Table of Appendices

Appendix A Reach Location & Reference Site Information

Reach Location & Reference Site Information

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Site Name	Reach Start UTM			Reach End UTM			Reference Site UTM			NTS Map 1: 50K		Air Photo #	Survey Date
			Zone	Easting	Northing	Zone	Easting	Northing	Zone	Easting	Northing	#	Date		
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	8	419300	6785500	8	419765	6786085	8	419938	6785855	115 H/1 E	1961	A27174-157 to 160	July 4, 2001
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	8	419765	6786085	8	427470	6790138	8	420112	6785947	115 H/1 E	1961	A27175-22 to 26	July 6, 2001
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake							8	420111	6785963	115 H/1 E	1961	A27175-22 to 26	July 6, 2001
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	8	440281	6801092	8	441056	6802181	8	440275	6801092	115 H/8 E	1961	A27175-118 & 119	July 9, 2001
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	8	441056	6802181	8	444200	6827800	8	440447	6803248	115 H/8 E	1961	A27175-165 & 166	July 10, 2001
C&S	2	Twin lakes access road X;	8	444200	6827800	8	446550	6841900	8	445647	6836775	115 H/9 E	1963	A27475 - 32 & 33	August 1, 2001
NUKA	1	Nordenskiold Upstream of Kirkland Creek	8	446550	6841900	8	444991	6846137	8	445276	6845724	115 H/9 E	1963	A2746-172 &173	August 4, 2001
KA	1	Kirkland Creek	8	444991	6846137	8	444021	6845962	8	444991	6846137	115 H/9 E	1963	A2746-172 &173	August 5, 2001
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	8	444991	6846137	8	447550	6850092	8	445906	6848363	115 H/16 E	1963	A2746-172 &173	August 5, 2001

Appendix B Stream-bed Data by Reach Site

Stream bed Data by Reach Site

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Site Name	Fines				Gravel			Larges					D90 (m)	Compaction
			% of Total	Clay	Silt	Sand	% of Total	Small	Large	% of Total	Small Cobble	Large Cobble	Boulder	Bed-rock		
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	**20%**	5%	5%	90%	**35%**	50%	50%	**45%**	20%	80%	0%	0%	0.18	High -
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	**85%**	0%	20%	80%	**10%**	100%	0%	**5%**	0%	0%	100%	0%	?	Moderate
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	**20%**	80%	10%	10%	**70%**	50%	50%	**10%**	60%	40%	0%	0%	0.17	Mod.
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	**95%**	10%	10%	80%	**< 5%**	100%	0%	**< 5%**	100%	0%	0%	0%	N/A	Low +
C&S	2	Twin lakes access road X;	**80%**	50%	20%	30%	**20%**	80%	20%	**0%**	0%	0%	0%	0%	N/A	Mod
NUKA	1	Nordenskiold Upstream of Kirkland Creek	**100%**	0%	95%	5%	**0%**	0%	0%	**0%**	0%	0%	0%	0%	N/A	Low
KA	1	Kirkland Creek	**20%**	0%	40%	60%	**45%**	35%	65%	**35%**	80%	20%	0%	0%	0.12	Mod.
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	**30%**	33%	33%	33%	**40%**	50%	50%	**30%**	90%	10%	0%	0%	N/A	Mod.

Appendix C Stream-bank Data by Reach Site

Stream Bank Data by Reach Site

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Site Name	Confinement E/C/FC/OC/UC	Avg. Bankful Depth (M)	Composition	Slope %	Stability %	Flood Stage	Flood Sign Height (M)	Notes
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	OC	0.6	Silt / Organic	75%	70%	High /flood	?	River is confined by banks on river right at reference site. Historic spawning dunes here.
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	UC	1.8	Silt / Organic	70%	50%	High /flood	2.1	Sloping unstable banks littered with large woody debris
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	uc	0.5	clay/sand/gravel	30%	50%	Mod.	0.75	This is the lowest reach at confluence. Further up stream are steep V shaped Valley walls with fast drops in elevation. This is the main exit of a multi-exit stream. Other exits are too small to measure except for one further u/s Nordenskiold.
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	.	.	.	.	.	.	.	.
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	OC	1.9	Organic/sand /clay	85%	60%	Low	2.4	.
C&S	2	Twin lakes access road X;	UC	0.7	fines	8%	20%	High	1	Experienced a lot of rain in the last month
NUKA	1	Nordenskiold Upstream of Kirkland Creek	UC	2.5	Silt / LOD	50%	60%	Low	3.2	Thick vegetation and LOD stabilises banks, otherwise unstable silt banks. Dead trees resulting from bank erosion and flooding now leaning over
KA	1	Kirkland Creek	UC	1.3	Gravel / Silt / Organics	80%	80%	Low	1.9	The stream is lower at Kirkland; water is low bud muddy/turbid
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	UC	1.65	Silt / Gravel / Organics	80%	40%	Mod. -	2	Deep rooted vegetation on sides but bank continuously eroding in bends and narrow channels

