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FISH AND FISH HABITAT INVESTIGATIONS

FOR THE PROPOSED

KITIMAT – SUMMIT LAKE

NATURAL GAS PIPELINE LOOPING PROJECT

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EXECUTIVE SUMMARY

Along its 462 km length, the proposed KSL Pipeline Looping Project route crosses 497 watercourses; of these, 143 crossings have been classified as fish-bearing and 354 classified as non-fish bearing. The total of fish-bearing watercourses includes 34 watercourses that have had their status defaulted to fish-bearing, pending further investigation in 2007. Of the fish-bearing watercourses that have been investigated in the field, 14 are classified as S1, 34 classified as S2, 50 classified as S3 and six classified as S4. Five watercourses classified as wetlands also supported fishes.

All watercourse crossings investigated were assigned a sensitivity rating. This rating takes into account fish presence or absence, the diversity of fish species present and their life-history stages, average riverine habitat potential to support fish at the time of sampling, and the potential for this habitat to support fishes at other times. From the total of 497 watercourses, 54 were assigned a "High" sensitivity rating, 42 a "Moderate" rating, 371 assigned a "Low" sensitivity and 92 assigned "None" -or having no sensitivity. The total number of watercourses yet to be assigned a sensitivity rating is 30.

In total, 32 different fish species were captured along the KSL Pipeline Looping Project route between KP 0 and KP 462.2. This included 10 of the 16 fish species identified as Valued Ecosystem Components (VEC's) in the Draft Terms of Reference. No SARA, COSEWIC or provincially "Red" listed species were found in any of the watercourses sampled. Dolly Varden and bull trout were the only provincially "Blue" listed species sampled, with Dolly Varden present in 26 of the watercourses sampled, and bull trout present in only three of the watercourses. The Interior Fraser population of coho salmon is listed by COSEWIC as "Endangered", however no coho from this population were sampled within watercourses along the KSL Project route proposed. The Nechako River population of white sturgeon (including the Stuart watershed) is also listed by COSEWIC and as of recently SARA as endangered. There is no crossing of the Nechako River proposed and no individuals were sampled in tributaries of the Nechako River.

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1.0 INTRODUCTION

1.1 Project Description

The construction of the Kitimat to Summit Lake Looping Project (the KSL Project) will enable Pacific Northern Gas Ltd. (PNG) to increase the capacity of the existing natural gas transmission pipeline. This effort is to meet shipper demand as well as to reverse the direction of flow so that the existing pipeline and the new pipeline loop can flow natural gas in both a westerly and an easterly direction. The project involves construction of 462 km of 914 mm (36-inch) diameter pipe between a location immediately north from the City of Kitimat, BC and a location immediately east from the Village of Summit Lake, BC (see Figure 1). The project also includes construction and operation of one new compressor station located at the mid-point of the new pipeline and the installation of associated aboveground facilities including block valves and receiving traps for pipeline inspection tools at specific locations within the designated right-of-way (Figure 1). The project will require construction of temporary camps, stockpile sites and other short-term work yards. No ground disturbing work is required on the existing PNG pipeline where it is not parallel to the proposed KSL Project.

PNG is regulated under the *B.C. Utilities Commission Act* [99] and the proposed KSL Project is subject to review under the *B.C. Environmental Assessment Act* (*BCEA Act*) [98] as well as the *Canadian Environmental Assessment Act* (*CEA Act*) [104]. This review and approval process will be conducted under the auspices of the Harmonization Agreement by the B.C. Environmental Assessment Office (BCEAO) and the Canadian Environmental Assessment Agency (CEA Agency). Application will be made to the BCEAO for an Environmental Approval Certificate (EAC) for the purposes of constructing and operating the KSL Project.

The purpose of the KSL Project is to deliver natural gas that is received at the proposed Kitimat Liquefied Natural Gas (KLNG) facility, located immediately southwest from the City of Kitimat, to the Duke Energy Inc. pipeline facilities located east from the Village of Summit Lake. To accommodate construction and operation of the KSL Project, PNG and KLNG have jointly formed a new company, Pacific Trail Pipelines Inc. (PTP) that will own and operate the proposed pipeline loop as well as the existing PNG pipeline.

1.2 Route Options

An initial option to follow the entire existing PNG Right-of-Way (ROW) from Summit Lake to Kitimat was considered, but significant geological and geotechnical constraints within the Telkwa Pass deemed this not viable. A 462.2 km alternative southern route was proposed which follows the existing PNG ROW from Summit Lake to Fraser Lake.

