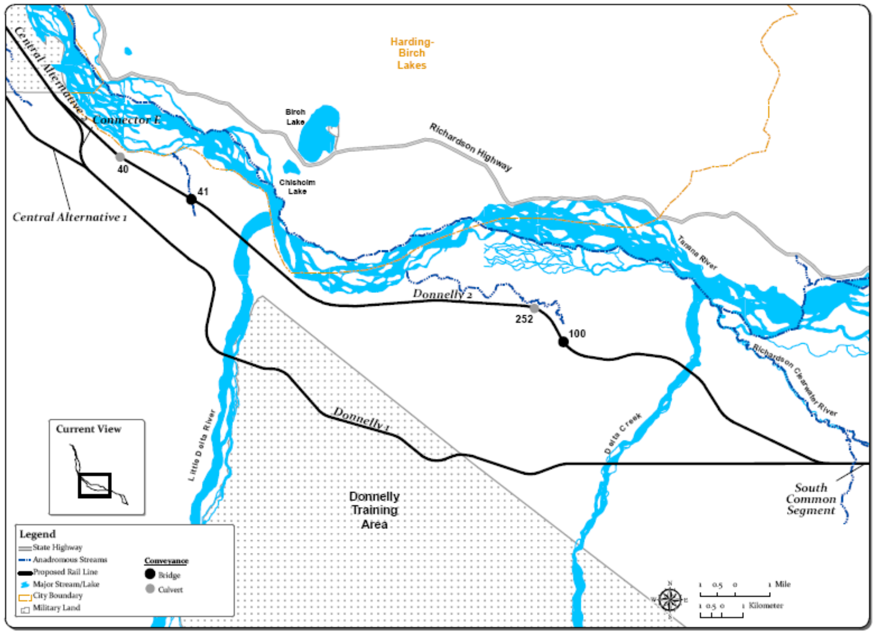

Figure G-7 – EFH-bearing Streams Crossed by the Donnelly Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

of the summer (Noel, 2007, Record 168, 169, 179). The lower portions of the Kiana Creek drainage support coho salmon rearing, and coho salmon spawning. The outflow channel from a clearwater stream complex, just down river from the Donnelly Alternative Segment 2 Delta Creek crossing, could contain habitat suitable for fall spawning chum salmon.

South Common Segment

South Common Segment would cross several tributaries of the Richardson Clearwater River (331-40-11000-2490-3370, Johnson and Weiss, 2007), a clearwater stream that flows northwest for about 14 miles before joining the Tanana River (Figure G-8). This stream supports populations of coho salmon and chum salmon; their eggs and likely juvenile coho salmon overwinter in the stream. Juvenile coho salmon and other resident fish use it as a summer feeding ground (Ridder, 1983; Johnson and Weiss, 2007). Project alternatives would cross the two unnamed tributaries of the Richardson Clearwater River (331-40-11000-2490-3370-4030 and 331-40-11000-2490-3370-4040, Johnson and Weiss, 2007) that support coho spawning and rearing. A third unnamed stream likely contains anadromous fish.

Tables G-14 and G-15 list EFH South Common Segment would cross. Although anadromous fish were not found during limited surveys of the area, because spawning gravels were present, it is likely that Crossing 103 provides habitat for coho salmon (Noel, 2007, Record 141). Construction of road and rail line bridges at these three crossings would lead to the removal of trees next to the streams. The wildland fire that occurred in this area in 1998 burned most of the trees along these streams, and crossings at these three streams would remove some of the few remaining trees that line the streams.

Table G-14
EFH-bearing Streams South Common Segment Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
136	Unnamed	Stream	EFH	10	Bridge	50
103	Unnamed	Stream	Anadromous	35	Bridge	65
104	Unnamed	Stream	EFH	15	Bridge	40

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-15
Fish, Life Stages, and Habitats That Could Be Affected By Construction and Operation of South Common Segment[a]

	Life Stages				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Richardson Clearwater River Tributaries (Crossings 136, 104)									
Chum Salmon	X	X		X	X		X		X
Coho Salmon	X	X	X	X	X	X	X	X	X
Richardson Clearwater River Tributaries (Crossing 103)									
Coho Salmon	X	X	X	X	X	X	X	X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