Appendix D

Vegetation & Habitat Cover Data by Reach Site

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Habitat Cover								Crown Closure	Riparian Vegetation
		Total	of which →	Dp Pool	L.O.D.	Boulder	Instrm Veg.	Over Veg.	Cut-banks		
NHA	1	50%	of which	25%	15%	15%	5%	10%	30%	10%	Dominant Vegetation: *Picea glauca / Salix* spp.; Additional occurrences: *Equisetum arvense* ., *Carex* spp., *Epilobium angustifolium* , *Potentilla fruticosa, Sherpherdia canadensis,* graminoids, *Achillea millefolium, Spiranthes* sp., *Parnassia* sp., *Rosa acicularis, Hedysarum alpinum, Aster sibiricus, Pyrola* sp., *Senecio lugens, Lupinus arcticus, Rubus acaulis, Fragaria virginiana, Monenses uniflora, Orthillia secunda, Vaccinium vitis-idaea, Ledum groenlandicum, Empetrum nigrum.* Instream vegetation: *Potamogeton* spp., *Hippuris* spp., and *Ranunculus aquatilus*
NHA	2	30%	of which	5%	40%	5%	10%	10%	30%	10%	Dominant Vegetation: *Picea glauca / Salix* spp.; Additional occurrences: *Carex* spp., *Potentilla fruticosa, Equisetum arvense., Epilobium angustifolium, graminoids, Achillea millefolium, Parnassia sp., Rosa acicularis, Hedysarum alpinum, Aster sibiricus, Rubus acaulis, Pyrola sp., Senecio lugens, Lupinus arcticus, Empetrum nigrum, Linnaea borrealis,Anemone richardsonii,Arctostaphylos rubra, Platanthera sp.* Instream vegetation: Potamogeton spp.. Notes: Large burn area, *Picea glauca* maturing - approx. 40 yrs. old.
SPC	1	70%	of which	15%	5%	80%	3%	10%	3%	10%	Dominant Vegetation: Salix spp /*Picea glauca* ; Additional occurrences: *Carex* spp., *Potentilla fruticosa, Equisetum arvense., Epilobium angustifolium, graminoids, Achillea millefolium, Parnassia sp., Rosa acicularis, Hedysarum alpinum, Aster sibiricus, Rubus acaulis, Pyrola sp., Senecio lugens, Lupinus arcticus, Empetrum nigrum, Linnaea borrealis,Anemone richardsonii,Arctostaphylos rubra, Platanthera sp.* Instream vegetation: Potamogeton spp.. Notes: Large burn area, *Picea glauca* maturing -
NHI	1	35%	of which	10%	30%	30%	5%	10%	15%	10-15%	Dominant Vegetation: *Picea glauca / Salix* spp.; Additional occurrences *Carex* spp., *Epilobium angustifolium, Equisetum arvense,* mosses, *Rosa acicularis* , graminoids, *Aster sibiricus, Hedesarum alpinum* . Notes: (has been burned probably from '58 fire). Left bank riparian vegetation only covers a 5 meter band and then an esker appears. Regenerated spruce avg. 3m tall. A lot of LWD falling into the river.
NDA	1	20%	of which	20%	20%	5%	10%	30%	15%	10%	Dominant Vegetation: *Picea glauca / Salix* spp.; Additional occurrences: graminoids, *Carex* spp., *Epilobium angustifolium, Equisetum arvense, Potentilla fruticosa, Aster sibiricus* . Instream Vegetation: *Hippuris* sp..
C&S	2	35%	of which	35%	10%	0%	10%	35%	10%	20%	Dominant Vegetation: Salix spp. / *Alnus incana & crispa* ; Additional occurrences: Picea glauca,graminoids, *Carex* spp., *Equisetum arvense,* Notes: old burn
NUKA	1	40%	of which	5%	40%	0%	15%	10%	30%	30%	Dominant Vegetation: *Picea glauca / Alnus incana & crispa / Salix* spp.; Additional occurrences: *Viburnum edule,* graminoids, *Carex* spp., *Equisetum arvense, Rosa acicularis, Rubus acaulis. Pyrola asarifolia, Linnaea borealis, Hedysarum alpinum, Platanthera* sp., *Cornus stolonifera, Ribes* sp.. Instream Vegetation: *Hippuris* sp., *Potamogeton* spp., *Sparganium* sp. Notes: a substantial amount of LOD.This year grasses are very productive and consumming river bank edges choking out other species.
KA	1	25%	of which	10%	30%	0%	3%	22%	35%	10%	Dominant Vegetation: *Picea glauca / Alnus incana* ; Additional occurrences: *Equisetum arvense, Mertensia paniculata, Epilobium angustifolium, Salix* spp., graminoids, *Carex* spp., *Arabis* sp. , *Achillea millefolium, Potentilla fruticosa, Rosa acicularis, Hedysarum alpinum, Solidago* sp., mosses, *Aster sibiricus, Ribes* sp., *Galium boreale., Parnassia* sp., *Epilobium* sp., *Erigeron* sp..
NDKA	2	20%	of which	30%	10%	0%	3%	40%	20%	?	Dominant Vegetation: Picea glauca / Alnus incana; Additional occurrences: Aspen & Salix spp., Epilobium angustifolium, graminoids, Carex spp., *Potentilla fruticosa, Rosa acicularis, Astragalu* s sp., *Galium boreale, Vibernum edule, Aster sibericus, Hedysarum alpinum, Parnassia* sp..

Appendix E Channel Characteristics by Reach Site

Reach #	Site #	Site Name	Avg. Channel Width (m)	Avg. Wetted Width (m)	Avg. Maximum Pool depth (m)	Avg. Maximum Riffle depth (m)	Avg. Maximum Run depth (m)	Survey Length (m)	Gradient %	Aspect	% Pool	% Riffle	% Run	% Side Channel	Braided Y/N	% Gravel Bars
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam		.	.	.	.	.	.	.	.	.	.	.	.	.
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	.	14	.	.	0.55	.	.	E	10%	0%	90%	10%	y	0
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	10.3	7.2	.	0.2	0.2	100	.	>1	NW	0%	90%	10%	Y	< 5%
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	.	.	.	.	.	.	.	.	.	.	.	.	.	.
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	11	10	1.48	N/A	0.7	100	1.2%	N	5%	0%	95%	0%	N	0
C&S	2	Twin lakes access road X;	22	15	1.6	0.5	1	.	<1%	N	45%	10%	45%	0%	N	0
NUKA	1	Nordenskiold Upstream of Kirkland Creek	17.3	17.3	N/A	N/A	1.5	180	<1	N	0%	0%	100%	0%	N	0
KA	1	Kirkland Creek	36	24	0.72	0.2	0.5	140	1.0%	NE	20%	25%	55%	25%	N	70
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	30	25.9	.	.	.	.	<1%	nw	0%	0%	100%	.	N	.

Appendix F Water Quantity Data by Reach Site - In-Situ Summer

In-situ Summer Water Quantity Data by Reach Site

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Site Name	Avg. Wetted Width (m)	Avg. Wetted Depth (m)	Total Area (m2)	Avg. Velocity (m/s)	Discharge (m3/s)	Notes
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	.	.	.	.	.	Not calculated-see NHA2
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	14.00	0.55	7.700	0.550	4.235	This measurement was taken shortly after the dam was removed and the lake was dropping rapidly
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	8.95	0.19	1.718	0.707	1.215	weighted average of two channels
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	12.00	1.07	12.840	0.758	9.730	Spawning gravels just upstream at about 680500N
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	10.50	1.30	13.650	0.800	10.920	.
C&S	2	Twin lakes access road X;	15.00	1.02	15.300	0.813	12.439	.
NUKA	1	Nordenskiold Upstream of Kirkland Creek	17.30	1.79	30.967	0.516	15.979	Discharge measurements taken from boat.
KA	1	Kirkland Creek	24.80	0.61	15.060	1.180	17.870	weighted average of two channels
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	25.90	1.13	29.138	1.300	37.879	.

Appendix G Water Quality Data by Reach Site - In-Situ Summer

Water Quality Summer In-Situ Data by Reach Site

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Site Name	Temp °C	pH	DO (mg/l)	Conduct-ivity (uS/cm)	Turb-idity (NTUs)	Ben-thics taken (Y/N)	Lab Sample taken (Y/N)	Notes
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	17.1	7.99	10	117	?	n	n	Water appeared pretty clear - little tubidity. Tubidity meter not working. Upstream of dam is silted in with more of a lake bentho community than in '98. Algie forming in eddy slough areas.
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	15.3	7.65	10.2	120	?	N	N	Brown turbid water
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	9.3	7.92	12	170	?	N	N	All measurements are from the second and main branch of creek going d/s. Water is very turbit with a red brown tinge. In the upp reaches in deep V valley River left is sand stone bed rock & river right is clay.
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	13.7	7.92	10.2	165	?	N	N	Spawning gravels just upstream at about 680500N
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	13.9	7.85	10.3	163	?	N	N	Permanent water depth gauge station; insalled temperature logger here
C&S	2	Twin lakes access road X;	14	7.67	10.3	196	?	N	N	Installed temperature logger aprox. 60m upstream of X on river rightbehind old bridge pillar
NUKA	1	Nordenskiold Upstream of Kirkland Creek	15.6	7.85	9.6	238	?	N	N	Back watering from kirkland
KA	1	Kirkland Creek	10.9	7.85	11.3	155	?	N	N	Installed temperature logger aprox. 60m upstream on top (u/s) of island with deep rooted trees.
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	13.5	7.89	10.5	200	?	N	N	Installed temperature logger aprox. 200m upstream of pull out on river right 445906E 6848363N