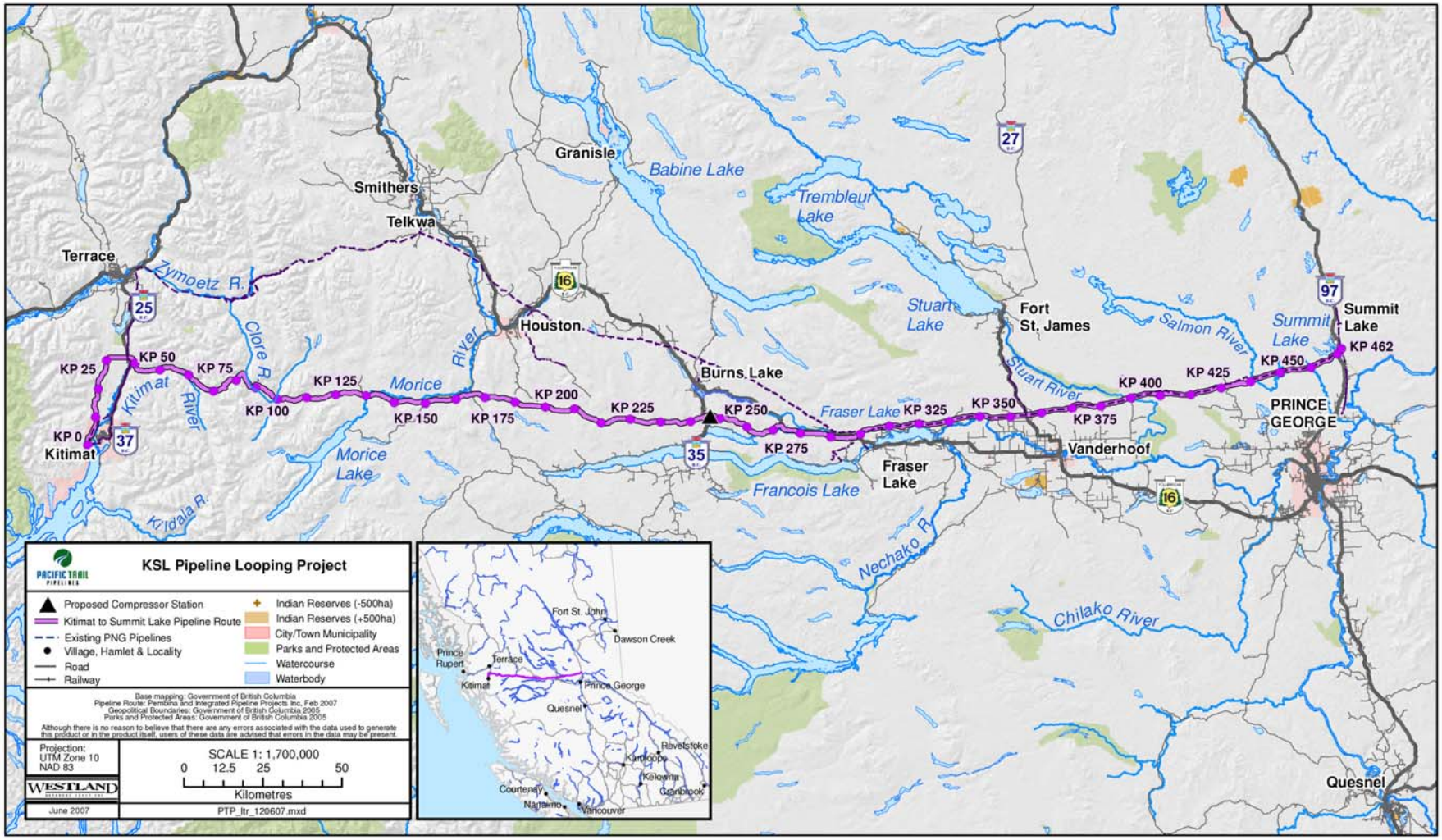

Figure 1 KSL Project Study Area

At Fraser Lake the revised route deviates away from the existing ROW and continues directly west to Kitimat (Figure 1). The revised southern route option is evaluated within this report.

Reference points along pipelines are commonly referred to as Kilometre Posts or "KP's". This system has been adopted for the KSL Project pipeline proposed with KP 0.0 located at the Kitimat Terminal where the pipeline will originate. KP's are 1 km apart and are used to describe features along the pipeline.

1.2.1 Proposed Route

The proposed route crosses three Ecoprovinces. From approximately KP 0 to KP 100, the route passes through the Coast and Mountain Ecoprovince. This region is characterized by wet, mild winters given the influence of Pacific air masses. The most common biogeoclimatic zones are Coastal Western Hemlock, Mountain Hemlock and Alpine Tundra at high elevations. From KP 100 to approximately KP 300 the route crosses the Central Interior Ecoprovince where the overall climate is still influenced by Pacific air masses resulting in precipitation maximums in late spring and early summer but the area is also influenced by interior weather systems. Biogeoclimatic zones are characterized by Sub-Boreal Spruce and Englemann Spruce-Subalpine Fir. From KP 300 to the terminus of the project at the Summit Lake Station (KP 462) the route crosses the Sub-Boreal Interior Ecoprovince where cold arctic air is frequent during winter periods. Sub-Boreal Spruce is the dominant Biogeoclimatic Zone, and precipitation tends to be evenly distributed throughout the year.

From a physiographic perspective the KSL route can be divided into two main geomorphic terrains, each with distinct landforms, soil types and geologic features: namely the Coast Mountains from KP 0 to KP 100 and the Interior Plateau from KP 100 to KP 462.

1.2.1.1 Coast Mountains, KP 0 to KP 100

The KSL Project pipeline route begins near the mouth of the Kitimat River and follows the river upstream to a drainage divide at Nimbus Mountain east in the Coast Mountains. Terrain within the Kitimat River valley is characterized by wide, glaciated valleys containing a thick sequence of deep gravel/cobble deposits.

East of KP 45 the valley walls are bedrock-controlled and steep with mountain streams, gullies and occasional avalanche tracks crossing the proposed route. Several mountain streams located at KP 68 to KP 75 have built extensive colluvial cones on the valley floor that are indicative of debris flow activity.

1.2.1.2 Interior Plateau, KP 100 to KP 462

Beyond the Coast Mountains and the confluence of the Clore and Burnie Rivers, the route traverses low to moderate relief hills and plains of the Interior Plateau. Terrain is characterized

by well-forested, elongate glaciated hills (drumlins) and eskers with shallow river and stream valleys. River valleys generally are broad and shallow with fluvial sands and gravels and some overbank deposits of silts and organics.

1.3 Regulatory Standards

Aquatic resource aspects of the KSL Project are subject to regulatory guidelines and standards established by two federal (Fisheries and Oceans Canada (DFO) and Transport Canada), and one provincial agency (British Columbia Ministry of Environment). Requirements of each jurisdiction are described below.

1.3.1 Federal

The Terms of Reference for the KSL Project was developed for the environmental screening pursuant to the *Canadian Environmental Assessment Act* [104] and *BC Environmental Assessment Act* [98]; and includes requirements of all Responsible Authorities (RAs) and Federal Authorities (FAs). Specific provisions dealing with fish and their habitat were also identified within the Terms of Reference document.

1.3.1.1 Fisheries and Oceans Canada

The *Fisheries Act* [102] prohibits the destruction of fish; alteration, disruption, or destruction of fish habitat; and deposition of deleterious substances into water frequented by fish or that flow into other waterbodies frequented by fish (sections 32, 35 and 36 of the *Act*, respectively). DFO is the federal agency responsible for administering the *Fisheries Act* [102] and ensuring compliance with it. It is Pacific Trail Pipelines' responsibility to provide sufficient data and information such that DFO can issue a letter of advice stating whether violation of the *Fisheries Act* [102] is likely to occur given works proposed. If a violation is likely, the proponent must obtain Ministerial approval to proceed with the works and remain in compliance with the *Act*. Part of this approval process requires that any harmful alteration, disruption or destruction (HADD) of fish habitat be mitigated through enhancement/improvement of that already existing, to satisfy the "No Net Loss" guiding principle [68]. Additional field work in rivers including the Stuart, Salmon, Wedeen and Little Wedeen, will be required outside the pipeline route proposed to document fish populations and their habitat to identify enhancement or improvement opportunities.

1.3.1.2 Transport Canada

Transport Canada has jurisdiction over watercourses that may have their navigability affected by pipeline or vehicle crossings through the *Navigable Waters Protection Act* (NWPA) [103]. The NWPA is a long-standing act, invoked in 1882 to legislate uninterrupted navigation of Canada's waterways. Recent guidelines have simplified the required reporting of pipeline construction

with respect to the NWPA [132]. However, temporary bridges are still subject to review/approval under the NWPA [132].

1.3.2 Provincial

1.3.2.1 British Columbia Ministry of Environment

The BC Ministry of Environment (BCMOE) manages fisheries within British Columbia, issues fish collection permits, and directs inventory and research programs. Although final determinations on *Fisheries Act* compliance will be made by DFO, BCMOE staff ensure conditions of the *Fish Protection Act* [97] and the *Water Act* [101] are adhered to.

The BC Resource Information Standards Committee (RISC) has developed standards for fish population and aquatic habitat inventories. These were adopted for all field work.

The BC Oil and Gas Commission has developed several stream crossing guidelines for pipelines in northeast British Columbia. These provide useful guidance for crossing design, and were considered when developing preferred and alternate crossing methods and proposed instream work windows.

1.3.3 Regulatory Consultation

The following federal, provincial, regional and local agencies were contacted through the course of the fish and fish habitat investigations and will be involved where applicable in preparation of mitigation/compensation options:

- DFO Pacific Region – BC Interior: Kamloops, Prince George, Smithers, Terrace and Quesnel; Central and Northern Coast: Prince Rupert ;
- Transport Canada –Vancouver;
- BCMOE – Prince George, Smithers.