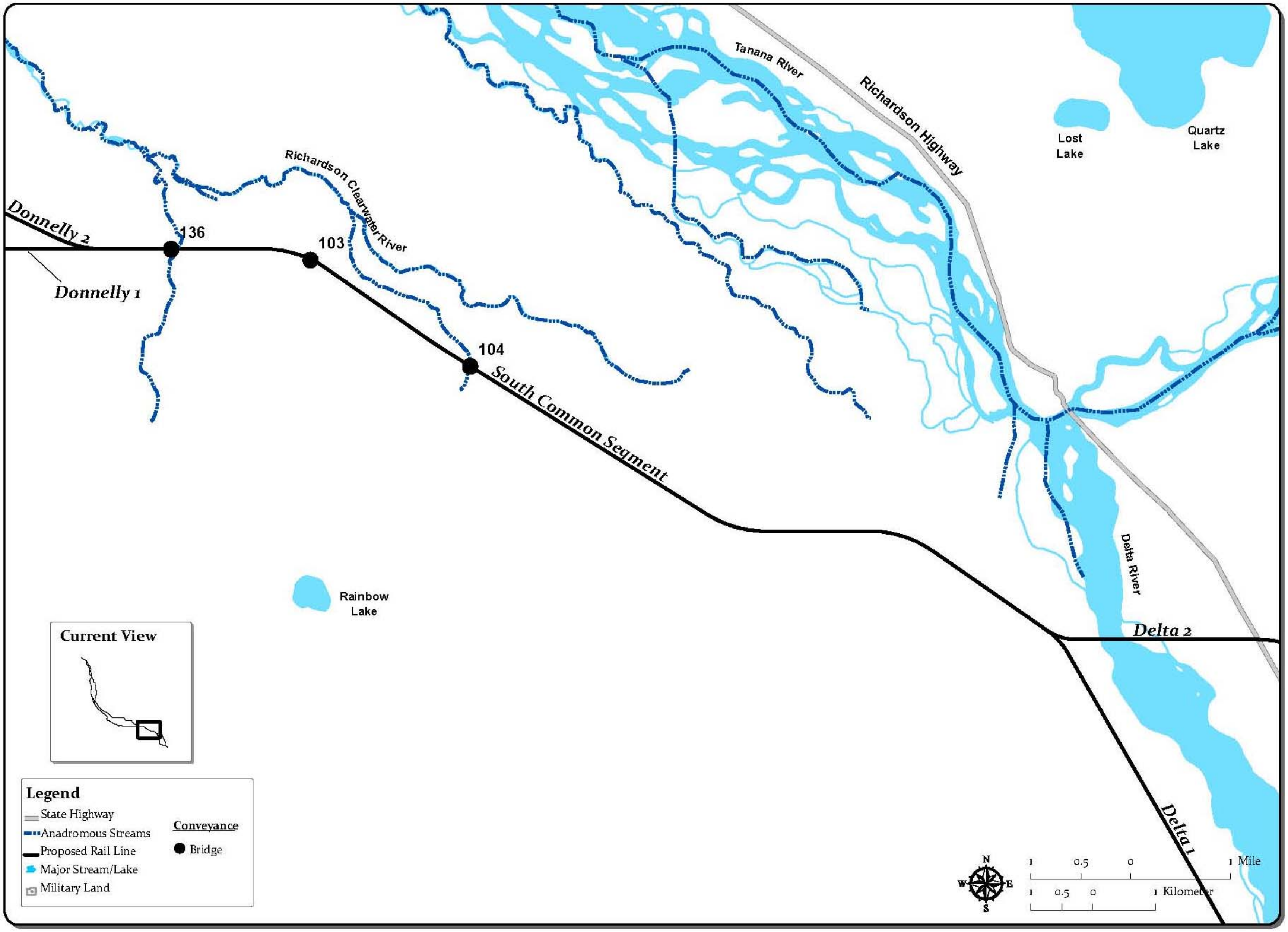

Figure G-8 – EFH-bearing Streams Crossed by South Common Segment (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007

South Common Segment Crossing 103 is a clearwater stream with gravel substrates, groundwater upwelling, and a mix of run riffle and pool habitat (Noel, 2007, Record 141). Spawning of summer-run chum salmon and fall-run coho salmon occur in the Richardson Clearwater River (Johnson and Weiss, 2007), into which this stream flows. The occurrence of suitable spawning habitat at this site, along with connection to a known anadromous stream, make it likely that coho salmon use this stream for spawning. Crossing 104 is similar to Crossing 103 and also contains gravels suitable for spawning.