Appendix H Fisheries Data

Appendix H-1 effort and catch

Nordenskiold Salmon Restoration Project: Salmon & Salmon Habitat Inventory: 2001											
		Trap #	Date (D/M/Y) & Time(24:00)				LENGTH	WEIGHT	K	Adipose	
Reach #	Site #		Set	Out	Hrs set	SPECIES	(mm)	(g)	Condition		COMMENTS
NHA	1	1	7/3/01 9:50 PM	7/4/01 5:30 PM	19.67						
NHA	1	2	7/3/01 9:55 PM	7/4/01 5:35 PM	19.67						
NHA	1	3	7/3/01 10:00 PM	7/4/01 5:40 PM	19.67						
NHA	1	4	7/3/01 10:05 PM	7/4/01 5:45 PM	19.67						
NHA	1	5	7/3/01 10:10 PM	7/4/01 5:50 PM	19.67						
NHA	1	6	7/3/01 10:15 PM	7/4/01 5:55 PM	19.67						
NHA	2	1	7/5/01 7:45 PM	7/6/01 1:30 PM	17.75						
NHA	2	2	7/5/01 7:50 PM	7/6/01 1:25 PM	17.58						
NHA	2	3	7/5/01 7:35 PM	7/6/01 1:05 PM	17.50						
NHA	2	4	7/5/01 7:40 PM	7/6/01 1:07 PM	17.45	ss	96	10.5	1.19		Very Large specimen
SPC	1	1	7/5/01 7:55 PM	7/6/01 1:15 PM	17.33						
SPC	1	2	7/5/01 8:00 PM	7/6/01 1:20 PM	17.33						
NDA	1		7/10/01 2:35 PM	7/11/01 11:48 AM	21.22						
NDA	1		7/10/01 2:40 PM	7/11/01 11:52 AM	21.20						
NDA	1		7/10/01 2:43 PM	7/11/01 11:55 AM	21.20						
NDA	1		7/10/01 2:47 PM	7/11/01 12:00 PM	21.22						
NDA	2		7/10/01 3:00 PM	7/11/01 12:05 PM	21.08						
NDA	2		7/10/01 3:04 PM	7/11/01 12:08 PM	21.07						
NDA	2		7/10/01 3:08 PM	7/11/01 12:12 PM	21.07						
NDA	2		7/10/01 3:12 PM	7/11/01 12:15 PM	21.05						
NHI	1		7/11/01 8:12 PM	7/12/01 12:00 PM	15.80						
NHI	1		7/11/01 8:17 PM	7/12/01 12:05 PM	15.80						
NHI	1		7/11/01 8:22 PM	7/12/01 12:09 PM	15.78						
NHI	1		7/11/01 8:27 PM	7/12/01 12:14 PM	15.78						
NHI	1		7/11/01 8:32 PM	7/12/01 12:20 PM	15.80						
NHI	1		7/11/01 8:37 PM	7/12/01 12:30 PM	15.88						
NUKA	2		7/31/01 10:40 PM	8/1/01 11:50 AM	13.17						
NUKA	2		7/31/01 10:45 PM	8/1/01 11:55 AM	13.17						
NUKA	2		7/31/01 10:50 PM	8/1/01 12:00 PM	13.17						
NUKA	3		7/31/01 10:55 PM	8/1/01 12:05 PM	13.17						
NUKA	3		7/31/01 11:00 PM	8/1/01 12:10 PM	13.17	b	29.3	16.2	64.40		shinny body
NUKA	3		7/31/01 11:05 PM	8/1/01 12:15 PM	13.17						
NUKA	1		8/3/01 7:35 PM	8/4/01 11:45 AM	16.17						Many adult salmon breaking surface here
NUKA	1		8/3/01 7:40 PM	8/4/01 11:50 AM	16.17						Many adult salmon breaking surface here
NUKA	1		8/3/01 7:45 PM	8/4/01 11:55 AM	16.17						Many adult salmon breaking surface here
NUKA	1		8/3/01 7:50 PM	8/4/01 12:00 PM	16.17						Many adult salmon breaking surface here
NUKA	1		8/3/01 7:55 PM	8/4/01 12:05 PM	16.17						Many adult salmon breaking surface here
NUKA	1		8/3/01 8:00 PM	8/4/01 12:10 PM	16.17						Many adult salmon breaking surface here
KA	1		8/4/01 1:00 PM	8/5/01 1:15 PM	24.25						1 King broke the surface 10 m up
KA	1		8/4/01 1:05 PM	8/5/01 1:20 PM	24.25						
KA	1		8/4/01 1:10 PM	8/5/01 1:25 PM	24.25						
KA	2		8/4/01 1:15 PM	8/5/01 1:30 PM	24.25						
KA	2		8/4/01 1:20 PM	8/5/01 1:35 PM	24.25						
KA	2		8/4/01 1:25 PM	8/5/01 1:40 PM	24.25						
NDKA	1		8/5/01 8:05 PM	8/6/01 9:55 AM	13.83						
NDKA	1		8/5/01 8:10 PM	8/6/01 10:00 AM	13.83	ss	74	4.4	1.09		
NDKA	1					ss	67	3.9	1.30		
NDKA	1					ss	66	3.1	1.08		
NDKA	1		8/5/01 8:15 PM	8/6/01 10:10 AM	13.92						
NDKA	1		8/5/01 8:20 PM	8/6/01 10:20 AM	14.00						
NDKA	1		8/5/01 8:25 PM	8/6/01 10:25 AM	14.00						
NDKA	1		8/5/01 8:30 PM	8/6/01 10:30 AM	14.00						
					17.84	Mean					
					909.82	sum					

Appendix H-2 Incidental catch summary

Incidental Catches by Species & Reach Site

Nordenskiold Salmon Restoration Project: 2001

Reach #	Site #	Trap #	SPECIES	LENGTH (mm)	WEIGHT (g)	Condition
S. Sculpin						
NHA	2	3	ss	96	10.5	1.19
NDKA	1	2	ss	74	4.4	1.09
NDKA	1	2	ss	67	3.9	1.30
NDKA	1	2	ss	66	3.1	1.08
		Mean	**S. Sculpin**	**75.8**	**5.5**	**1.2**
Burbot						
NUKA	3	5	b	29.3	16.2	64.40