1.4 First Nation Assistance

Throughout the course of the fish and habitat field programme (spanning fall 2005 to summer 2006) First Nation field technicians assisted with the collection of data. The following First Nations contributed in all aspects of inventory data collection:

- Stellat'en First Nation in conjunction with Carrier Sekani Tribal Council
- Wet'suwet'en First Nation
- Moricetown First Nation
- Kitselas First Nation

1.5 Study Objectives

The primary objective of the inventory programme was to identify and confirm the locations and fish habitat potential of watercourses along the KSL Project pipeline route, from KP 0 to KP 462.2. Sampling also documented fish presence/absence and habitat productivity.

Field work was preceded by a literature search using *Fish Wizard,* an online database, to locate information about watercourses already investigated, and to refine the scope and scale of investigations [90]. General information about fishes and their habitat was available for most named large creeks and rivers traversed by the proposed route. Field work was designed to:

- determine the nature and extent of riverine habitat and its potential to support fishes and individual life-history stages during fall 2005, spring and summer 2006, and spring 2007;
- determine fish species composition and relative abundance within a field-defined zone-of-influence at each crossing;
- record concentrations of fall and spring-spawning fish and/or activity; and
- document presence of species at risk or species of special status.

This report covers both pipeline and vehicle crossings where they fall within the zone of influence (ZOI). Where new access is required outside the ZOI, then this will be assessed in subsequent field visits as required.

Information collected during the fish and fish habitat programme is provided in the following volumes:

- Fish-Bearing Atlas: KSL Project (KP 0 to KP 462);
- Non-Fish-Bearing Atlas: KSL Project -

  Volume A: KP 0 – KP 70

  Volume B: KP 70 – KP 120

  Volume C: KP 120 – KP 230

  Volume D: KP 230 – KP 340

  Volume E: KP 340 – KP 462

- Appendix A: KSL Project – Summary Watercourse Crossing Table (separate volume).
- Appendix B: KSL Project – Fish and Fish Habitat Map Set (separate volume).

2.0 SETTING AND PREVIOUSLY DOCUMENTED FISH PRESENCE

2.1 Literature Sources

The greatest single source of information on previously documented fish presence in water bodies crossed by the route proposed was Fish Wizard [90], an online, web-based tool that gains access to the provincial repository of fish data (information held by Fisheries and Oceans Canada and BCMOE and administered by the Freshwater Fisheries Society of BC). Additional literature and historical records of fish and fish habitat from forestry, First Nation and independent sources were also investigated.

2.2 KSL Project Setting Overview

2.2.1 Kitimat Watershed

The Kitimat River is 97 km long and originates from Atna Peak in the Coast Mountains of British Columbia. The river flows north from its origin and west on it's decent from the mountains then south to the Kitimat Arm of the Douglas Channel on the Pacific Ocean near the City of Kitimat, British Columbia. The proposed route parallels the river for approximately 50 km from KP 0 to ~67.

2.2.2 Skeena Watershed

The Skeena River originates in the Skeena Mountains in the northern part of the province and flows for 580 km to the Pacific Ocean along the central coast of British Columbia [135]. The pipeline proposed crosses two sub-basins, the Zymoetz and Bulkley, within the Skeena Watershed. In particular, the Clore River and its tributaries within the Zymoetz sub-basin and several tributaries to the Bulkley River, including the Morice River within the Bulkley sub-basin will be crossed.

2.2.3 Fraser Watershed

The Fraser River is the second largest drainage system in British Columbia and the largest river system within the province [135]. The Fraser River originates near Cube Ridge in Mount Robson Provincial Park within the Rocky Mountains. It flows north towards the City of Prince George before turning south and making its way to the Strait of Georgia near the City of Vancouver. The proposed pipeline crosses a portion of the Fraser watershed in a fairly straight line from west to east, south from Burns Lake and north from the Town of Vanderhoof, crossing through the Nechako and Salmon River sub-basins.

2.2.4 Peace Watershed

The pipeline proposed terminates within the Peace Watershed south from Summit Lake. The Peace Watershed is part of the Mackenzie Basin which is the largest drainage in British Columbia [135]. The Peace River originates in Northern British Columbia and flows northeast through Alberta, enters the Mackenzie River, and flows northwest through the Northwest Territories before entering the Beaufort Sea in the Arctic Ocean. The proposed pipeline crosses tributaries to Summit Lake.

2.3 Kitimat Watershed: KP 0 to KP 79

The proposed pipeline is adjacent to the Kitimat River between KP 0 to KP 10. The Kitimat River supports 18 different species of fish (Table 1). It is stocked annually since at least 1989 with cutthroat trout and steelhead smolts [90]. Duck Creek (KP 4.7) supports coastrange sculpin [66], chum salmon [73, 181], coho salmon [73, 123, 181], cutthroat trout [181], Dolly Varden [123, 181], pink salmon [73, 181], rainbow trout [123], lamprey [66], and stickleback [66]. Goose Creek (KP 5.8) and an unnamed channel (KP 6.9) are known to support coho and pink salmon [73].

The Little Wedeene River (KP 12.9) originates near Mount Carthew and flows into the Kitimat River approximately 6 km downstream from the crossing proposed. The river supports coastrange sculpin [66], prickly sculpin [76], chinook salmon [131], chum salmon [131], coho salmon [131], Dolly Varden [76, 117], pink salmon [131], rainbow trout [117], and steelhead [131, 140]. Trout Creek (KP 14.6) is a tributary to the Little Wedeene River and supports coho salmon [73].

The Wedeene River (KP 17.0) originates from an icefield on Wedeene Mountain and flows into the Kitimat River approximately 7 km downstream from the crossing proposed. After crossing the Wedeene River, the pipeline proposed parallels the Wedeene River and crosses several tributaries. Anadromous (coastal) cutthroat trout [139], prickly sculpin [75], chinook salmon [66, 67, 129, 130], chum salmon [66, 129, 130, 131], coho salmon [66, 129, 130, 131], cutthroat trout [77], Dolly Varden [75], pink salmon [129, 130], rainbow trout [75], and steelhead [139] are known species in the Wedeene River. The pipeline proposed crosses (KP 25.6) a tributary to Lone Wolf Creek, which flows into the Wedeene River. Lone Wolf Creek supports steelhead [139], pink salmon [75, 131], sculpin [75], chum salmon [131], and coho salmon [131].

TABLE 1

SPECIES PREVIOUSLY RECORDED IN THE KITIMAT RIVER

Common Name	Scientific Name	Reference
Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	139, 186
Coastrange sculpin	*Cottus aleuticus*	213
Prickly sculpin	*Cottus asper*	213
Chinook salmon	*Oncorhynchus tshawytscha*	28, 67, 129, 130, 131
Pacific staghorm sculpin	*Leptocottus armatus*	213
Chum salmon	*Oncorhynchus keta*	67, 129, 130, 131
Coho salmon	*Oncorhynchus kisutch*	67, 129, 130, 131
Cutthroat trout	*Oncorhynchus clarkii*	126, 140
Dolly Varden	*Salvelinus malma*	126, 134, 213
Eulachon, candlefish	*Thaleichthys pacificus*	24, 73
Kokanee	*Oncorhynchus nerka*	78
Pink Salmon	*Oncorhynchus gorbuscha*	66, 67, 73, 129, 130, 131
Pacific lamprey	*Lampetra tridentata*	78
Rainbow Trout	*Oncorhynchus mykiss*	75, 213
Unknown stickleback	*Gasterosteus sp.*	66
Sockeye Salmon	*Oncorhynchus nerka*	72
Steelhead	*Oncorhynchus mykiss*	67, 77, 78, 133, 134, 139
Threespine stickleback	*Gasterosteus aculeatus*	66

Cecil Creek (KP 30.1) originates from Larsen Ridge and flows into the Kitimat River 10 km downstream from the crossing proposed. An unnamed tributary to Cecil Creek (KP 28.3) supports coho salmon [130, 131]. Cecil Creek itself supports coastal cutthroat trout [66], chinook salmon [130, 131], coho salmon [67, 130, 131, 208], cutthroat trout [75, 208], chum salmon [130, 131], Dolly Varden [75, 208], lamprey [66], pink salmon [130], rainbow trout [75, 208], steelhead [75, 139], and stickleback [66].