Delta Alternative Segments

The Delta River (331-10-11000-2490-3390, Johnson and Weiss, 2007) supports resident fish, especially during seasonal movements, and the lower 2 miles of this river downstream of the crossings also support fall chum and coho spawning (Figure G-9). Upwelling in this area cleans gravels of glacial silts and maintains sufficient flows to remain unfrozen during winter, providing overwinter incubation habitat for eggs and larvae of chum and coho salmon. The Delta alternative segments would not cross this area.

The Delta alternative segments would not directly cross EFH. Gravel mining within the channel of the Delta River and channel constriction caused by the placement of gravel fill within the active channel and floodplain of the Delta River have the potential to affect the subsurface water flow and sediment movement that maintain the EFH downstream from the Delta River crossing sites.

G.4 Mitigation

This section identifies mitigation measures that would avoid, minimize, or compensate for potential adverse impacts to EFH. Federal, State of Alaska, and local regulations and permit processes are in place to ensure that construction and operations activities are conducted in an environmentally responsible manner, and the Applicant would be required to comply with these various regulatory requirements and associated best management practices.

Section G.4.1 describes voluntary measures proposed by the Applicant, some of which are regulatory-related requirements and associated best management practices, and Section G.4.2 describes SEA’s recommended preliminary mitigation measures. SEA’s preliminary mitigation measures are based on the information available to date, consultations with appropriate agencies, and the environmental analysis in the EIS.

G.4.1 Applicant’s Voluntary Mitigation Measures

The Applicant has identified the following voluntary measures as potential mitigation for impacts to water resources and fisheries resources:

Erosion and Sedimentation Controls

The Applicant shall be subject to U.S. Environmental Protection Agency jurisdiction under the National Pollutant Discharge Elimination System (NPDES) for stormwater discharges resulting from construction activities. Requirements that are commonly part of a Stormwater Pollution Prevention Plan associated with a NPDES Stormwater Construction Permit include the following:

- Ground disturbance shall be limited to only the areas necessary for project-related construction activities.

