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December 4, 2009

Rec'd 12/22/09

Ms. Victoria Rutson
Chief, Section of Environmental Analysis
Surface Transportation Board
395 E Street, S.W.
Washington, D.C. 20423

Re: Finance Docket No. 35095, The Alaska Railroad Corp. -- Petition For An Exemption From 49 U.S.C. §10901 To Construct and Operate a Rail Line Extension to Port MacKenzie, Alaska

Dear Ms. Rutson:

Per your March 20, 2009 information request, and on behalf of the Alaska Railroad Corporation and with the support of the Matanuska-Susitna Borough, enclosed please find our responses regarding your requests 1-5.

Request 1: New water crossing information, including the purpose of the proposed 48-inch culvert near the eastern tie-in point of the Big Lake Segment to the main line.

Response: The 48" culvert near the eastern tie-in point on the Big Lake Segment to the main line was originally placed based on the ARRC Track Chart. Any inconsistencies will be addressed during preliminary design. All other revisions and additions are shown in red text in the attached Revised Appendix G Tables.

Request 2: Types of conveyance structures that could be needed.

Response: All revisions and additions, including conveyance structures types, are shown in red text in the attached Revised Appendix G Tables.

Request 3: Typical cross section of the anadromous stream relocation design and anticipated footprint for construction, including equipment access and staging areas, if required.

Table G-1 Drainage Area Properties

Milepost	Total Area (sq mi)	Storage Areas	Storage Area (sq mi)	Storage % Total Area	Annual Precip. (in)	Q-100 (cfs)	Q-100 Flow Sized Structure	Maximum Culvert Flow (cfs)
MW-4.6	4.08	Freshwater Pond Lake	0.03 0.36	9.5%	20	91.1	48-in Culvert	98.7
MW-11.0	0.91	Freshwater Pond Lake	0.02 0.06	9.2%	20	25.8	36-in Culvert	45.0
ME-4.4	1.66	Freshwater Pond Lake	0.02 0.36	23.0%	20	35.1	36-in Culvert	45.0
CI-2.6	5.96	Freshwater Pond Lake	0.03 0.22	4.1%	20	148.7	72-in Culvert	272.5
W-0.6 (Little Susitna River)	295.5	Freshwater Pond Lake	1.53 8.90	3.5%	28	5891.8	Bridge	NA
W-10.0	32.14	Freshwater Pond Lake	0.52 4.23	14.8%	20	474.3	Drainage Structure	NA
W-14.4	0.75	Freshwater Pond Lake	0.00 0.00	0.0%	20	37.8	36-in Culvert	45.0
W-16.7	5.4	Freshwater Pond Lake	0.10 0.70	14.8%	20	104.9	72-in Culvert	272.5
W-20.9	0.86	Freshwater Pond Lake	0.00 0.00	0.2%	20	40.6	36-in Culvert	45.0
W-24.0 (Willow Creek)	255.57	Freshwater Pond Lake	0.92 2.03	1.2%	27	5946.0	Bridge	NA
MP-189.0 (Existing Bridge)	12.54	Freshwater Pond Lake	0.07 0.00	0.6%	24	448.4	Bridge	NA
MP-190.3 (Existing Bridge)	5.43	Freshwater Pond Lake	0.03 0.04	1.3%	25	212.3	Bridge	NA
H-0.8	25.06	Freshwater Pond Lake	0.32 1.64	7.8%	20	440.9	Drainage Structure	NA
H-4.3	2.14	Freshwater Pond Lake	0.03 0.42	21.0%	20	44.4	36-in Culvert	45.0
H-6.3	17.35	Freshwater Pond Lake	0.07 1.69	10.2%	20	305.3	Drainage Structure	NA
H-9.6	2.81	Freshwater Pond Lake	0.01 0.22	8.3%	20	68.4	48-in Culvert	98.7
HN-3.2 (Little Susitna River)	202.54	Freshwater Pond Lake	0.44 2.02	1.2%	32	5787.4	Bridge	NA
HN-4.4	33.25	Freshwater Pond Lake	0.35 2.78	9.4%	20	538.4	Drainage Structure	NA
HN-4.8	5.17	Freshwater Pond Lake	0.01 0.12	2.5%	20	144.4	72-in Culvert	272.5
HN-5.7	21.44	Freshwater Pond Lake	0.21 4.44	8.2%	20	382.4	Drainage Structure	NA
HS-1.0	0.77	Freshwater Pond Lake	0.00 0.00	0.0%	20	38.6	36-in Culvert	45.0
MP-174.3 (Existing Bridge)	160.41	Freshwater Pond Lake	0.08 0.39	0.3%	35	3798.3	Bridge	NA
B-6.4	13.38	Freshwater Pond Lake	0.09 1.34	10.7%	20	242.6	72-in Culvert	272.5
B-9.0	118.04	Freshwater Pond Lake	1.27 11.15	10.5%	20	1535.5	Drainage Structure	NA
B-14.3	0.23	Freshwater Pond Lake	0.03 0.00	11.6%	20	7.7	24-in Culvert	14.5
B-14.8	1.09	Freshwater Pond Lake	0.07 0.00	6.1%	20	38.6	36-in Culvert	45.0
B-15.1	0.56	Freshwater Pond Lake	0.00 0.00	0.0%	20	29.5	36-in Culvert	45.0
B-15.2	15.86	Freshwater Pond Lake	0.11 0.60	4.5%	20	334.4	Drainage Structure	NA
B-15.9	46.01	Freshwater Pond Lake	0.38 2.57	6.4%	20	767.6	Drainage Structure	NA
B-16.6	2.12	Freshwater Pond Lake	0.00 0.21	10.1%	20	51.7	48-in Culvert*	98.7
B-17.4	1.75	Freshwater Pond Lake	0.00 0.21	12.3%	20	42.1	36-in Culvert*	45.0