The pipeline proposed crosses Chist Creek (KP 38.8), then turns south and the ROW lies parallel to the creek up to its confluence with the Kitimat River. Chist Creek supports chinook salmon [22], chum salmon [129, 130, 131], coho salmon [22], cutthroat trout [75], Dolly Varden [22, 49], pink salmon [129], rainbow trout [66], sockeye salmon[67], and steelhead [22, 139].

Between KP 41.6 and KP 66.1 the pipeline is situated parallel to the Kitimat River on the north side. Hunter Creek (KP 63.4) is the only tributary with known fish presence in this section. Chinook salmon [22], chum salmon [22], coho salmon [22], Dolly Varden [22], and rainbow trout [215] have been found in Hunter Creek.

From KP 66.2 to KP 79 all crossings proposed are located on tributaries to Hoult Creek. Chinook salmon [211], chum salmon [130], coho salmon [130], and rainbow trout [210] have been documented from Hoult Creek. The pipeline proposed then crosses over a mountain range and into the Skeena Drainage.

2.4 Skeena Watershed: KP 80 to KP 174 and KP 195 to KP 214

Although the Bulkley, Zymoetz and Skeena rivers themselves are not crossed by the pipeline proposed, rivers such as the Morice, a tributary to the Bulkley River are crossed. It is important to document the species that are known in each of the larger systems as they have the potential to be found within the watercourses crossed by the pipeline proposed (Table 2).

TABLE 2

SPECIES PREVIOUSLY RECORDED IN THE SKEENA, ZYMOETZ, BULKLEY AND MORICE RIVERS

Species		Reference			
Common Name	**Scientific Name**	**Skeena River**	**Zymoetz River**	**Bulkley River**	**Morice River**
Coastal (anadromous) cutthroat trout	*Oncorhynchus clarkii clarkii*			66	
Burbot	*Lota lota*	33, 137	137	137, 172	
Western brook Lamprey	*Lampetra richardsoni*	47			
Bull trout	*Salvelinus confluentus*	47		30, 45	92
Coastrange sculpin	*Cottus aleuticus*	47			
Prickly sculpin	*Cottus asper*	33, 58	41, 66	66, 122	
Unknown sculpin	*Cottus sp*	58	191, 192		
Slimy sculpin	*Cottus cognatus*			185	
Chinook salmon	*Oncorhynchus tshawytscha*	33, 58, 175, 175, 212	20, 116, 192, 193	30, 45, 55, 74, 172, 179, 185, 189, 196, 214,	50, 65, 137, 176, 203, 215
Chum salmon	*Oncorhynchus keta*	33, 48, 66, 58, 147, 160,	20		65
Coho salmon	*Oncorhynchus kisutch*	58, 66, 147, 148, 160, 175, 212	23, 50, 116, 136, 169, 191, 192, 193, 195	30, 45, 46, 70, 71, 74, 122, 157, 172, 173, 179, 185, 189, 203	50, 51, 65, 137, 149, 176, 203
Largescale sucker	*Catostomus macrocheilus*	33		178, 179	
Cutthroat trout	*Oncorhynchus clarkii*	33 58, 60, 136, 137, 212	136, 191	30, 109, 136, 137, 172	50, 137, 176,

Species		Reference			
Common Name	**Scientific Name**	**Skeena River**	**Zymoetz River**	**Bulkley River**	**Morice River**
Dolly Varden	*Salvelinus malma*	33, 58, 67, 136, 137, 148	50, 136	30, 45, 136, 137, 203	50, 176, 215
Eulachon, candlefish	*Thaleichthys pacificus*	47, 167, 209			
Green Sturgeon	*Acipenser medirostris*	47, 207			
Kokanee	*Oncorhynchus nerka*		137		
Unknown lamprey	*			66	
Lake chub	*Couesius plumbeus*	33		168	
Longnose dace	*Rhinichthys cataractae*	33	66	45, 179, 185, 200, 203	176, 203
Longfin Smelt	*Spirinchus thaleichthys*	47			
Longnose sucker	*Catostomus catostomus*	33		45, 109, 122	176
Lake Trout	*Salvelinus namaycush*			137	
Lake whitefish	*Coregonus clupeaformis*			137	
Mountain whitefish	*Prosopium williamsoni*	137, 175, 207, 215	66	45, 136, 137, 168, 200, 203	50, 137, 179, 203
Northern pikeminnow	*Ptycheilus oregonensis*	33		196	65
Peamouth chub	*Mylocheilus caurinus*	33, 58	66	196	
Pink Salmon	*Oncorhynchus gorbuscha*	33, 48, 58, 66, 67, 160, 147, 207, 214	13, 20	30, 46, 189, 214	46, 50, 65
Pacific lamprey	*Lampetra tridentata*	47			
Pygmy whitefish	*Prosopium coulterii*	47			65
Rainbow Trout	*Oncorhynchus mykiss*	58, 136	23, 50, 136, 192	30, 45, 74, 122, 136, 137, 139, 172, 173, 179, 196, 200, 203,	50, 65, 137, 203
Northern redbelly dace	*Phoxinus eos*	33			
River Lamprey	*Lampetra ayresi*	47			
Redside shiner	*Richardsonius balteatus*	33, 58		66, 168, 178, 179, 196	
Unknown sculpin	*Cottus sp*			66	65, 203
American Shad	*Alosa sapidissima*	47			
Sockeye Salmon	*Oncorhynchus nerka*	33, 175, 214	137, 214	30, 136, 185	50, 55, 137
Steelhead (summer-run)	*Oncorhynchus mykiss*			172	
Steelhead	*Oncorhynchus mykiss*	33, 48, 67, 148	36, 48, 50, 139, 140, 195	30, 48, 139, 140, 173, 189	50, 65, 137, 140, 139, 176, 215,
Unknown Sucker	*Catostomus sp.*	212		200, 203	65
Threespine	*Gasterosteus aculeatus*	33, 58		66	

Species		Reference			
Common Name	**Scientific Name**	**Skeena River**	**Zymoetz River**	**Bulkley River**	**Morice River**
stickleback					
White sturgeon	*Acipenser transmontanus*	47			
Steelhead (winter-run)	*Oncorhynchus mykiss*		194		
White sucker	*Catostomus commersonii*	33			

2.4.1 Zymoetz Watershed (KP 80 to KP 104)

The pipeline proposed will be installed parallel to the Clore River (KP 88.5), crossing it once below its confluence with the Burnie River, which is crossed at KP 99.6. It then crosses into the Bulkley watershed. The Clore River originates in the Kitimat Range of the Coast Mountains and flows north for 72 km to its confluence with the Zymoetz River. The Clore River supports burbot [137], chinook salmon [111, 116], coho salmon [20, 111], cutthroat trout [137], Dolly Varden [111, 136], kokanee [137], mountain whitefish [40], rainbow trout [111, 137], steelhead [111, 116, 140, 195], and winter-run steelhead [194]. An unnamed tributary to the Clore River (KP 84.5) supports Dolly Varden [95].