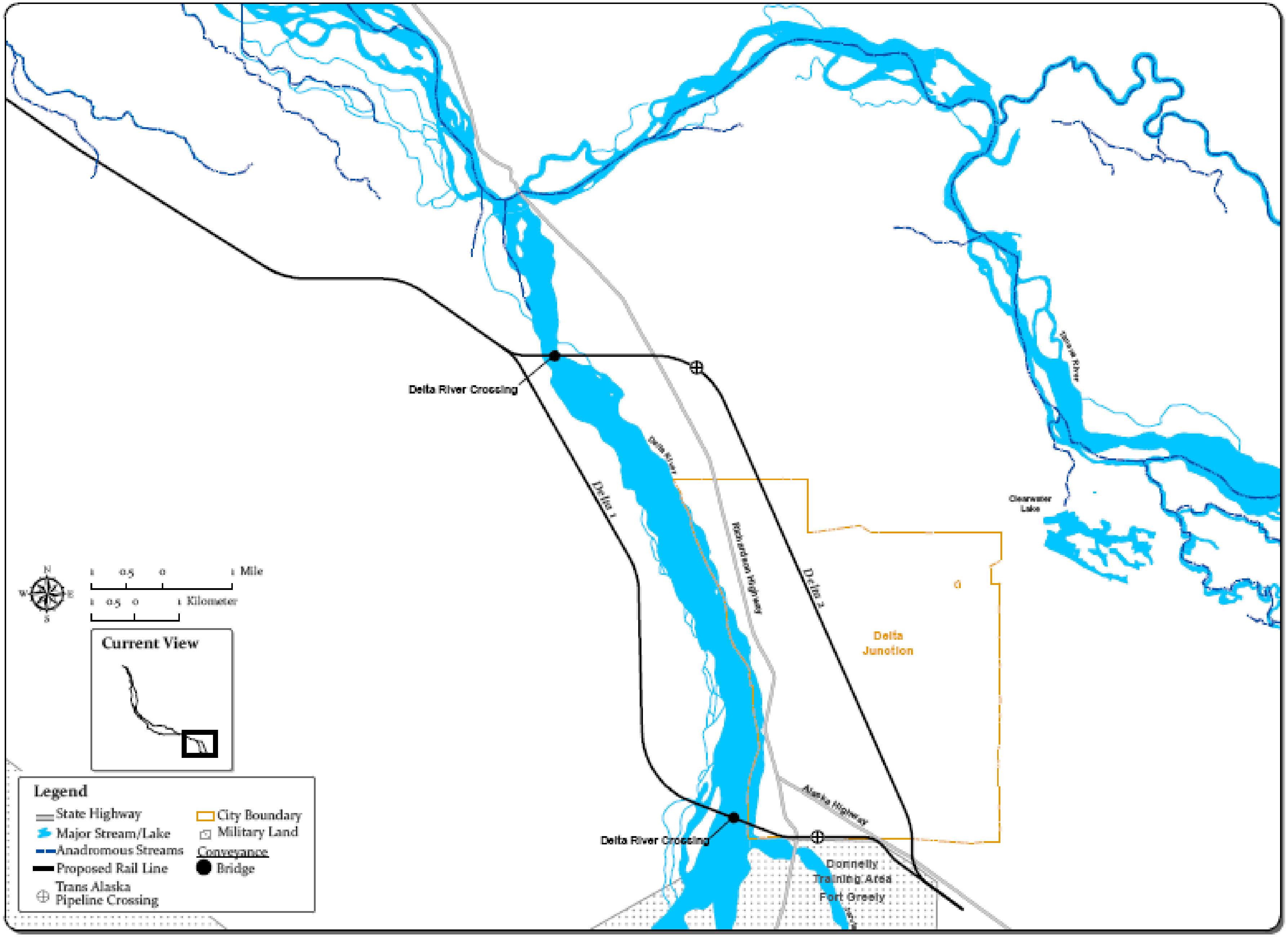

Figure G-9 – EFH -Bearing Streams Crossed by the Delta Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

- During earthmoving activities, topsoil shall be reused wherever practicable and stockpiled for later application during reclamation of disturbed areas.
- Appropriate erosion control measures shall be employed to minimize the potential for erosion of soil stockpiles until they are removed and the area is restored.
- Disturbed areas shall be restored as soon as practicable after construction ends along a particular stretch of rail line, and the goal of restoration shall be the rapid and permanent reestablishment of native ground cover on disturbed areas to prevent soil erosion.
- The bottom and sides of drainage ditches shall be revegetated using natural recruitment from the native seed sources in the stockpiled topsoil or a seed mix free of invasive plant species.
- If weather or season precludes the prompt reestablishment of vegetation, temporary erosion control measures shall be implemented.

Water Resources Protection

- Prior to initiating any project-related construction activities, a spill prevention, control, and countermeasure plan for petroleum products or other hazardous materials, as required by Federal and state regulations, shall be developed. The plan shall prevent discharges and contain such discharges if they occur. The plan shall include a requirement to conduct weekly inspections of equipment of any fuel, lube oil, hydraulic, or antifreeze leaks. If leaks are found, the Applicant shall require the contractor(s) to immediately remove the equipment from service and repair or replace it.
- Federal permits, including those required by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, shall be obtained from the U.S. Army Corps of Engineers prior to initiation of construction. The Applicant shall also obtain necessary state permits and authorizations (*e.g.*, Alaska Department of Fish & Game Fish Habitat Permit, Alaska Department of Natural Resources Land Use Permit, and an Alaska Department of Environmental Conservation Section 401 water quality certification). Permit stipulations shall be incorporated into construction contract specifications.
- The new rail line shall be designed and constructed in such a way as to maintain natural water flow and drainage patterns to the extent practicable. This shall include placing equalization culverts through the embankment as necessary, preventing impoundment of water or excessive drainage, and maintaining the connectivity of floodplains and wetlands.
- The smallest area practicable around any streams shall be disturbed and, as soon as practicable following construction activities, disturbed areas shall be revegetated using native vegetation.
- Bridges and culverts shall be designed, constructed, and operated to maintain existing water patterns and flow conditions as practicable.
- Culverts shall be designed and constructed for new fish-stream crossings with a width greater than or equal to 125 percent of the width of the stream at the ordinary high water stage. The culvert grade shall approximate the surrounding slope of the stream channel. Whenever possible, new culverts shall be buried to approximately 40 percent of their diameter with substrate material that would remain stable at expected flood discharge rates. This shall not apply to any water crossing more than 15 feet in bank-to-bank width due to span length limitations. Alternative design measures shall be required to meet the same design goals on streams more than 15 feet wide at ordinary high water.