NOTES:

From Mannings Equation the maximum flow (full pipe flow) for the corresponding sizes of corrugated metal pipes (Manning's $N=0.23$) at 1% slope and a head to a depth of 1.5 X the culvert diameter (AREMA Manual for Railway Engineering 2006 Section 4.8.2) (calculated using FHWA's HY-8 culvert design software)

24-inch: 14.5 cfs

36-inch: 45 cfs

48-inch: 98.7 cfs

72-inch: 272.5 cfs

Pipe sizings were designed for the 100 year event (AREMA Manual for Railway Engineering 2006 Section 4.8.2) for each drainage area as calculated by the USGS regression equations published in USGS Water-Resources Investigation Report 03-4188

Total Drainage Areas were calculated using ArcHydro watershed delineation of USGS 2-arc second DEM's as well as USGS quad maps

Areas of lakes and ponds within each drainage area were taken from USFWS NWI quad maps

Drainage Structures will be determined during the subsequent design processes and could include multi-plate culverts, pre-cast arches, and single or multiple short span bridges

Anadromous streams, highlighted in blue, are currently sized for flow; however, sizing for fish passage will also need to be performed for final design.

* - Conveyance structures within 1500' of trail crossings were sized up to drainage structures in Table F-2

Red text indicates modification from PEAR

Red-strikingthrough indicates removed culverts outside of project extent due to change in Houston North alignment