The Burnie River originates from Burnie Lake and flows southwest for approximately 37 km to its confluence with the Clore River, approximately 4 km downstream from the crossing proposed. Burnie River supports prickly sculpin [29], cutthroat trout [29], and mountain whitefish [29]. Burnie Lake supports cutthroat trout [34, 151], kokanee [34, 151], longnose sucker (*Catostomus catostomus*) [34, 151], mountain whitefish [34, 151], redside shiner (*Richardsonius balteatus*) [34], Dolly Varden [29, 151], prickly sculpin [29], and burbot [137]. A 20 m high falls on the Clore River prevents anadromous fish from accessing the Clore headwaters and the Burnie River [174].

2.4.2 Bulkley Watershed (KP 104 to KP 174 and KP 195 to 214)

2.4.2.1 Gosnell Creek (KP 104-127)

As the pipeline proposed crosses over into the Bulkley watershed it enters the Gosnell Creek sub-basin. Gosnell Creek originates in the Morice Mountain range and flows northeast for 59 km to its confluence with the Morice River. Gosnell Creek (KP 110.0) supports bull trout [44, 61], prickly sculpin [40], chinook salmon [17, 47, 81, 108], coho salmon [15, 17, 26, 37, 44, 47, 81, 106, 108, 119, 171, 177, 190, 191, 197, 199], cutthroat trout [46, 119], Dolly Varden [17, 44, 81, 136, 190], lamprey [47, 108], lake chub [44], longnose dace [15, 199], mountain whitefish [44], peamouth chub [61], pink salmon [80, 81, 106, 136], rainbow trout [81, 119, 197], redside shiner [47], summer-run steelhead [44, 61], steelhead [46, 47], unidentified trout [190], whitefish [119], and an unidentified species [44]. Gosnell Creek accounts for a significant portion of coho spawning returns [35]. Steelhead are known to spawn in tributaries to Gosnell Creek [35]. Pink

and coho salmon occasionally spawn in the lower reaches while bull trout are known to spawn in the upper reaches of Gosnell Creek [35].

Within the Gosnell Creek sub-basin, several tributaries support fishes. Two unnamed channels (KP 104.6 and 105.2) flow into an unnamed lake that has rainbow trout presence documented [44]. Three unnamed channels (KP 106.1, 106.6, and 108.0) flow into a tributary to Gosnell Creek (KP 109.3) and have recorded Dolly Varden presence [44]. This tributary and one other, at KP 109.5, have documented coho salmon [44, 47], Dolly Varden [44], and rainbow trout [44] presence.

An unnamed tributary to Gosnell Creek at KP 112.1 supports coho salmon [44, 47], cutthroat trout [44], Dolly Varden [44], lake chub [44], summer-run steelhead [44] and an unidentified species [44]. At KP 112.9, a tributary to the channel crossed at KP 112.1 has documented Dolly Varden and lake chub presence [44]. At KP 113.6 an unnamed tributary to Gosnell Creek supports coho salmon [17, 44], cutthroat trout [17, 44], Dolly Varden [17, 44] and lake chub [44] and its tributary (KP 114.2) supports Dolly Varden [44].

From KP 116.1 to 120.0, all the crossings proposed are located within a small watershed of an unnamed tributary to Gosnell Creek. Within this area coho salmon, cutthroat trout and Dolly Varden have been documented in the unnamed tributary (KP 116.1) [44]. Dolly Varden has been documented in three unnamed channels (KP 116.9, 119.8 and 119.9) [44] while cutthroat trout are also documented in the unnamed channel at KP 119.9 [44].

Cutthroat trout and Dolly Varden are known to inhabit an unnamed lake that an unnamed channel flows into, approximately 300 m downstream from the KP 121.4 crossing proposed [44]. The outlet from the lake is a tributary to Gosnell Creek and supports Dolly Varden [44], cutthroat trout [17, 44], lake chub [44], and coho salmon [17, 44].

Crystal Creek is 22 km long and a major tributary to Gosnell Creek. A crossing of Crystal Creek is proposed at KP 124.5. Bull trout [44], coho salmon [44, 47], Dolly Varden [44, 177], summer-run steelhead [44] and unidentified species [44] have been documented previously. Bull trout are known to spawn in Crystal Creek [35].

2.4.3 Morice River (KP 127-174)

The pipeline proposed crosses the Morice River (KP 130.6) upstream from the confluence with Gosnell Creek and then alongside the Morice River to the south for 47 km until the ROW enters the Fraser Watershed. The Morice River originates from Morice Lake and flows northeast for 108 km to its confluence with the Bulkley River near Houston, British Columbia. A summary of the species found in the Morice River is listed in Table 2. The Morice River is one of the three most important rivers in the Skeena Watershed for chinook salmon [35]. Since 1985, the number of chinook returns is consistently over 10,000 fish annually [35]. Steelhead, sockeye and chinook salmon all spawn within the Morice River, with chinook spawning between Lamprey Creek and Morice Lake [35, 174]. Coho salmon are also known to spawn in the Morice River upstream from

Fenton Creek. Between 5,000 and 175,000 pink salmon annually spawn in the Morice River, with the majority spawning between Lamprey and Fenton creeks [35].

The pipeline proposed parallels the Morice River between KP 130.6 and KP 149.9. Of the 49 crossings within this stretch, only nine have previously documented fish presence. The first is Cedric Creek (KP 142.7) which supports chinook salmon, coho salmon, cutthroat trout, and rainbow trout [6].

Lamprey Creek (KP 149.9) originates from Lamprey Lake and flows northeast to its confluence with the Morice River. Lamprey Creek supports burbot [190], prickly sculpin [119], sculpin [41, 190, 191, 199, 201, 203], chinook salmon [52, 199, 201, 215], coho salmon [18, 19, 25, 41, 190, 191, 199, 201, 203], cutthroat trout [19, 137, 201], dace [18], Dolly Varden [19, 41, 80, 199, 201], lamprey [18], longnose dace [41, 199, 201, 203], longnose sucker [199], mountain whitefish [66, 80, 199, 201, 203], rainbow trout [18, 19, 190, 199, 201, 203], steelhead [197, 202], sucker [41, 66, 190, 201], and trout [191]. Coho salmon and steelhead are occasionally known to spawn in the lower reaches of Lamprey Creek [35].

There are several lakes that feed into Lamprey Creek. In addition to some of the above mentioned species, Collins Lake has documented redside shiner and peamouth chub presence [11, 187]. Lamprey Lake supports lake chub and rainbow trout [34]. An unnamed tributary to Lamprey Creek (KP 150.9) has documented rainbow trout presence [170].