- When project-related construction activities, such as culvert and bridgework, shall require work in streambeds, these activities shall be conducted during low-flow conditions or as otherwise permitted.
- During construction, project-related construction vehicles shall be directed to avoid driving in or crossing streams at other than established crossing points.
- Temporary stream crossings shall be placed across waterways during construction to provide access for contractors, work crews, and heavy equipment.
- Temporary structures shall avoid overly constricting active channels and shall be removed as soon as practicable after the crossing is no longer needed.
- As part of the National Pollutant Discharge Elimination System Stormwater Construction Permit and Stormwater Pollution Prevention Plan, during construction:
  - Temporary barricades, fencing, and/or flagging shall be used to contain project-related impacts to the construction area and avoid impacts beyond the project footprint.
  - Areas disturbed, except for the rail line embankment, shall be returned to their preconstruction contours to the extent practicable, and reseeded or replanted with native vegetation within one growing season following construction to provide permanent stabilization and minimize the potential for erosion.
  - Contaminant-free embankment and surface materials shall be used.
  - Appropriate best management practices shall be used within parallel drainage ditches that are within 1,000 feet of perennial waters to provide stormwater retention and filtration. Drainage ditches shall be maintained as necessary (e.g., by removing accumulated sediments to maintain stormwater retention capacity and function).
- For the portions of the project within the Fairbanks North Star Borough (FNSB), the Applicant shall coordinate with the local FNSB Floodplain Administrator to ensure that new project-related stream and floodplain crossings were appropriately designed. For crossings within the mapped 100-year floodplain, drainage crossing structures shall be designed to pass a 100-year flood.

Fisheries Resources Protection

- State permits and authorizations, like the Alaska Department of Fish and Game Fish Habitat Permit, shall be obtained. Permit stipulations shall be incorporated into the construction contract specifications.
- Construction in anadromous streams shall be timed where practicable to minimize adverse effects to salmon during critical life stages. Timing windows, as specified by Alaska Department of Fish and Game’s Division of Habitat, shall be incorporated into construction contract specifications for instream work. Stream crossings shall be designed and constructed so as not to impede fish passage or impair the hydrologic functioning of the waterbody.
- When project-related construction activities, such as culvert and bridgework, require work in streambeds, activities shall be conducted, to the extent practicable, during either summer or winter low-flow conditions.
- Construction in anadromous streams shall be timed where practicable to minimize adverse effects to salmon during critical life stages. Timing windows, as specified by Alaska

Department of Fish and Game's Division of Habitat, shall be incorporated into construction contract specifications for instream work. Stream crossings shall be designed and constructed so as not to impede fish passage or impair the hydrologic functioning of the waterbody.

- Essential Fish Habitat (EFH) conservation measures shall be implemented as agreed upon with the National Marine Fisheries Service during the EFH consultation process.

G.4.2 SEA's Preliminary Mitigation Measures

SEA has identified the following preliminary measures as potential mitigation for impacts to water resources and fisheries resources:

Water Resources Mitigation

- During the final design process and facility siting, the Applicant shall conduct pre-siting investigations of potential borrow areas, staging areas, camps, and access roads to:
  - Identify the highly sensitive areas within the project area (in consultation with U.S. Fish and Wildlife Service and Alaska Department of Fish and Game) and locate facilities in previously disturbed sites and not in sensitive habitat areas, to the extent practicable.
  - Avoid to the extent practicable areas that could affect or be affected by flooding (especially with frequent recurrence intervals during the construction window); areas that have moderate to high densities of fine-grained permafrost soils, especially if the permafrost area is adjacent to or nearby a waterbody; and areas that are otherwise sensitive.
  - Minimize to the extent practicable the total number and footprint area of facilities (*e.g.*, for borrow areas, by hauling material longer distances to avoid environmentally sensitive areas adjacent to water bodies; and for access roads, by minimizing width).
  - During construction, minimize the duration and extent of activity to develop the facilities and provide surface treatments to minimize soil compaction (*e.g.*, scarify compacted soils through the compacted zone during reclamation to promote infiltration) and promote vegetation regrowth, including a reclamation plan that addresses rehabilitating recharge characteristics to maintain long-term hydrologic stability, habitat, and final usage (*e.g.*, recreation, aquatic habitat). Plans for excavation depths shall be developed in cooperation with appropriate agency staff to both minimize areal extent (by maximizing depth) and maximize post-project function (through such measures as leaving shelves or gently sloping littoral areas).
- For conveyance structures located in active braided channels, the Applicant shall examine the seasonal and annual stages and extent of flooding for the braided rivers to determine the optimum construction window and to estimate heights for protective berms or dikes necessary to minimize flooding during the construction period and to minimize the effect on drainage patterns during flooding.
- The Applicant shall avoid potential ice-jam locations and permafrost areas, fine-grained sediments, and steep, high streambanks when locating ice bridges and approaches. Specially adapted best management practices shall be applied for construction activities within these types of areas. For example, the Applicant shall slot ice bridges in several areas to accommodate faster disintegration of the bridge during the spring breakup period.

- The Applicant shall evaluate construction water needs in relation to streamflow rates and minimize effects of water supply extraction from watercourses. If the Applicant uses groundwater as a water supply source, the Applicant shall evaluate estimated groundwater withdrawal rates in relation to annual and seasonal recharge rates and minimize effects of water withdrawal on surface water and groundwater.
- The Applicant shall conduct detailed site-specific hydraulic analyses and modeling (*e.g.*, as indicated in Roach, 2007, and Zufelt, 2007), including examination of potential ice-jam and scour effects, for the Tanana River crossings to predict changes to flow paths, velocity profiles, and scour at high-flow discharges.
- The Applicant shall conduct site-specific analyses of seasonal variations in sediment transport mechanisms before the bridge construction work proposed in the two large braided streams (Delta Creek and the Little Delta River) to minimize the potential for disturbance.
- During final design, rail line and access roads located in floodplains shall allow for the flow of floodwaters to floodplain storage areas by incorporating a sufficient number and size of culverts or bridges. The Applicant shall conduct site-specific analyses that incorporate flood conveyance and hydraulics and flood storage requirements of the 100-year flood as part of the design. For crossings within the mapped 100-year floodplain, the Applicant shall design drainage crossing structures to pass a 100-year flood without increasing the surface water elevation of the base flood by more than 1 foot, consistent with Federal Emergency Management Agency regulations (44 Code of Federal Regulations Part 9).
- Spill barriers or absorbent material shall be provided at the down-gradient ends of staging areas and camp sites to contain any potentially contaminated surface runoff. Erosion and sediment controls shall also be required as needed at these locations.
- Standard protocols for transporting hazardous substances and other deleterious compounds to minimize the potential for a spill occurrence near or adjacent to water bodies shall be followed.
- Tank storage facilities shall be placed at the farthest practical locations away from any streams or rivers, and standard protocols (*i.e.*, lined and bermed pits for secondary containment) for storing chemical and petroleum products shall be implemented. The Applicant shall consult with Alaska Department of Environmental Conservation to determine appropriate measures and distances.
- As specified in the U.S. Army Corps of Engineers Alaska District's Nationwide Permits General Best Management Practice guide (USACE, 2007b):
    - Sediment and turbidity at the work site shall be contained by installing diversion or containment structures.
    - Dredge spoils or unusable excavated material not used as backfill at upland disposal sites shall be disposed of in a manner that minimizes impacts to wetlands.
    - Wetlands shall be revegetated as soon as possible, preferably in the same growing season, by systematically removing vegetation, storing it in a manner to retain viability, and replacing it after construction to restore the site.
    - Stream banks shall be restored and revegetated using techniques such as brush layering, brush mattressing, and use of jute matting and coir logs to stabilize soil and reestablish native vegetation.

- Topsoil and organic surface material, such as root mats, shall be stockpiled separately from overburden and returned to the surface of the restored site.
- Fill materials that are free from fine material shall be used.
- The load of heavy equipment shall be dispersed such that the bearing strength of the soil shall not be exceeded, either by using mats when working in wetlands or by using tracked rather than wheeled vehicles.