Appendix I Photos

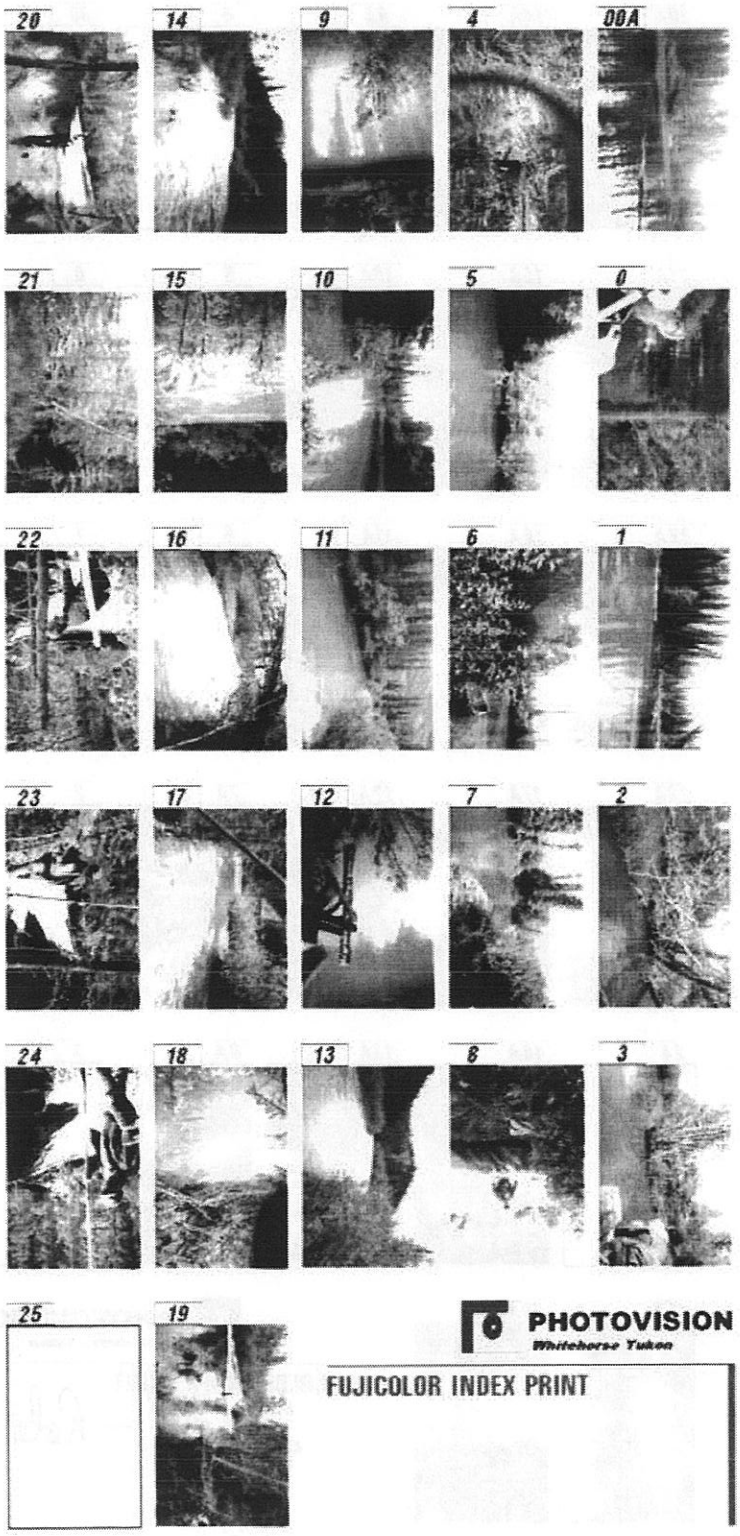
Appendix I -1 Photo Descriptions – Reach description

Reach #	Site #	Site Name	Reference site			Downstream			Upstream		
			Role	Frame	Notes	Role	Frame	Notes	Role	Frame	Notes
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	.	.	not taken	.	.	Not taken	.	.	Not taken
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	1	15	420112E - 6785947N	1	14	fast moving water on corner	1	13	fast moving water on corner
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	1	18	.	1	17	.	1	16	.
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	.	.	.	.	.	.	.	.	.
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	1	9	.	1	11	.	1	10	.
C&S	2	Twin lakes access road X;	1	8	Boat on side with Gord	1	7	.	1	6	Boat empty with Gord on bank
NUKA	1	Nordenskiold Upstream of Kirkland Creek	2	.	Picture never turned out	2	22		2	23	Gord in Boat
KA	1	Kirkland Creek	2	19; 18	Reference site 1; and 2	2	17; 15	downstream site 1 an 2	2	16; 14	upstream site 1 an 2
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	2	10	.	2	8	.	2	9	.

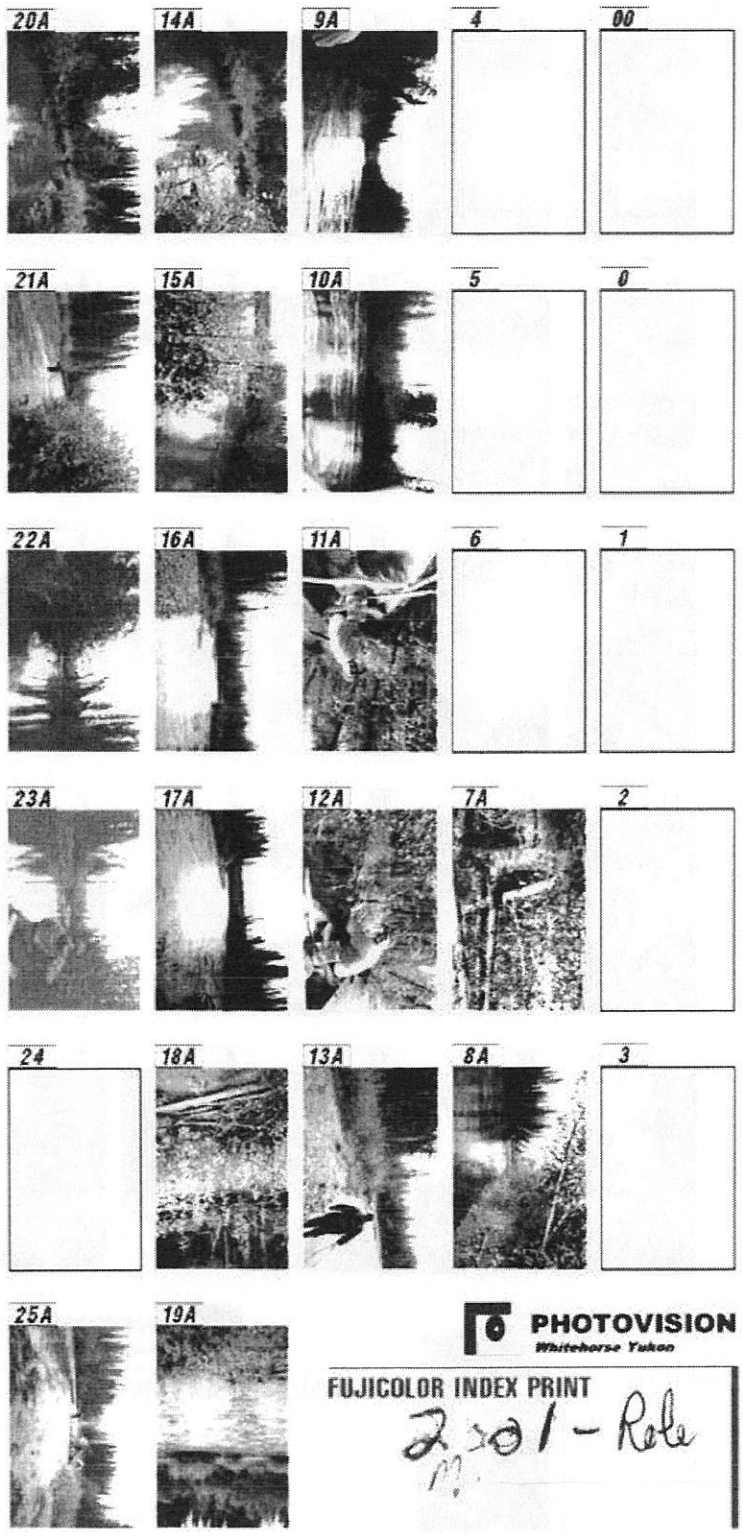
Appendix I -2 Photo Descriptions - other photos taken