Table G-2 Drainage Crossing List

Alignment Segment	Station	Mile-post	Water Body Type	Conveyance Type	Culvert Diameter (inches)	Quantity	Culvert Length (feet)	Extension Length (feet)	Fisheries	Navigation	Size-Controlling Factor
Mac East	45+73.32	T-0.9	UMD	Culvert	48	1	80	-	-	None	
Mac East	65+37.63	T-1.2	Wetland	Culvert	48	1	80	-	-	None	
Mac East	130+46.23	ME-2.5	UMD	Culvert	48	1	80	-	-	None	
Mac East	changed	ME-4.5	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Mac East	358+68.43	ME-7.4	UMD	Culvert	48	1	80	-	-	None	
Mac East Additional	Unspecified	NA	UMD	Culvert	36	13	80	-	NA	NA	
Mac East Equalization	Unspecified	NA	Wetland	Culvert	24	10	60	-	NA	NA	
Mac West	195+84.69	MW-3.7	UMD	Culvert	48	1	80	-	-	None	
Mac West	263+94.12	MW-4.6	Stream	Culvert	48	1	80	-	Possible	Possible	Flow
Mac West	276+19.99	MW-5.2	UMD	Culvert	48	1	80	-	-	None	
Mac West	330+98.80	MW-6.3	UMD	Culvert	48	1	80	-	-	None	
Mac West	358+53.21	MW-6.8	UMD	Culvert	48	1	80	-	-	None	
Mac West	382+42.08	MW-7.2	UMD	Culvert	48	1	80	-	-	None	
Mac West	511+40.33	MW-9.7	UMD	Culvert	48	1	80	-	-	None	
Mac West	439+14.28	MW-8.3	UMD	Culvert	48	1	80	-	-	None	
Mac West	461+74.48	MW-8.8	UMD	Culvert	48	1	80	-	-	None	
Mac West	491+06.15	MW-9.3	UMD	Culvert	48	1	80	-	-	None	
Mac West	534+03.07	MW-10.1	UMD	Culvert	48	1	80	-	-	None	
Mac West	581+25.07	MW-11.0	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Mac West	634+88.01	MW-12.0	UMD	Culvert	48	1	80	-	-	None	
Mac West Additional	Unspecified	NA	UMD	Culvert	36	13	80	-	NA	NA	
Mac West Equalization	Unspecified	NA	Wetland	Culvert	24	20	60	-	NA	NA	
Conn 1	11+20.07	C1-0.2	Wetland	Culvert	48	1	80	-	-	None	
Conn 1	35+29.20	C1-0.7	Wetland	Culvert	48	1	80	-	-	None	
Conn 1	47+47.04	C1-0.9	Wetland	Culvert	48	1	80	-	-	None	
Conn 1	58+29.20	C1-1.1	Wetland	Culvert	48	1	80	-	-	None	
Conn 1	118+68.21	C1-2.3	UMD	Drainage Structure	NA	1	-	-	-	None	Trail
Conn 1	137+13.20	C1-2.6	Stream	Culvert	72	1	80	-	Anadromous	Possible	Flow
Conn 1	157+84.70	C1-3.0	Wetland	Culvert	48	1	80	-	-	None	
Conn 1 Additional	Unspecified	NA	UMD	Culvert	36	5	80	-	NA	NA	
Conn 1 Equalization	Unspecified	NA	Wetland	Culvert	24	7	60	-	NA	NA	
Conn 2	10+21.66	C2-0.2	Wetland	Culvert	48	1	80	-	-	None	
Conn 2	90+19.38	C2-1.7	UMD	Culvert	48	1	80	-	-	None	
Conn 2	98+20.86	C2-1.9	UMD	Culvert	48	1	80	-	-	None	
Conn 2	118+98.84	C2-2.3	UMD	Culvert	48	1	80	-	-	None	
Conn 2 Additional	Unspecified	NA	UMD	Culvert	36	4	80	-	NA	NA	
Conn 2 Equalization	Unspecified	NA	Wetland	Culvert	24	4	60	-	NA	NA	
Conn 3	79+20.00	C3-1.5	UMD	Culvert	36	1	80	-	-	None	
Conn 3	116+16.00	C3-2.2	Wetland	Culvert	24	1	80	-	-	None	
Conn 3	157+36.22	C3-3.0	Wetland	Culvert	48	1	80	-	-	None	
Conn 3	190+08.00	C3-3.6	UMD	Culvert	36	1	80	-	-	None	
Conn 3 Additional	Unspecified	NA	UMD	Culvert	36	3	80	-	NA	NA	
Conn 3 Equalization	Unspecified	NA	Wetland	Culvert	24	1	60	-	NA	NA	
Willow	28+99.68	W-0.6	Willow	Bridge	NA	1	-	-	Anadromous	Navigable	Flow
Willow	128+90.21	W-2.4	UMD	Culvert	48	1	80	-	-	None	
Willow	128+90.21	W-3.6	UMD	Culvert	36	1	80	-	-	None	
Willow	529+01.04	W-10.0	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Willow	727+48.56	W-13.8	UMD	Culvert	48	1	80	-	-	None	
Willow	761+24.87	W-14.4	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Willow	816+23.01	W-15.8	UMD	Culvert	48	1	80	-	-	None	
Willow	867+76.52	W-16.4	UMD	Culvert	48	1	80	-	-	None	
Willow	883+09.84	W-16.7	Stream	Culvert	72	1	80	-	Possible	Possible	Flow
Willow	1032+99.57	W-19.6	Wetland	Drainage Structure	NA	1	-	-	-	None	Trail
Willow	1100+73.35	W-20.9	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Willow	1131+74.79	W-21.4	UMD	Culvert	48	1	80	-	-	None	
Willow	1198+07.28	W-22.7	UMD	Culvert	48	1	80	-	-	None	
Willow	1219+09.17	W-23.1	Wetland	Drainage Structure	NA	1	-	-	-	None	Trail
Willow	1269+20.88	W-24.0	Little	Bridge	NA	1	-	-	Anadromous	Navigable	Flow
Willow	1310+43.59	W-24.8	UMD	Culvert	48	1	80	-	-	None	
Willow	1343+94.53	W-25.5	UMD	Culvert	48	1	80	-	-	None	
Willow	1353+27.20	W-25.6	UMD	Culvert	48	1	80	-	-	None	
Willow Existing Mainline	MP188.16	MP-188.2	Wetland	Culvert	48	1	53	30	-	None	Match Existing
Willow Existing Mainline	MP189.0	MP-189.0	Stream	Bridge	NA	1	-	-	Anadromous	Boat	Match Existing
Willow Existing Mainline	MP189.32	MP-189.3	Wetland	Culvert	36	1	36	30	NA	NA	Match Existing
Willow Existing Mainline	MP189.58	MP-189.6	Wetland	Culvert	36	1	40	30	NA	NA	Match Existing
Willow Existing Mainline	MP190.3	MP-190.3	Stream	Bridge	NA	1	-	-	Anadromous	None	Match Existing
Willow Additional	Unspecified	NA	UMD	Culvert	36	28	80	-	NA	NA	
Willow Equalization	Unspecified	NA	Wetland	Culvert	24	19	60	-	NA	NA	
Houston	39+60.05	H-0.8	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Houston	98+04.98	H-1.2	Wetland	Culvert	24	1	80	-	-	None	
Houston	98+04.98	H-1.9	Wetland	Culvert	48	1	80	-	-	None	
Houston	145+12.99	H-2.8	UMD	Culvert	48	1	80	-	-	None	
Houston	226+06.18	H-4.3	Stream	Culvert	72	1	80	-	Anadromous	Possible	Flow
Houston	98+04.98	H-5.8	Wetland	Culvert	36	1	80	-	-	None	
Houston	333+88.41	H-6.3	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Houston	374+92.74	H-7.1	UMD	Culvert	48	1	80	-	-	None	
Houston	438+54.94	H-8.3	UMD	Culvert	48	1	80	-	-	None	
Houston	497+45.95	H-9.4	UMD	Culvert	48	1	80	-	-	None	
Houston	505+48.22	H-9.6	Stream	Culvert	48	1	80	-	Possible	Possible	Flow
Houston Additional	Unspecified	NA	UMD	Culvert	36	11	80	-	NA	NA	
Houston Equalization	Unspecified	NA	Wetland	Culvert	24	20	60	-	NA	NA	
Houston North	63+81.81	HN-1.2	UMD	Culvert	48	1	80	-	-	None	
Houston North	142+75.61	HN-2.7	Wetland	Culvert	48	1	80	-	-	None	
Houston North	170+19.53	HN-3.2	River	Bridge	NA	1	-	-	Anadromous	Possible	Flow
Houston North	233+00.00	HN-4.4	Stream	Drainage Structure	NA	1	-	-	Anadromous	None	
Houston North	233+47.87	HN-4.8	Stream	Culvert	72	1	80	-	Anadromous	None	
Houston North	299+23.73	HN-5.7	Stream	Drainage Structure	NA	1	-	-	Anadromous	None	Flow
Houston North Existing Mainline	MP177.50	MP-177.5	UMD	Culvert	48	1	42	30	-	None	Match Existing
Houston North Existing Mainline	MP177.81	MP-177.8	UMD	Culvert	36	1	22	30	-	None	Match Existing
Houston North Existing Mainline	MP178.11	MP-178.1	UMD	Culvert	48	1	40	30	-	None	Match Existing
Houston North Existing Mainline	MP178.5	MP-178.5	Stream	Culvert	48	1	42	30	-	None	Match Existing
Houston North Existing Mainline	MP178.85	MP-178.9	UMD	Culvert	36	1	54	30	NA	NA	Match Existing
Houston North Existing Mainline	MP178.97	MP-179.0	UMD	Culvert	36	1	53	30	NA	NA	Match Existing
Houston North Existing Mainline	MP179.1	MP-179.1	UMD	Culvert	48	1	42	30	NA	NA	Match Existing
Houston North Existing Mainline	MP179.4	MP-179.4	UMD	Culvert	60	1	60	30	-	None	Match Existing
Houston North Existing Mainline	MP179.5	MP-179.5	UMD	Culvert	48	1	50	30	-	None	Match Existing
Houston North Existing Mainline	MP179.6	MP-179.6	UMD	Culvert	36	1	22	30	NA	NA	Match Existing
Houston North Existing Mainline	MP179.67	MP-179.7	UMD	Culvert	36	1	22	30	NA	NA	Match Existing
Houston North Existing Mainline	MP179.8	MP-179.8	UMD	Culvert	48	1	47	30	NA	NA	Match Existing
Houston North Existing Mainline	MP179.94	MP-179.9	UMD	Culvert	48	1	43	30	NA	NA	Match Existing
Houston North Existing Mainline	MP180.35	MP-180.3	UMD	Culvert	36	2	48	30	NA	NA	Match Existing
Houston North Existing Mainline	MP180.45	MP-180.4	UMD	Culvert	36	2	48	30	NA	NA	Match Existing
Houston North Existing Mainline	MP180.52	MP-180.5	UMD	Culvert	36	2	48	30	NA	NA	Match Existing
Houston North Existing Mainline	MP180.6	MP-180.6	UMD	Culvert	36	2	48	30	NA	NA	Match Existing
Houston North Additional	Unspecified	NA	UMD	Culvert	36	8	80	-	NA	NA	
Houston North Equalization	Unspecified	NA	Wetland	Culvert	24	23	60	-	NA	NA	
Houston South	40+24.41	HS-0.8	UMD	Culvert	48	1	80	-	-	None	
Houston South	50+54.34	HS-1.0	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Houston South	72+67.94	HS-1.4	UMD	Culvert	48	1	80	-	-	None	
Houston South	98+43.90	HS-1.9	UMD	Culvert	48	1	80	-	-	None	
Houston South Existing Mainline	MP173.25	MP-173.3	UMD	Culvert	48	1	82	30	-	None	Match Existing
Houston South Existing Mainline	MP174.3	MP-174.3	River	Bridge	NA	1	-	-	Anadromous	Navigable	Match Existing
Houston South Existing Mainline	MP175.01	MP-175.0	UMD	Culvert	36	1	42	30	-	None	Match Existing
Houston South Additional	Unspecified	NA	UMD	Culvert	36	8	80	-	NA	NA	