- Stream channels and existing culvert locations shall be marked before snowfall to avoid damage to these areas.
- Road and track crossings of water bodies shall be aligned perpendicular or near perpendicular to watercourses to minimize crossing length and potential bank disturbance.
- The impact of development on key wetlands, including fens, shall be minimized. Key wetlands are those that are important to fish, waterfowl, shorebirds, and other wildlife species because of their high value or scarcity in the region.
- All construction debris (including construction materials, soil, or woody debris) shall be removed from surface waters immediately upon placement during the open-water period, or prior to break-up for debris on top of or within ice or snow crossings.
- Except at approved crossing or other approved work locations, riparian vegetation shall not be cleared within 100 feet of fish-bearing water bodies.
- Gravel mining required for construction or operations shall be restricted to the minimum necessary to develop and operate the rail line efficiently and with minimal environmental damage. Gravel mine sites shall not be located within the active floodplain of a watercourse unless the Alaska Department of Natural Resources Division of Mining, Land, and Water, after consultation with Alaska Department of Fish and Game, determines that there would be no feasible and prudent alternative, or that a floodplain mine site would enhance fish and/or wildlife habitat after mining operations were completed and the site was appropriately closed. Mine site development and rehabilitation within floodplains shall follow the general procedures and guidelines outlined in *North Slope gravel pit performance guidelines* (Mclean, 1993).

Fisheries Resources Mitigation

- The Applicant shall accommodate the restoration efforts underway by U.S. Fish and Wildlife Service for Piledriver Slough and other sloughs occurring within the Piledriver Slough drainage during rail line construction and operations. Crossings shall be consistent with ongoing and planned fish habitat restoration efforts.
- The Applicant shall not place bridge piers or abutments in known areas of permafrost.
- Ice or snow bridges and approach ramps constructed at stream crossings shall be substantially free of extraneous material (*e.g.*, soil, rock, wood, or vegetation) and must be removed or breached before spring breakup.
- Under Title 16 of the Alaska Statutes (AS), the measures listed below would be imposed by ADF&G for all activities below the ordinary high water mark in specified anadromous water bodies and for activities in fish-bearing waters that could block fish passage. Exceptions to these requirements, including exceptions for the use of spill containment and recovery equipment or material source development, may be allowed on a case-by-case basis.

  - All ice crossings would be drilled before equipment crossing to determine the ice thickness.
  - Alteration of river, stream, or lake banks or beds, except for approved permanent crossings, would be prohibited.
  - The operation of equipment, excluding boats, in open water areas of rivers and streams would be prohibited. Exceptions to this for water withdrawal would be permitted on a site-specific basis.
  - Ice or snow bridges and approach ramps constructed at river, slough, or stream crossings would be substantially free of extraneous materials (*e.g.*, soil, rock, wood, or vegetation) and would be removed or breached before spring breakup.
  - Bridges are the preferred watercourse crossings in fish spawning and important rearing habitats. In areas where culverts are used, they would be designed, installed, and maintained to provide efficient passage of fish.

- Detonation of explosives within, beneath, or close to fish-bearing waters would not result in overpressures exceeding 2.7 pounds per square inch unless the water body, including its substrate, is frozen solid. Peak particle velocity stemming from explosives detonation would not exceed 0.5 inch per second during the early stages of egg incubation. (Blasting criteria have been developed by ADF&G and are available on request.)
- Winter ice bridge crossing and summer ford crossing of all anadromous and resident fish streams would require prior ADF&G permit authorization under AS 16.05.841 and AS 16.05.871. If necessary, natural ice thickness may generally be augmented (through removing snow, adding ice or water, or other techniques) if site-specific conditions, including water depth, are sufficient to protect fish habitat and maintain fish passage. Factors to be considered include whether augmented ice thickness is likely to 1) cause freeze down into gravels used for spawning or fish overwintering habitat, 2) cause bed scouring that disturbs gravels used for fish spawning or fish overwintering habitat, 3) excessively reduce the quality or volume of fish overwintering habitat, or 4) adversely alter stream flow patterns above or below the crossing.
- The Applicant would not narrow an anadromous waterbody between its ordinary high water marks unless specifically authorized in writing by ADF&G prior to construction.
- Water withdrawal from fish-bearing waters would be subject to prior written approval by the ADNR Division of Mining, Land & Water and ADF&G Division of Habitat, would reserve adequate flow to support indigenous aquatic life, and the watercourse would not be blocked to the passage of fish. Each water intake directly accessible by fish would be designed to prevent the intake, impingement, or entrapment of fish. Maximum screen mesh size and approach velocities for various fish species are available from ADF&G.