An unnamed tributary to the Morice River (KP 154.8) supports coho salmon, cutthroat trout, Dolly Varden, rainbow trout, and summer-run steelhead [42]. Cutthroat trout, Dolly Varden, and rainbow trout are also found in a tributary to this channel (KP 154.6). Another unnamed tributary to the Morice River (KP 158.3) supports coho salmon [42]. Fenton Creek (KP 163.0) has documented coho salmon [42, 80, 170], Dolly Varden [7, 42], rainbow trout [7, 42], summer-run steelhead [42], and sucker species [6, 7]. Owen Creek (KP 165.3) has previously documented prickly sculpin [170], coho salmon [19, 159, 201], chinook salmon [85, 215], Dolly Varden [43, 159, 197, 201, 203], longnose dace [40, 41, 43, 201, 203], longnose sucker [16], mountain whitefish [19, 43, 159, 201], northern pikeminnow [19], pink salmon [66], rainbow trout [201, 203], redside shiner [127, 201], summer-run steelhead [43], steelhead [14, 50, 197], sucker [201], sculpin [201], and lamprey [14]. Coho salmon, pink salmon and steelhead are occasionally known to spawn in the lower reaches of Owen Creek [35]. An unnamed tributary to Owen Creek (KP 172.5) supports rainbow trout [43] and coho salmon [170].

2.4.3.1 Buck Creek (KP 195-214)

Between KP 174-195 the ROW traverses the Fraser Watershed, but returns to the Skeena Watershed between KP 195-214. Here, it lies parallel to Buck Creek on the south side before crossing back into the Fraser Watershed. Buck Creek originates on the Nechako Plateau immediately north from the pipeline route near KP 214 and flows northwest for 68 km, through the Town of Houston, British Columbia and into the Bulkley River. None of the watercourses that are crossed in this section have documented fish presence but Buck Creek supports burbot

[173], bull trout [30], prickly sculpin [57, 59], chinook salmon [30, 69, 74, 106, 172, 173, 180, 198, 200, 203, 221], coho salmon [30, 53, 69, 74, 156, 172, 173, 180, 198], largescale sucker [38], cutthroat trout [180], Dolly Varden [30], lamprey [180], longnose dace [38, 57, 172, 180, 200, 203], longnose sucker [57, 221], mountain whitefish [38, 57, 200], pink salmon [30, 106, 115], rainbow trout [30, 46, 53, 69, 74, 137, 172, 179, 180, 200, 203], sockeye salmon [30], summer-run steelhead [172], steelhead [30, 198], sucker [200, 203], and white sucker [53, 180].

Buck Creek flows into Goosly Lake near KP 200 and several of the watercourses crossed flow into Goosly Lake which has a documented presence of largescale sucker, kokanee, longnose sucker, mountain whitefish, peamouth chub, rainbow trout, and redside shiner [220].

2.5 Fraser Watershed: KP 174 to KP 195 and KP 214 to KP 454

2.5.1 Parrott Creek KP 174-195

The section of the pipeline proposed in the Fraser Watershed between the Morice River and Buck Creek drainages in the Skeena Watershed is located within the Parrott Creek sub-basin. Parrot Creek originates on the Nechako Plateau and flows southeast for 28 km through the Parrot Lakes chain to Francois Lake, approximately 24 km downstream from KP 179.0. The pipeline proposed is located upstream from Parrot Lakes. Parrot Creek supports many fish species however only rainbow trout and lake chub are known above an impassable barrier (4 m falls) located downstream from the lakes [174].

2.5.2 Allin Creek KP 214-236

The pipeline proposed crosses back to the Fraser Watershed from the Skeena Watershed and into the Allin Creek sub-basin. Allin Creek flows southeast to Francois Lake. The pipeline proposed crosses Allin Creek at KP 215.2 and then parallels the channel and a tributary (Beach Creek). Allin Creek supports prickly sculpin [87], longnose dace [39], rainbow trout [39, 87], and sculpin [39]. An unnamed tributary to Allin Creek (KP 226.7) and two unnamed tributaries to Beach Creek (KP 230.5 and 231.8) have documented rainbow trout presence [87]. Beach Creek has no known fish presence; however, Anders Lake which is located on Beach Creek supports lake chub and rainbow trout [62].

Francois Lake supports rainbow trout [9, 161, 166, 188], lake trout [9, 166, 188], kokanee [94, 166, 188], sockeye salmon [12], sucker [188], mountain whitefish [166, 188], Dolly Varden [188], chub [188], northern pikeminnow [166], lake whitefish [166], longnose sucker [166], sculpin [166], and burbot [166].

2.5.3 Tchesinkut Creek KP 236-280

Tchesinkut Creek flows southeast into Tchesinkut Lake and then from the lake, the creek flows east into the Endako River. The pipeline proposed crosses Tchesinkut Creek at KP 239.5 and then parallels Tchesinkut Lake and creek on the north side until KP 278.9, where it crosses Tchesinkut Creek again. There is no known historical fish presence for Tchesinkut Creek but

Tchesinkut Lake supports largescale sucker [217], lake trout [217], lake whitefish [217], rainbow trout [217], kokanee [56] and burbot [56]. An unnamed channel flowing into Tchesinkut Lake is crossed twice at KP 248.0 and 250.4 and supports lake chub, longnose sucker and rainbow trout [87].

2.5.4 Endako River KP 280-302

The Endako River flows southeast for 106 km and into the Stellako River. The pipeline proposed parallels the Endako River on the south side before the crossing proposed at KP 297.5. The Endako River supports burbot [84], prickly sculpin [84], chinook salmon [84,] kokanee [84], leopard dace [84], lake chub [84], longnose dace [84], longnose sucker [84], mountain whitefish [84], northern pikeminnow [84], rainbow trout [84, 86, 122], redside shiner [84], and sockeye salmon [128]. The unnamed tributary to the Endako River at KP 292.1 has no known documented fish presence, however Casey Lake, located approximately 3 km upstream from the crossing proposed supports rainbow trout [139].

The Stellako River is only 13.5 km long but it serves as a migration corridor between Francois and Fraser Lake. The Stellako River supports burbot [39, 216], prickly sculpin [39, 216], rainbow trout [39, 64, 216], redside shiner [39, 216], Dolly Varden [67], mountain whitefish [67], northern pikeminnow [67], chinook salmon [128], sockeye salmon [128], kokanee [125], and longnose dace [39].

2.5.5 Fraser Lake KP 302-325

After crossing the Endako River, the ROW follows the north shore of Fraser Lake. Fraser Lake supports populations of Dolly Varden [10, 121], lake trout [10, 121], mountain whitefish [10, 121], northern pikeminnow [10, 121], peamouth chub [10, 121], rainbow trout [10, 121], largescale sucker [121], and burbot [64]. Lake whitefish, longnose sucker and sockeye salmon are also documented within Fraser Lake. At KP 304.4 the pipeline proposed is located north from Deserter Lake which supports rainbow trout [139]. Ormond Creek (KP 314.9) originates from Ormond Lake (approximately 8 km upstream from the crossing proposed) and supported historical runs of chinook salmon [128], Dolly Varden [67], kokanee [67], rainbow trout [67], and sockeye salmon [128]. Ormond Lake supports burbot [107], lake whitefish [158], longnose sucker [107, 158], peamouth chub [107, 158], rainbow trout [107, 158], and whitefish [107]. Currently, the status of fish populations in this system is unknown.

2.5.6 Nechako River KP 325-362

The Nechako River originates from Natalkuz Lake and flows north to its confluence with the Nautley River (outlet of Fraser Lake). Here, the river turns east, and finally southeast to its confluence with the Fraser River. The Nechako River is 285 km long and is a major tributary to the Fraser River. The pipeline proposed parallels the Nechako River to its north side while it flows east. At KP 343 the Nechako River turns south and the pipeline proposed continues east into the Stuart River sub-basin.