Alignment Segment	Station	Mile-post	Water Body Type	Conveyance Type	Culvert Diameter (inches)	Quantity	Culvert Length (feet)	Extension Length (feet)	Fisheries	Navigation	Size-Controlling Factor
Houston South Equalization	Unspecified	NA	Wetland	Culvert	24	4	60	-	NA	NA	
Big Lake	218+17.48	B-4.1	UMD	Culvert	48	1	80	-		None	
Big Lake	671+88.45	B-5.9	Wetland	Culvert	24	1	80	-		None	
Big Lake	337+24.99	B-6.4	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Big Lake	671+88.45	B-7.2	UMD	Culvert	36	1	80	-		None	
Big Lake	671+88.45	B-8.4	Wetland	Culvert	24	1	80	-		None	
Big Lake	473+59.63	B-9.0	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Big Lake	671+88.45	B-9.9	Wetland	Culvert	24	1	80	-		None	
Big Lake	671+88.45	B-11.9	Wetland	Culvert	24	1	80	-		None	
Big Lake	671+88.45	B-12.7	Wetland	Culvert	48	1	80	-		None	
Big Lake	710+49.73	B-13.5	Wetland	Culvert	48	1	80	-		None	
Big Lake	753+65.36	B-14.3	Stream	Culvert	24	1	80	-	Possible	Possible	Flow
Big Lake	763+90.56	B-14.5	UMD	Culvert	48	1	80	-		None	
Big Lake	779+75.27	B-14.8	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Big Lake	795+15.78	B-15.1	Stream	Culvert	36	1	80	-	Possible	Possible	Flow
Big Lake	801+39.38	B-15.2	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Big Lake	834+37.26	B-15.8	UMD	Culvert	48	1	80	-		None	
Big Lake	839+73.28	B-15.9	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Big Lake	874+84.99	B-16.6	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Trail
Big Lake	919+57.06	B-17.4	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Trail
Big Lake	966+90.00	B-18.3	Stream	Drainage Structure	NA	1	-	-	Anadromous	Possible	Flow
Big Lake	South Side Hawk Lane Keloc	UMD	Culvert	Unknown*	1	80	-	-		None	
Big Lake Existing Mainline	MP170.85	MP-170.7	UMD	Culvert	Unknown*	1	Unknown*	30		None	Match Existing
Big Lake Existing Mainline	MP170.5	MP-170.5	Stream	Culvert	60	1	70	30		None	Match Existing
Big Lake Existing Mainline	MP170.14	MP-170.1	UMD	Culvert	60	1	96	30	NA	NA	Match Existing
Big Lake Equalization	Unspecified	NA	Wetland	Culvert	24	14	60	-	NA	NA	
Big Lake Additional	Unspecified	NA	UMD	Culvert	36	19	80	-	NA	NA	