G.5 Summary of Impacts to EFH

The primary impacts to EFH and anadromous fish habitat from crossing structures would be loss and degradation of instream habitats due to placement of structures, alteration of stream hydrology, and blockage of movements. All stream crossings would result in some loss and degradation of instream and riparian habitats, and alterations of stream hydrology, as discussed in Chapter 4 of the EIS. Bridged crossings would normally result in a smaller area of instream habitat loss compared to closed bottom culverts. In general, clear-span bridges (those without instream bridge pilings) would have less potential to create conditions that would cause blockage of salmon movements. The primary impact of instream gravel removal would be temporary or permanent habitat alteration, depending on the amount of gravel removed and the gravel recharge rate. Most alternative segments would cross documented EFH with bridges. The proposed action would require 10 anadromous fish-stream crossings including 6 crossings of EFH and 4 crossings of streams likely to contain anadromous salmon and habitat (Table G-16). Salcha Alternative Segment 2 would result in filling and alteration of Tanana River side channels near the outflow of the Little Salcha River and across from Flag Hill. Both side channels are used for fall-run chum salmon spawning. Construction and operation of the Tanana River bridge and river training structures in the river channels associated with both Salcha Alternative Segment 1 and Salcha Alternative Segment 2 would have direct adverse effects on EFH (chum salmon spawning and migration habitats) both upstream and downstream from the proposed structures. Stream crossings on the west side of the Tanana River would each include two crossing structures, one for the rail and one for the maintenance road, although this had been identified as a single crossing in tables. The minimum number of EFH and anadromous salmon stream crossings that would be required for the proposed NRE would be 8 (87 percent bridges, 75 percent EFH), and the maximum number would be 21 (62 percent bridges, 52 percent EFH). All EFH crossings for the proposed action would use bridges, and most anadromous salmon stream crossings would use bridges (75 percent, Table G-16). Construction of the proposed NRE would have moderate impacts to anadromous salmon resources in the project area.

Table G-16
Summary of EFH and Anadromous[a] Fish-bearing Streams Crossed by the NRE Alternative Segments

	EFH				Anadromous Fish Habitat			
Alternative Segment	Bridge	Culvert	None	Total EFH Crossings	Bridge	Culvert	Total Anadromous Crossings	Total EFH and Anadromous Crossings
North Common Segment	1			1				1
Eielson 1	1	1		2				2
Eielson 2	2			2				2
Eielson 3	1			1				1
Salcha 1	1			1				1
Salcha 2[b]	4	1	1	6	1	3	4	10
Central 1								
Central 2					1		1	1
Connector A					1		1	1
Connector B	1			1		1	1	2
Connector C	1			1	2	3	5	6
Connector D					3	1	4	4
Connector E					1		1	1
Donnelly 1								
Donnelly 2	1			1	1	2	3	4
South Common Segment	2			2	1		1	3
Delta 1								
Delta 2								
Proposed Action[c]	6	0	0	6	3	1	4	10
Minimum Crossings Alternative[d]	5	1	0	6	2	0	2	8
Maximum Crossings Alternative[e]	9	1	1	11	4	6	10	21

[a] EFH includes important spawning, rearing, or migration habitat for Chinook, coho, or chum salmon (Johnson and Weiss, 2007); anadromous habitats are those areas with probable-use based on proximity and habitat or documented, but uncataloged use by these species

[b] Salcha 2 would fill rather than cross a side channel; there would be no conveyance (“none” column) structure.

[c] Proposed Action (the Applicant’s preferred route): North Common, Eielson 3, Salcha 1, Connector B, Central 2, Connector E, Donnelly 1, South Common, and Delta 1.

[d] Minimum stream crossings: North Common, Eielson 1, Salcha 1, Connector A, Central 1, Donnelly 1, South Common, and Delta 1.

[e] Maximum stream crossings: North Common, Eielson 3, Salcha 2, Central 1, Connector C, Donnelly 1, South Common, and Delta 1.

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