Reach #	Site #	Site Name	Other 1			Other 2			Other 2		
			Role	Frame	Notes	Role	Frame	Notes	Role	Frame	Notes
NHA	1	1st Reach on Nordenskiold below Hutchi Lake above dam	1	24; 23	Before Beaver Dam obstructing migration was remed just below Hutchi	1	22; 21	Durin dam removal; Old lodge and cuttings just upstream of dam	1	20; 19	Dam after ends removed
NHA	2	2nd site on 1st Reach below Hutchi Lake and below Dam	.	.	.	.	.	.	.	.	.
SPC	1	1st Reach of Super Porridge Creek - 1st stream to confluence Nordenskiold on river left down past Hutchi Lake	.	.	.	.	.	.	.	.	.
NHI	1	Nordenskiold Upstream of Division Mtn. Camp	.	.	.	.	.	.	.	.	.
NDA	1	Nordenskiold Downstream of Division Mtn. Camp	1	12	Water monitoring guage - Temp logger placed here	.	.	.	.	.	.
C&S	2	Twin lakes access road X;	1	5	Beaver Lodge 445389E 6838039N	1	4	Beaver Lodge 445472E 6839534N	1	3	Beaver Lodge
NUKA	1	Nordenskiold Upstream of Kirkland Creek	.	.	.	.	.	.	.	.	.
KA	1	Kirkland Creek	2	13	Site of temperature data logger placement - just up past Gord and Boat - red flagging	.	.	.	.	.	.
NDKA	2	Nordenskiold Below Kirkland Creek at spawning area close to takeout	2	12; 11	Site of temperature data logger placement - Gord and Boat.	2	7	flagging site of data logger 446068E 6848529N	.	.	.