NOTES: Stream - Designates drainage channels mapped by Matanuska-Susitna Borough's GIS Division compiled based on tax parcel maps and orthomagnery

UMD - Designates an "Un-Mapped Drainage" identified by analysis of digital elevation data or from ARRC Track Chart

Drainage Structures will be determined during the final design process and could include multi-plate culverts, pre-cast arches; and single or multiple short span bridges

Anadromous streams are currently sized for flow; however, sizing for fish passage will also need to be performed for final design.

Conveyance structures within 1500' of trail crossings were sized up to drainage structures.

An additional 36", 80' long culvert was added for every 1 mile of track in each segment

An additional 24", 60' long equalization culverts were added for every 1000' of track through wetland in each segment

Extensions to 60" culverts were sized at 72" culverts for ease of summarization

Structures highlighted in yellow are not shown on plan and profile sheets

Red text indicates modification from PEAR

~~Red-outlined-through~~ indicates removed culverts outside of project extent due to change in Houston North alignment

Unknown* - Designates culvert extensions for existing mainline culverts identified by the Environmental Impact Statement survey and were assumed to have a diameter of 48" for quantity summaries

Table G-3 Quantity Summary by Segment										
	Willow	Conn1	Conn2	Conn3	Houston	Houston North	Houston South	Big Lake	Mac East	Mac West
River Bridges	2	0	0	0	0	1	1	0	0	0
Drainage Structures	5	1	0	0	2	1	0	7	0	0
24-Inch Culvert (ft)	1140	420	240	140	1280	1380	240	1240	600	1200
36-Inch Culvert (ft)	2540	400	320	400	960	790	720	1760	1120	1120
48-Inch Culvert (ft)	750	400	320	80	480	370	300	510	320	960
72-Inch Culvert (ft)	80	80	0	0	80	110	0	60	0	0

Table G-4 Quantity Summary by Alignment Alternative								
	Mac West, Conn 1, Willow	Mac West, Conn 1, Houston, Houston North	Mac West, Conn 1, Houston, Houston South	Mac West, Conn 2, Big Lake	Mac East, Conn 3, Willow	Mac East, Conn 3, Houston, Houston North	Mac East, Conn 3, Houston, Houston South	Mac East, Big Lake
River Bridges	2	1	1	0	2	1	1	0
Drainage Structures	6	4	3	7	5	3	2	7
24-Inch Culvert (ft)	2760	4280	3140	2680	1880	3400	2260	1840
36-Inch Culvert (ft)	4060	3270	3200	3200	4060	3270	3200	2880
48-Inch Culvert (ft)	2110	2210	2140	1790	1150	1250	1180	830
72-Inch Culvert (ft)	160	270	160	60	80	190	80	60



Big Lake Alignment

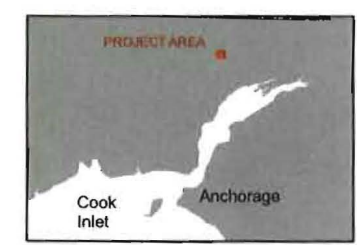
Stream Relocation and Railroad Crossing



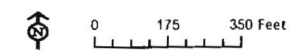
Proposed Project Overview

LEGEND

- Existing Stream Channel
- New Stream Channel
- 5ft Contours
- Alternatives
- ARRC ROW - 200ft



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Date: June 2009
 Projection: Alaska State Plane Zone 4, NAD 83
 Author: HDR Alaska, Inc.
 Sources: ADNIR, ARRC, HDR Alaska, Inc.,
 MSB GIS, TNH-Hanson, USGS.

Big Lake Alignment

Stream Course Modification



Site Access and Construction Staging Areas

LEGEND

- Site Access
- Materials Staging Area
- Existing Stream Channel
- New Stream Channel
- 5ft Contours
- ARRC ROW - 200ft