The Nechako River supports chinook salmon [130, 162, 216], sockeye salmon [83, 112], pink salmon [91,216], brassy minnow [63, 207], leopard dace [63, 207], pygmy whitefish [207], white sturgeon [163, 182, 207], rainbow trout [139, 182], sucker [182], Dolly Varden [182], northern pikeminnow [182], mountain whitefish [182], slimy sculpin [63], peamouth chub [63], white sucker [63], longnose sucker [63], redside shiner [63], coho salmon [118] and sculpin [8]. Rainbow trout have been documented in Kluk Creek (KP 340.2) and lake chub and longnose sucker have been documented in Clear Creek (KP 356.8) [93]; both are tributaries to the Nechako River.

2.5.7 Stuart River KP 362-408

The Stuart River originates from Stuart Lake and flows southeast towards the confluence of Chinohchey Creek. Here, the river flows south towards its confluence with the Nechako River. The pipeline proposed follows the south bank of the Stuart River, crossing the river at KP 388.9, upstream from the confluence with Chinohchey Creek. It then crosses several tributaries before moving into the Salmon River sub-basin. The Stuart River supports burbot [114], bridgelip sucker [114], prickly sculpin [114], chinook salmon [27, 67, 114], largescale sucker [114], Dolly Varden [114], kokanee [114], longnose dace [114], longnose sucker [114], northern pikeminnow [114], peamouth chub [114], rainbow trout [114], redside shiner [114], sockeye salmon [113, 183], whitefish [114], and white sturgeon [163] (Table 3).

QH (KP 370.1) and Breadalbane (KP 376.4) creeks are both tributaries to the Stuart River and have documented chinook salmon presence [114]. Breadalbane Lake, located 600 m upstream from the crossing proposed on the creek, supports northern pikeminnow [223]. Shanley Lake, located upstream from Breadalbane Lake, supports northern pikeminnow [222], peamouth chub [222], and redside shiner [222]. Welch Creek (KP 384.4) and Chinohchey Creek (KP 399.6) are both tributaries to the Stuart River and have documented chinook salmon and rainbow trout presence [114]. An unnamed channel (KP 405.3) flows into Mandalay Creek and supports chinook salmon [114].

2.5.8 Salmon River KP 408-454

The Salmon River originates on the Nechako plateau and meanders for 290 km to its confluence with the Fraser River. As a result of the Salmon River meanders and the fact that the pipeline proposed is relatively straight, the Salmon River has three crossings proposed (KP 430.3, 441.2, and 449.2). The Salmon River flows into the Fraser River approximately 30 km downstream from the last crossing proposed. This section of the Fraser River is known as Middle Fraser River. The Fraser River watershed supports 52 species of fishes of which 31 are located within the Middle Fraser River watershed (Table 3).

The Salmon River supports burbot [2, 3, 4, 21, 79], brassy minnow [1, 2], chinook salmon [1, 2, 3, 128, 206, 216], dace [1, 2, 3, 4], Dolly Varden [21, 66, 206], kokanee [21], mountain whitefish [1, 2, 3], northern pikeminnow [1, 2, 3], pink salmon [216], rainbow trout [1, 66, 206], redside shiner [2, 3, 4], sucker [1, 2, 3, 4], and sculpin [2]. Within this section, there is no known historical fish presence for any of the tributaries to the

Salmon River. However, Clauminchil Lake and Green Timber Lake have documented fish presence and are located on the Crocker Creek drainage (KP 424.8). Clauminchil Lake supports largescale sucker, longnose sucker, northern pikeminnow, peamouth chub, and rainbow trout [110]. Green Timber Lake supports lake chub, northern pikeminnow and sucker [124].

2.6 Peace Watershed: KP 454 to KP 462

The pipeline proposed is only in the Peace River Watershed for 8 km and is located south from Summit Lake. The species that can be found in the upper Peace River are outlined in Table 3. Summit Lake supports brassy minnow [145], bull trout [144], prickly sculpin [150], largescale sucker [145, 150], longnose sucker [145, 150], lake trout [144, 150, 204, 219], lake whitefish [150], minnow [204, 219], northern pikeminnow [144, 145, 150], peamouth chub [144, 145, 150], rainbow trout [144, 150, 204, 219], redside shiner [144, 145], sculpin [144, 204, 219], sucker [204, 219], whitefish [144, 204, 219], and white sucker [145].

Echo Creek (KP 355.8) supports peamouth chub [205]. Echo Lake, located approximately 1 km downstream from the crossing proposed on Echo Creek, supports prickly sculpin, largescale sucker, longnose sucker, lake whitefish, northern pikeminnow, peamouth chub, rainbow trout, and sucker [215]. Thorps Creek (KP 458.7) supports brassy minnow, lakechub, longnose sucker, northern pikeminnow, peamouth chub, redside shiner, and white sucker [145].

2.7 Summary of KSL Project Documented Fish Presence

Within the length of the KSL Project, 59 species have been previously documented. Of these species, 29 were sport fish, six were coarse fish, 19 cyprinids, four were lamprey, and one was unknown (Table 3). The distribution of species by watershed is shown below:

Kitimat Watershed, 19 species previously documented;

- 12 sport fish species
- 5 cyprinid species
- 2 lamprey species

Skeena Watershed, 45 species previously documented;

- 25 sport fish species
- 4 coarse fish species
- 11 cyprinid species
- 4 lamprey species
- 1 unknown species.

Fraser Watershed, 39 species previously documented;

- 18 sport fish species
- 6 coarse fish species
- 14 cyprinid species
- 1 lamprey species.

Peace Watershed, 25 species previously documented;

- 10 sport fish species
- 5 coarse fish species
- 10 cyprinid species

TABLE 3

SUMMARY OF PREVIOUSLY RECORDED FISH PRESENCE IN THE WATERSHEDS CROSSED BY THE KSL PROJECT

Species	Latin Name	Kitimat	Skeena	Fraser	Peace
Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	√	√		
Burbot	*Lota lota*		√	√	√
Western brook lamprey	*Lampetra richardsoni*		√		
Brassy minnow	*Hybognathus hankinsoni*			√	√
Bridgelip sucker	Catostomus columbianus			√	√
Bull trout	*Salvelinus confluentus*		√	√	√
Coastrange sculpin	*Cottus aleuticus*	√	√	√	
Prickly sculpin	*Cottus asper*	√	√	√	√
Unknown sculpin	*Cottus sp*		√	√	√
Slimy sculpin	*Cottus cognatus*		√	√	√
Chinook salmon	*Oncorhynchus tshawytscha*	√	√	√	
Unknown chub	*			√	
Pacific staghorm sculpin	*Leptocottus armatus*	√			
Chum salmon	*Oncorhynchus keta*	√	√		
Chisselmouth	Acrocheilus alutaceus			√	
Coho salmon	*Oncorhynchus kisutch*	√	√	√	
Carp	Cyprinus carpio			√	
Largescale sucker	*Catostomus macrocheilus*		√	√	√