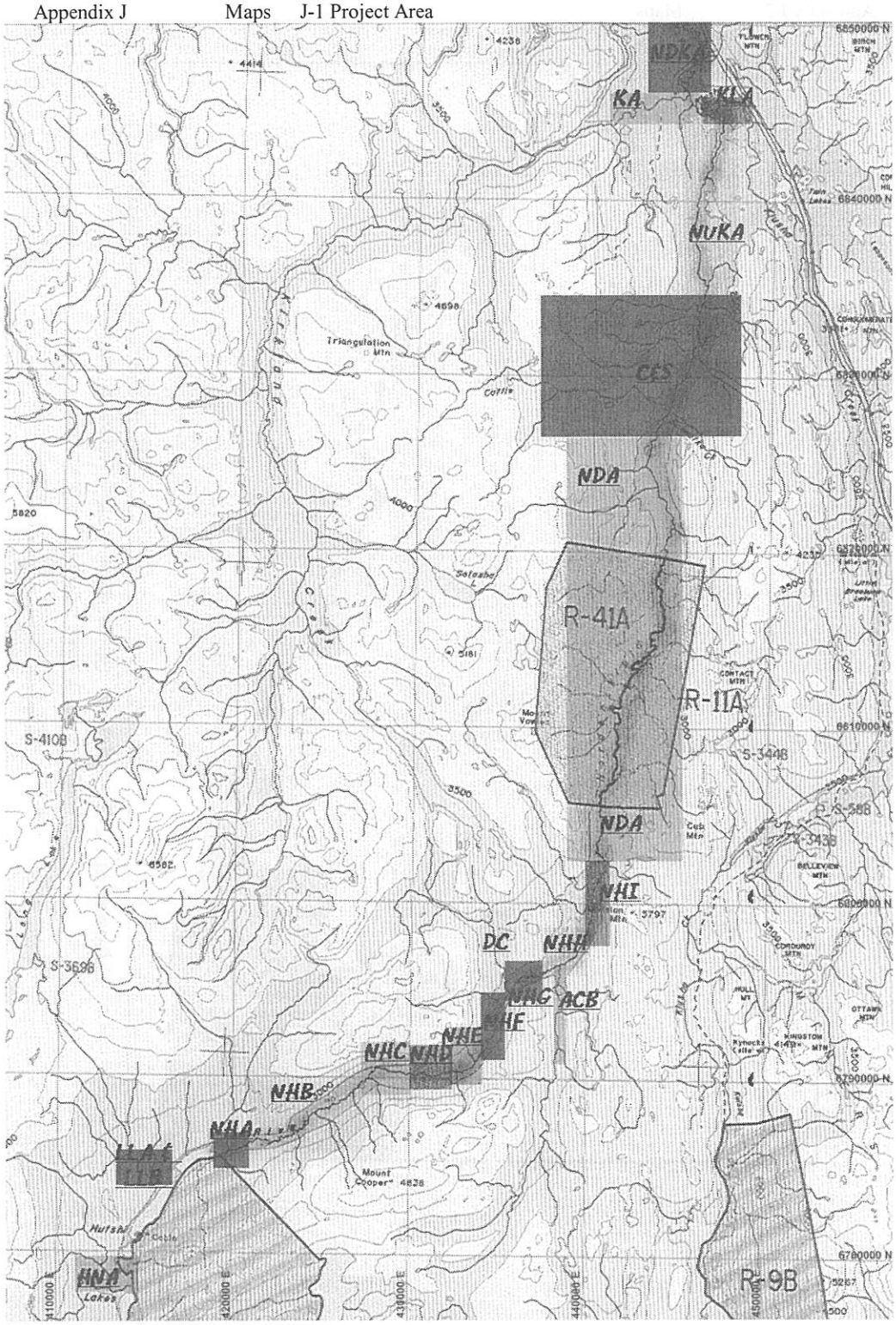
Appendix I – 3
Role 1



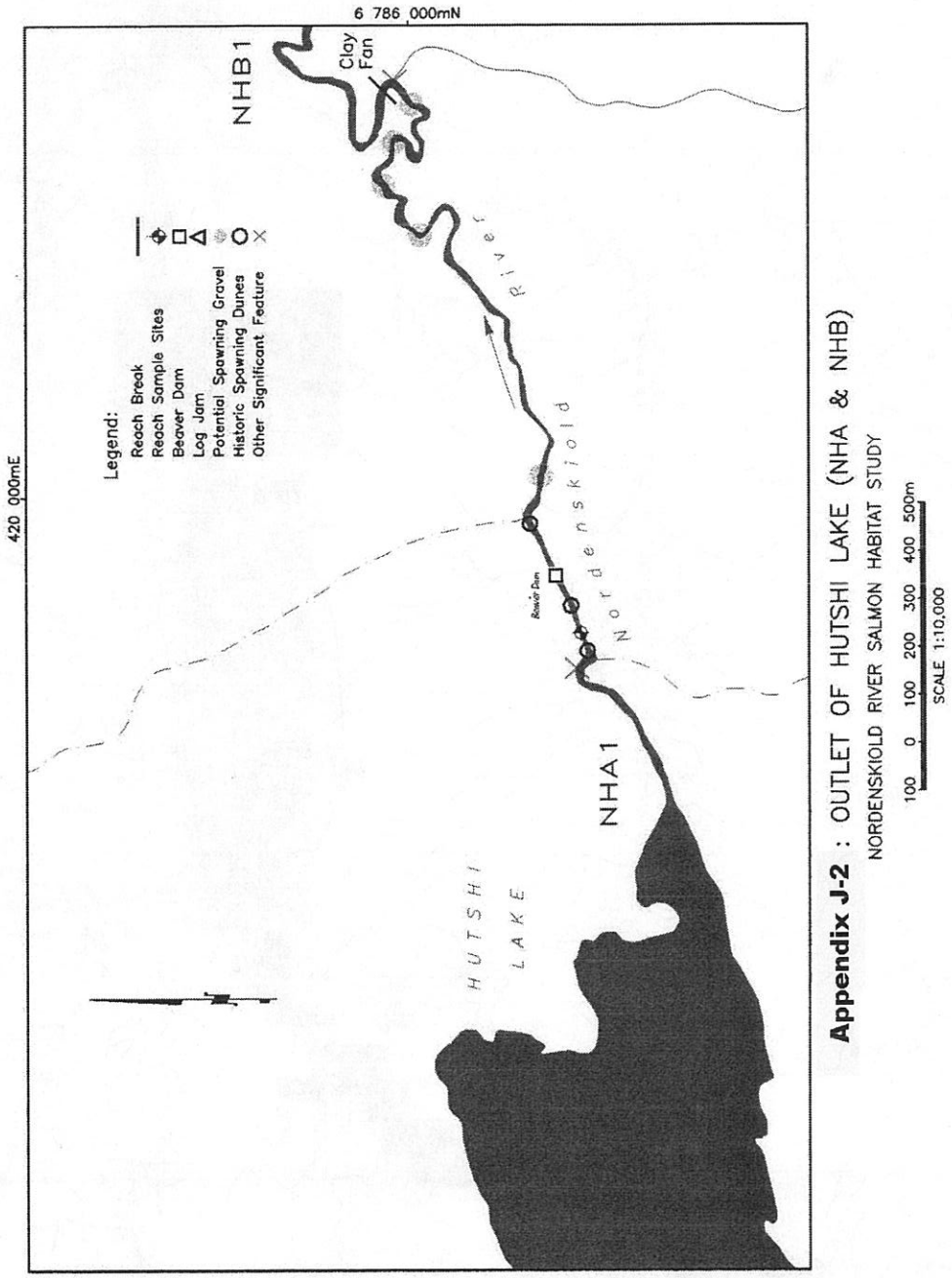
Appendix I – 3
Role 2



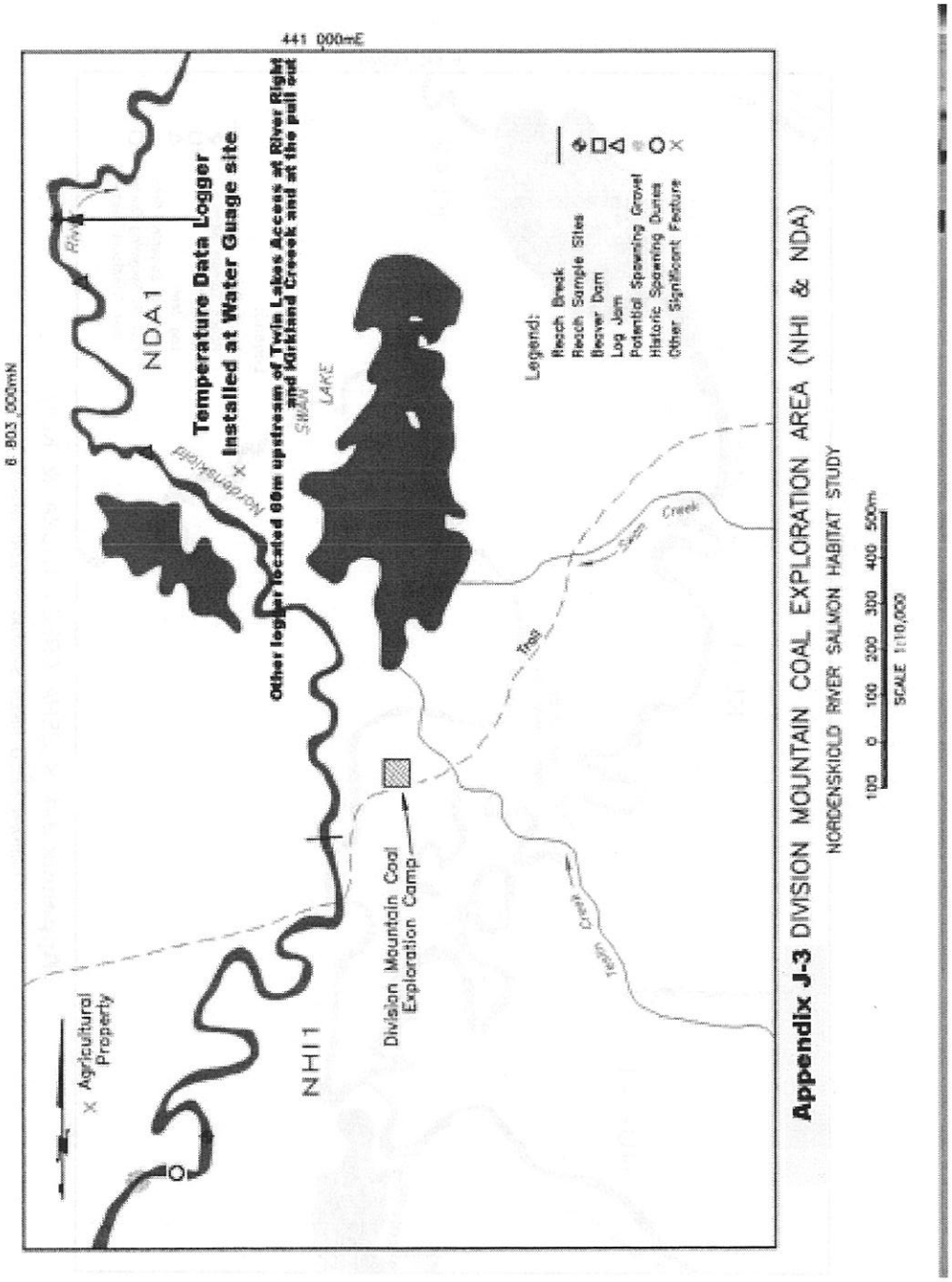
Appendix J Maps J-1 Project Area



Appendix J-2 Maps

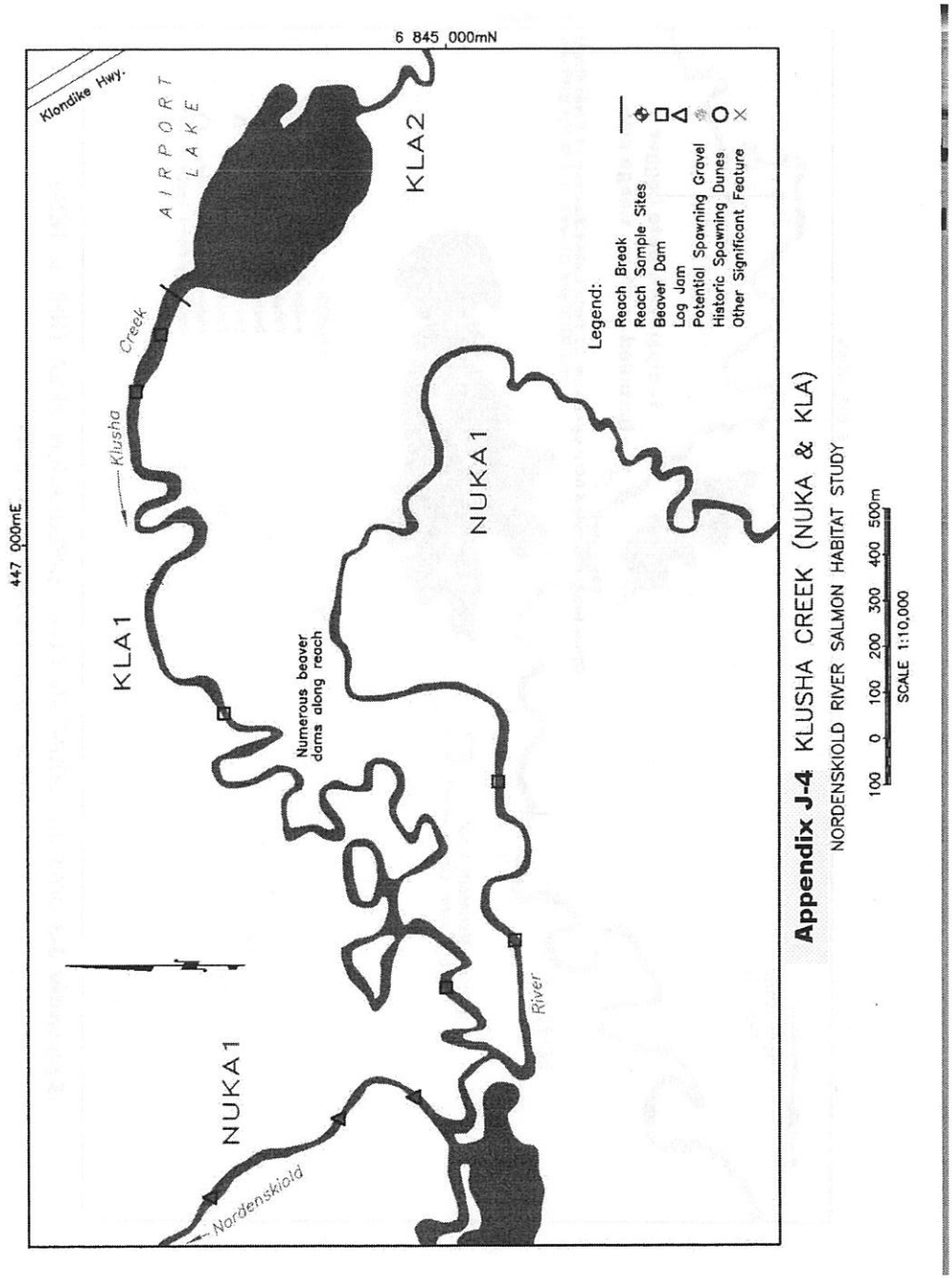


Appendix J-3 Maps

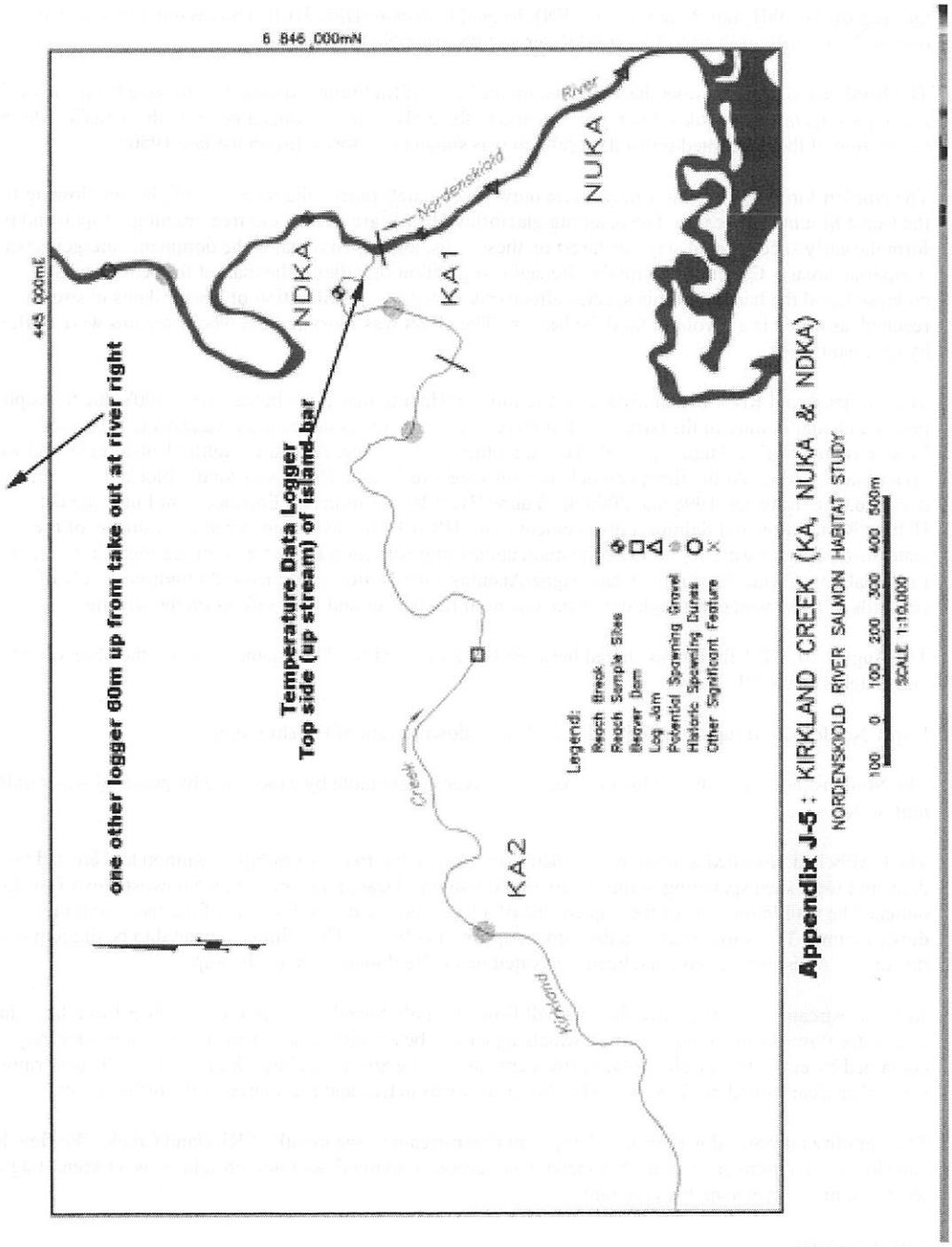


Appendix J-3 DIVISION MOUNTAIN COAL EXPLORATION AREA (NHI & NDA)
NORDENSKIOLD RIVER SALMON HABITAT STUDY

Appendix J-4 Maps



Appendix J-5 Maps



Appendix J-5 : KIRKLAND CREEK (KA, NUKA & NDKA)
NORDENSKIOLD RIVER SALMON HABITAT STUDY

Appendix K – Aerial Survey – Notes from Al von Finster

On August 20, 2001, Ian Pumphrey (CAFN), Raquel Roizman (DFO HEB) and myself conducted an overflight of much of the Nordenskiold River and it's principle tributaries.

The Nordenskiold River watershed appears, on the basis of traditional knowledge, to have been one of the major producers of chinook salmon prior to, and in the early years of contact by, non-aboriginals. Much of the portion of the watershed utilised by salmon was subject to a forest fire in the late 1950's.

The Nordenskiold and Klusha valleys were outwash channels during the recession of glaciers flowing from the Coast Mountain icecaps. The resulting glaciofluvial soils are coarse and free draining. Aspen and pine form the early successional stage of forest on these soils, and aspen remains the dominant emergent species in riparian areas. Concurrent with the fire and revegetation of valleys, the market for beaver pelts collapsed, and the harvest of this species effectively ended. A proliferation of beaver dams in streams resulted, as aspen is a favoured food for beaver. The effect was most marked where streams were buffered by upstream lakes.