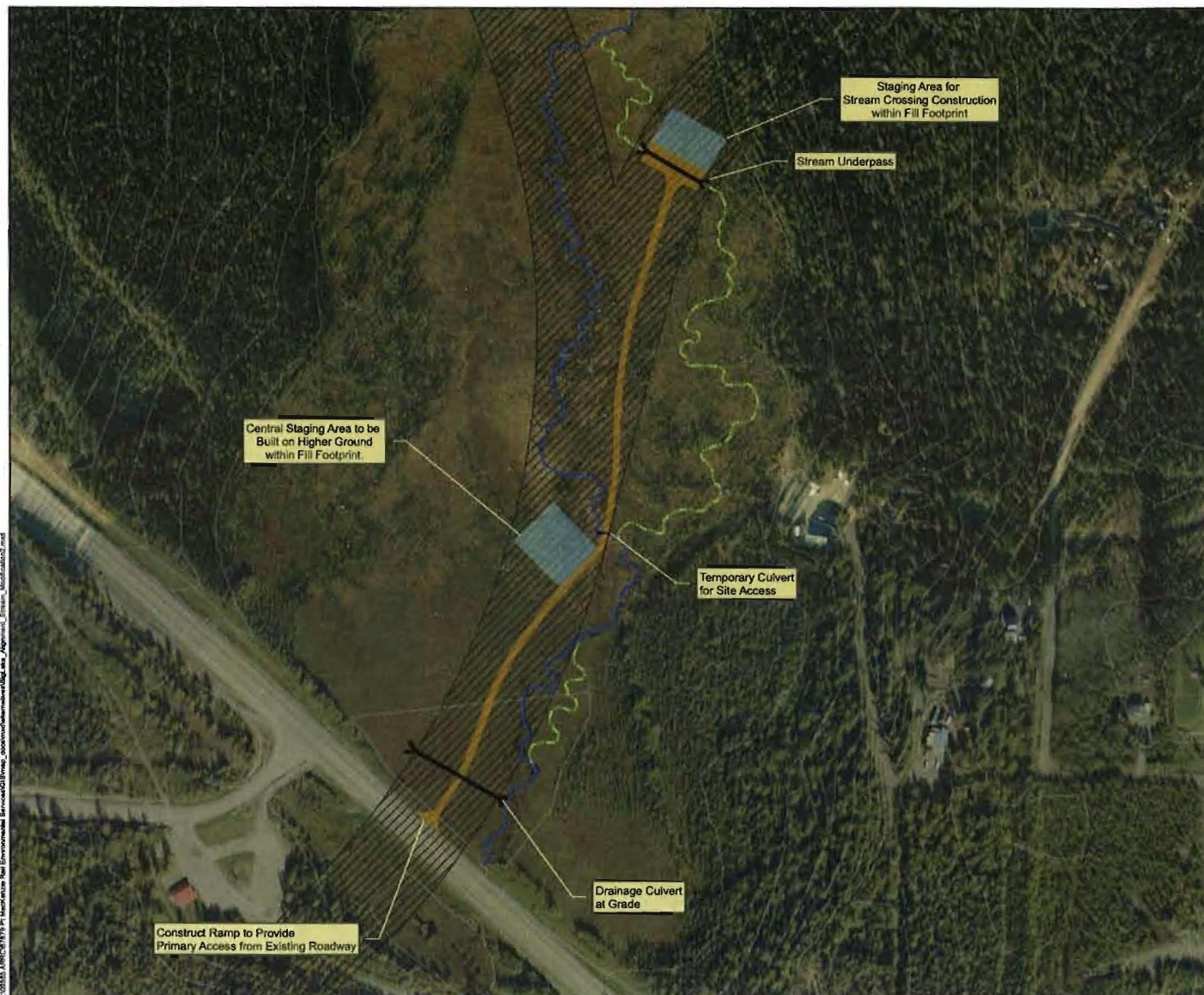


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0 160 320 Feet

Date: June 2009
 Projection: Alaska State Plane Zone 4, NAD 83
 Author: HDR Alaska, Inc.
 Sources: ADN, ARRC, HDR Alaska, Inc.,
 MSB GIS, TNH-Hanson, USCS.

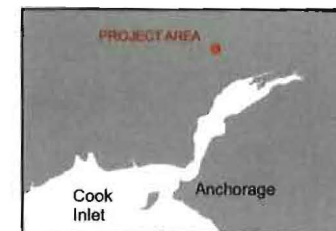
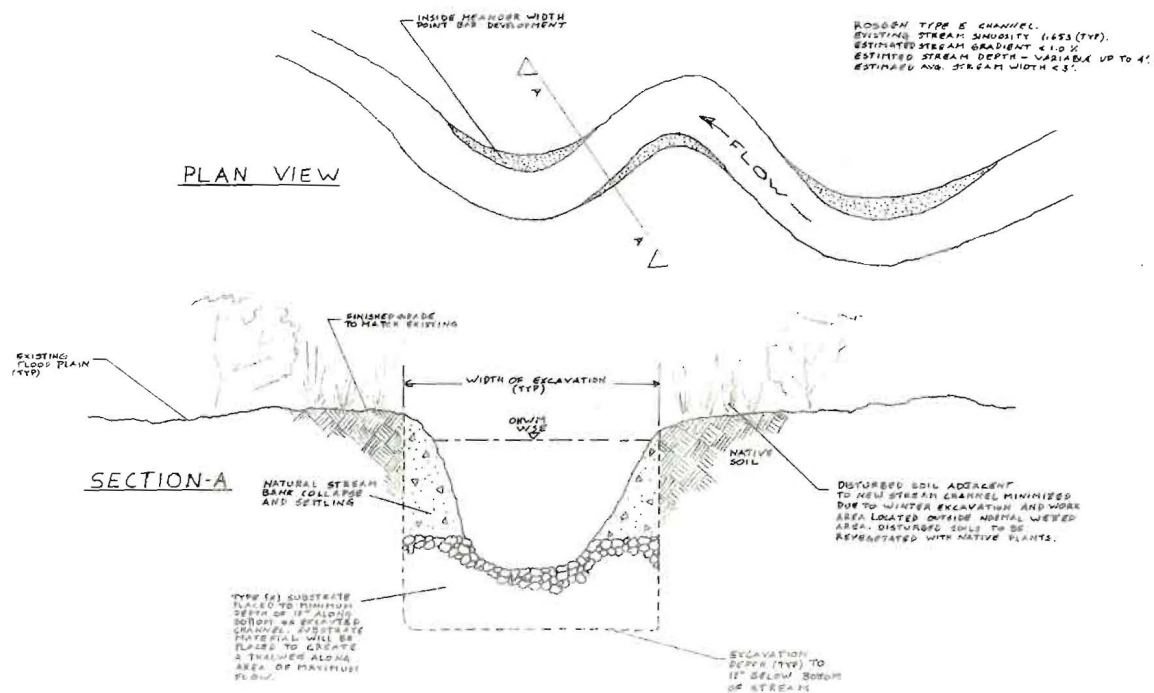


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STREAM RELOCATION AND RAILROAD CROSSING



STREAM CHANNEL PLAN AND SECTION VIEWS



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Date: June 2009
Author: PB, HDR Alaska, Inc.

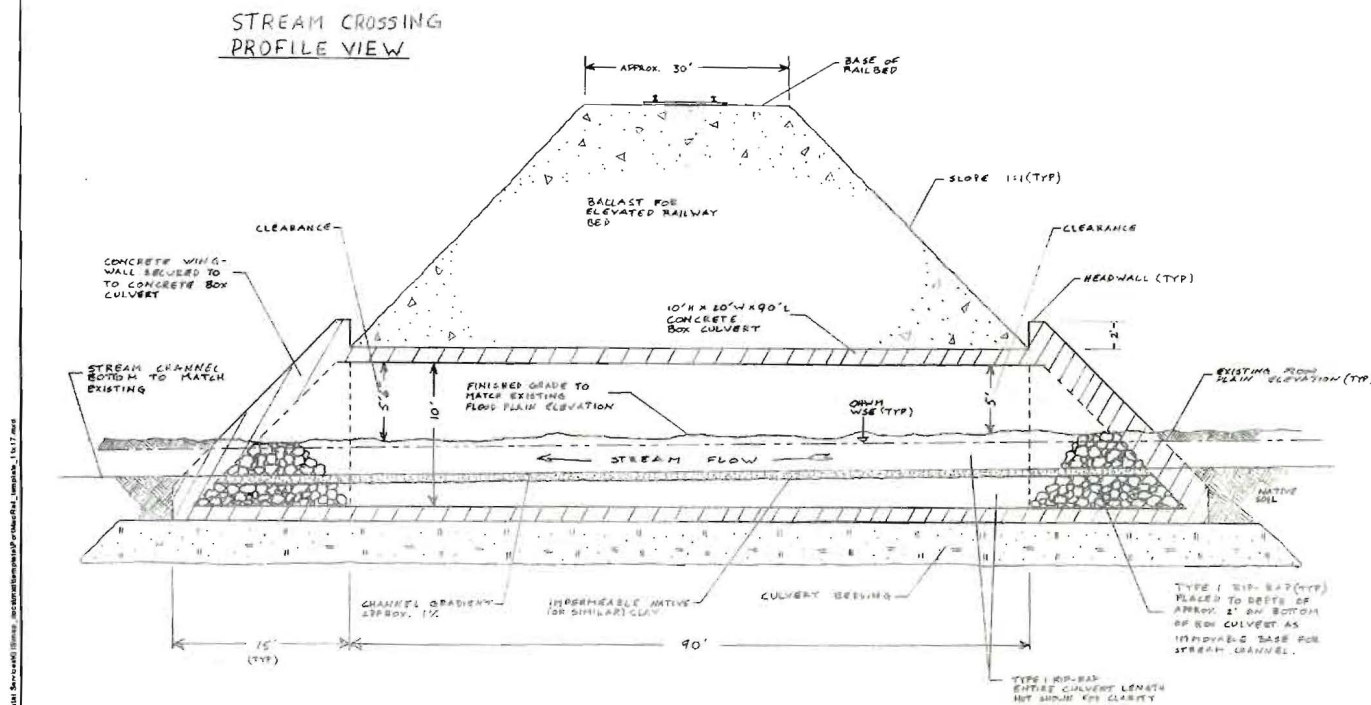
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Big Lake Alignment

STREAM RELOCATION AND RAILROAD CROSSING



STREAM CROSSING PROFILE VIEW



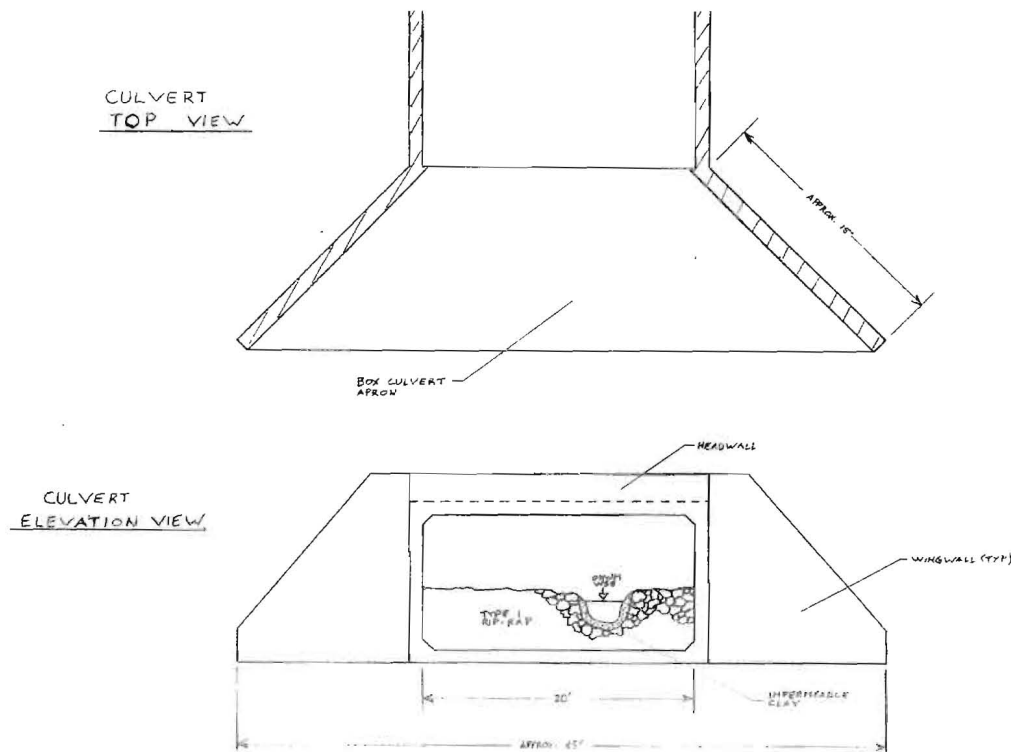
This map represents a conceptual level of utility, detail, and accuracy. The information displayed here is for planning purposes only. Base information shown constitutes data from various federal, state, public, and private sources. These maps are for reference purposes only and are not intended for use in securing permits, design, or for construction purposes.