The Nordenskiold River began to receive attention by Habitat managers in the early 1990's due to proposed placer and coal mining in the basin. A definitive overflight was conducted on August 11, 1995 (von Finster, memo to file, August 15, 1995) during which salmon were seen at the outlet Hutshi Lake and well up Kirkland Creek. At the time, chinook salmon access to Klusha Creek was totally blocked by a series of beaver dams. Between 1996 and 2000 the Yukon River Restoration and Enhancement Fund and the Habitat Restoration and Salmon Enhancement Plan (HRSEP) funded a number of assessments of the watershed. Beaver were found to be the main agents of obstruction to upstream migrating salmon. The Little Salmon/Carmacks and the Champagne/Aishihik First Nations resumed their traditional role of stewards of these waters through the management of the beaver and their effects on the streams.

The August 20, 2001 flight was shared between DFO and CAFN. This memo provides the observations and insights of the DFO staff.

Upper Nordenskiold (upstream of Kirkland Creek, downstream of Hutshi Lake)

The Nordenskiold flows from Hutshi Lake. The river is navigable by canoe, and by powered watercraft at high water.

The CAFN had breached a major beaver dam some time prior to our overflight. Salmon had crested the dam, and were seen spawning at the site of an old fish trap located a short distance downstream of the lake outlet. The visible remains of the trap consist of a log structure on the left side of the river (looking downstream). The trap rested on a dune-like deposit of cobbles. The salmon appeared to be digging into this dune. A distinctive redd had been excavated in a riffle downstream of the trap.

Just downstream of the breached dam a small flow of highly turbid water entered the river from the right. The water flows from a unique feature which appears to be a major area of thermokarst almost entirely contained by either till- or glacio-lacustrine deposits. There are two gulleys draining this - the uppermost was either clear or had no flow, while the lowermost was active and the source of the turbid water.

The turbidity introduced here was still apparent downstream to the mouth of Kirkland Creek. We flew low and slow over a number of areas, but viewing conditions remained poor and no salmon were seen. Eagles were absent. Gravel/sand bars are rare.

Kirkland Creek

Chinook spawning in this creek was documented in 1995, but no salmon have been observed since. The creek has little lake storage. Starting on the plateau, it flows first into a confined valley and then into what is virtually a canyon. The canyon extends to the valley of the Nordenskiold, and the start of an alluvial fan.

The fan is as yet weekly developed. The fan extends to the north and has pushed the Nordenskiold to the far valley wall.

The overall gradient of the creek is uneven, with riffle/run segments interspersed with boulder runs. Gravel bars are very well developed in the depositional area downstream of the canyon, implying significant volumes and energy of streams at high flows.

Water levels were low/medium at the time of the flight, and the water was slightly turbid. We found one carcass in the valley upstream of the canyon (at 61 42.617"/136 12.343), thus confirming chinook salmon spawning in this stream.

Mid-Nordenskiold (Kirkland Creek to Rawlinson Creek.)

The combined flows of Klusha, Kirkland and the Upper Nordenskiold fundamentally change the nature of the Nordenskiold. The river is navigable to powered light watercraft under all flow regimes. There are a few logjams that would require dragging a watercraft over or around, and this should be considered by boaters.

This section starts with a moderate gradient, gravel and cobble bottomed reach that extends from the mouth of Kirkland downstream to the end of the old fan. Gravel bars are common, and were well trodden by bear. A large number of eagles were observed. The water was slightly turbid and viewing conditions into all but the most shallow portions of the river were poor. The substrate in this section of the river tends to be dark, and redds are not visible except when the water is very clear.

This is almost certainly the primary spawning location for mainstem Nordenskiold River salmon. A number of carcasses and a few live salmon were observed.

Downstream of this, the Nordenskiold has a generally low gradient. There are sections of locally increased gradient downstream of each of a series of small alluvial fans which extend from the east. Creeks entering most of these fans normally go to ground prior to joining the Nordenskiold. Aquifers charged during the summer of 2000 continue to discharge in 2001 and streams that would normally be dry at the Mayo Road crossings continue to flow.

Turbidity was noted from the creek entering the river at the Jensen's farm fan. We followed the creek up, and found a large slump on a north-facing slope in the headwaters of the south fork. The slump appeared to be of glacial till. Massive ice is visible in the upper headwall of the fan, and highly sedimented ground water discharges from the bowl below. A possible mechanism for the failure would be a charging of deep ground water to the point where pore water pressure essentially floated the overlying ice off. The failure, when it did happen, was sudden: the walls of the valley downslope were scoured well above the current creek bed. The pulse attenuated with distance downstream.

We continued downstream to the mouth of Rawlinson Creek and then turned fly toward Incised Creek.

Incised Creek

Incised Creek is a right bank tributary of Rawlinson Creek. Chinook salmon spawning was first documented in this creek on August 12, 1990. Subsequent over-flights have found salmon only in the lowest reach, where the creek enters and crosses the Rawlinson Creek valley. On this flight we intercepted the creek upstream of this. Water levels were medium and the creek was slightly turbid (it usually runs clear). One salmon was observed, and was located in the previously documented spawning area. Rawlinson Creek was high and turbid.

Lower Nordenskiold (confluence with Rawlinson Creek to mouth)

Rawlinson Creek is similar to Kirkman Creek, but has a greater flow. It's descent from the Yukon Plateau is steep, and it has cut a deep canyon. Material carried downstream has formed a well developed alluvial

fan. This has forced the Nordenskiold against the right (east) valley wall. The fan has also raised the channel of the Nordenskiold. This, in conjunction with the greater erosive power of the Yukon River, has resulted in an area of increased gradient extending to the mouth of the Nordenskiold. Chinook salmon spawn in this area.

During the summer of 2000 it was noted that the river had formed a new channel upstream of the proposed Freegold Road location. On the overflight, we found that the neck of a meander curve located just upstream of the crossing had cut through.

The river in this area continued turbid due to the Jensen's farm slide and the turbidity introduced by the Nordenskiold. One salmon was seen in shallow water.

Klusha Creek

After refuelling and returning at high level up the valley, we followed Klusha Creek upstream from the mouth. Klusha Creek is a small creek and drains a structurally complex basin. The creek flows into- and out of surface and sub-surface storage. The lowest section of the creek is navigable by only the smallest and lightest of vessels, such as kayaks and canoes.

The lowest reach, downstream of Airport Lake, is back-watered from the Nordenskiold. Above this is a low gradient reach which includes a wetland area. The creek then climbs more steeply to the outlet of West Twin Lake. The latter reach and much of the low gradient reach was back-watered by beaver dams for many years. The stream bottom in much of the low gradient area appeared covered by organic material which supported grasses and aquatic vegetation

On our overview, we found that all the beaver dams had been breached upstream to the outlet of West Twin Lake. Water clarity was excellent. It appeared that the fine material and vegetation was in the process of peeling off the stream bottom in the moderate gradient reach. The exposed stream bottom was composed of gravel and cobble, with some sections dominated by small boulders.

Two redds were observed perhaps 150 meters downstream of the logging bridge over the creek. Several salmon were observed on these redds. This is the first sighting of salmon in this stream since 1963!!

We continued up the creek to West Twin Lake and then flew the remainder of the creek at a greater altitude and speed. Most or all of the beaver dams observed were breached. At the outlet of Little Braeburn Lake a dune like feature similar in shape and form to that at the fish trap at Hutshi Lake was noted.

We then returned to Whitehorse.