Date: June 2009
Author: PB, HDR Alaska, Inc.

STREAM RELOCATION AND RAILROAD CROSSING



**CULVERT TOP AND
ELEVATION VIEWS**



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Date: June 2009
Author: PB, HDR Alaska, Inc.

To: Brian Lindamood, ARRC	
From: Donna Robertson	Project: Port MacKenzie Rail Extension
CC: Mike Pochop, Hanson	
Date: March 24, 2009	Job No: 67879

Re: Big Lake Alternative Stream Relocation and Rail Crossing

Construction of the Big Lake Alternative of the Port MacKenzie Rail Extension project would require the relocation of an unnamed stream that is located between the existing Alaska Railroad mainline and the Parks Highway. The stream provides migration and rearing habitat for anadromous fish. This memo provides a conceptual framework for how the stream relocation would be designed and constructed if the Big Lake Alternative is selected as the preferred alternative. Attached are 4 exhibits that show the project area and the approximate current and new locations of the stream channel, plan and section views of the realigned stream, a profile of the new stream as it would pass under the railroad embankment, and top and elevation views of the culvert under the railroad embankment.

General Construction Methods

One or more reference reaches would be identified on the existing stream that adequately exhibits the overall characteristics of the work area. Data collected from the reference reach or reaches would be used to establish general design criteria for the constructed channel. Reference reach or reaches along the existing stream course would be determined while collecting initial field data. Field data to be collected would include:

- Channel type
- Stream gradient
- Channel bottom gradient
- Bankfull width (mean/min/max)
- Bankfull depth (pool/riffle)
- Substrate distribution (pool/riffle)
- Flood-prone width (channel width at 2 x bankfull depth)
- Sinuosity (length of stream/length of valley)
- Entrenchment
- Maximum velocity at flood stage
- Vegetation
- Habitat type distribution

To avoid in-water work, prevent damage to riparian vegetation, and reduce impacts to aquatic life, the construction work window would be November through April or between freeze up and breakup.

The new stream channel and the railway bed underpass would be constructed in the dry prior to rerouting the stream. The new construction would remain in place and unused for a season to allow for natural erosive and settling processes to stabilize the work.

Fish access, stream velocity, stream gradient, as well as habitat type distribution and total amount of habitat would be retained.

Stream Channel

The channel for the new stream course would be scored (when soil is frozen) along both banks using a ditch-witch to a depth approximately 6 inches below normal channel bottom elevation. Scored center material would be excavated by backhoe and removed to a permitted upland disposal location.

The bottom of the stream channel would be lined with substrate sized similar to what exists in the natural channel. Substrate material would be placed so that a thalweg is created, as well as to protect areas of highest expected flow (outer side of meander bends).

Stream channel width would be constructed slightly narrower than existing, to account for expected minor stream bank collapse and settling, which are natural channel maintenance processes.

Stream sinuosity, meander length, and meander radii would be constructed to within the limits of the naturally occurring stream channel where possible, to promote natural channel maintenance after construction.

The newly constructed stream channel would maintain the approximate distribution of habitat types (e.g., pools, riffles, glides.), as well as the average dimensions (width and depth) of each habitat type. The total amount of stream habitat would not be reduced as a result of this project.

Railroad Stream Underpass

The railway bed would consist of gravel fill materials, elevated approximately 20 feet above existing ground surface. It would have a footprint of approximately 120 feet wide at the base. The constructed stream channel would be conveyed through a concrete box culvert of adequate size for the channel and a floodplain as is passes under railway bed.

The box culvert (on the order of 10' height x 20' width) would be wide enough to provide adequate drainage from upslope areas and would not impede fish passage. The invert elevation of the box culvert would be buried to depth that will allow approximately 2 feet of Type I rip-rap and appropriate fill to be capped by 6 inches of impermeable native (or similar) clay under the constructed stream bed. To prevent unwanted lateral erosion and future maintenance, the stream channel through the box culvert would be confined in a hardened channel of Type I rip-rap cemented in a native clay and gravel matrix.

To prevent scour on the downstream side and ponding on the upstream side of the box culvert, the natural stream bed elevation would be carried through the culvert.