Species	Latin Name	Kitimat	Skeena	Fraser	Peace
Cutthroat trout	*Oncorhynchus clarkii*	√	√		
Unknown dace	*			√	
Dolly Varden	*Salvelinus malma*	√	√	√	√
Eastern brook trout	Salvelinus fontinalis			√	
Eulachon, candlefish	*Thaleichthys pacificus*	√	√		
Green sturgeon	*Acipenser medirostris*		√		
Kokanee	*Oncorhynchus nerka*	√	√	√	
Unknown lamprey	*	√	√		
Leopard dace	*Rhinichthys falcatus*			√	
Lake chub	*Couesius plumbeus*		√	√	√
Longnose dace	*Rhinichthys cataractae*		√	√	√
Longfin smelt	*Spirinchus thaleichthys*		√		
Longnose sucker	*Catostomus catostomus*		√	√	√
Lake trout	*Salvelinus namaycush*			√	√
Lake whitefish	*Coregonus clupeaformis*		√	√	√
Unknown minnow	*				√
Mountain sucker	Catostomus platyrhynchus			√	
Mountain whitefish	*Prosopium williamsoni*		√	√	√
Northern pikeminnow	*Ptycheilus oregonensis*		√	√	√
Peamouth chub	*Mylocheilus caurinus*		√	√	√
Pink salmon	*Oncorhynchus gorbuscha*	√	√	√	
Pacific lamprey	*Lampetra tridentata*	√	√	√	
Pygmy whitefish	*Prosopium coulterii*		√	√	√
Rainbow trout	*Oncorhynchus mykiss*	√	√	√	√
Northern redbelly dace	*Phoxinus eos*		√		
River lamprey	*Lampetra ayresi*		√		
Redside shiner	*Richardsonius balteatus*		√	√	√
Unknown stickleback	*Gasterosteus sp.*	√			
American shad	*Alosa sapidissima*		√		
Sockeye salmon	*Oncorhynchus nerka*	√	√	√	√
Steelhead (summer-run)	*Oncorhynchus mykiss*		√		
Steelhead	*Oncorhynchus mykiss*	√	√		
Unknown sucker	*Catostomus sp.*		√	√	√
Unknown trout	*		√		

Species	Latin Name	Kitimat	Skeena	Fraser	Peace
Threespine stickleback	*Gasterosteus aculeatus*	√	√		
Unknown species	*		√		
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*			√	
Unknown whitefish	*		√	√	√
White sturgeon	*Acipenser transmontanus*		√	√	
Steelhead (winter-run)	*Oncorhynchus mykiss*		√		
White sucker	*Catostomus commersonii*		√	√	√

3.0 METHODS

3.1 Preliminary Field Work

In late-September 2005, AAR began to complete a literature review, collect relevant fish population and riverine habitat information and obtained all necessary research and fish collection permits for fieldwork carried out in fall 2005. All field investigations in 2005 were undertaken in accordance with the terms and conditions of BC MOE Permit No. SM/PG05-17612 and DFO Licence Number 05.935. For summer and fall work carried out in 2006 an additional BC MOE fish collection permit (SM/PG06-23271) and DFO Licence (XHAB 178 2006, 147 2006, 148 2006 and 149 2006). Supplemental field work carried out in spring 2007 was carried out under BC MOE fish collection permit SM/PG07-34075 and DFO licences XHAB 116 2007, 118 2007, 124 2007, 125 2007, and 126 2007.

Before beginning fieldwork in 2005, watercourses were identified on 1:20,000 Terrain Resource Inventory Mapping (TRIM) [100] and on 1:12,000 [153] and 1:10,000 [154] PNG photo mosaic alignment sheets of the exiting ROW. Following revisions to the pipeline route, additional field maps were produced for the 2006 field programme using TRIM data existing [100].

3.2 Aquatic Resource Inventories

To determine the relative importance of channels within the zone of influence (ZOI) of pipeline crossings planned with respect to fish populations and their habitat, all watercourses identified by mapping were assigned unique identifiers. This zone represents the area of the water body where the majority of the sediment discharged as a result of the works would be deposited. Each of the crossings identified were visited to provide insight into the distribution, species composition and relative abundance of fishes and the nature of habitat present. To this end, all crossings of smaller watercourses along or close to the existing PNG ROW from KP 301.0 to KP 462.2 were visited first, in fall 2005.

During the winter of 2005-2006 mapped crossings between KP 147.8 and KP 462.2 were visited and habitat investigated under winter conditions. In the summer of 2006 fish population and aquatic habitat inventories were carried out at crossings along the entire route proposed; for crossings between KP 301.0 and the terminus in Summit Lake (KP 462.2) inventories were only carried out at sites deemed in fall 2005 surveys to require a second season of sampling to confirm their non-fish-bearing status, or at new sites created as a result of minor route changes. Investigation of larger watercourses requiring a boat and other specialized equipment. These were completed at low flow in late summer 2006.

In the winter of 2006-2007 several minor changes to the pipeline alignment proposed were adopted. As a result, several new watercourse crossings required assessment. The assessment of fish populations and aquatic habitat inventories at these new sites was carried out in spring 2007.

Provincial standards were followed to satisfy research permit requirements and facilitate fish collection permit return requirements (Fisheries Data Information System (FDIS)). The UTM coordinates of all sites were recorded using a portable global positioning system (GPS). This included the pipeline crossing location and the upstream and downstream extent of the channel surveyed. Field crews used provincial standard site cards and fish collection cards to record and organize data. In addition, information about fish habitat potential was also recorded at each site.

3.2.1 2005

Late summer-fall 2005 inventories of fishes and their habitat were carried out from August 20 to November 16. Up to six field crews, each consisting of a fish biologist and technician, traversed the route proposed on foot, with trucks and/or, all terrain vehicles. Field representatives from the Stellat'en (in conjunction with Carrier Sekani Tribal Council), Moricetown, Wet'suwet'en and Kitselas First Nation Band's assisted with the collection of data and other information along the route proposed within their respective Band's traditional area.

3.2.2 2006

Over a two week period in March 2006 (15-28th), three crews consisting of a fish biologist and technician carried out investigations of selected sites under winter conditions between KP 147.8 and KP 462.2. Access to all sites was made using a combination of snow shoe, trucks and snow-mobiles. A field assistant from both the Stellat'en and Wet'suwet'en First Nation Band's accompanied two of the three crews on the winter assessments.

Between July 22 and September 12, five crews, each consisting of a fish biologist and technician, completed inventories of fishes and their habitat along the entire route proposed, dispersed evenly between Kitimat and Summit Lake. Each crew traversed the route proposed on foot, by trucks and/or all terrain vehicles. Only First Nation representatives from the Kitselas Band were available to work with crews in the Kitimat area. Access to sites between KP 74.5-83.0 and KP 88.0-104.0 was by helicopter. Where the gradient of these watercourses was >30% (calculated by averaging topographic map contour intervals over 300 m), only an aerial assessment (photograph and notes) of the watercourse was made. The watercourse was then defaulted to a non-fish-bearing status (S5 or S6 per RISC Standards). At watercourses with a gradient <30%, a fish biologist and technician were deployed to the ground to carry out a full fish and fish habitat assessment.

Crews (n=2), each consisting of a fish biologist and technician visited miscellaneous sites in the fall of 2006, over a 15 day period from September 21 – October 6. These were sites created by minor route adjustments, or sites where a fall redd survey was recommended by the biologist during the summer visit. During this fall field programme, several crossings could not be visited or were found to be colder than the 4^{o}C minimum required for electrofishing in BC waters. These sites have been defaulted to a fish-bearing status, pending a future site assessment. This is

a conservative approach in the interest of minimizing the overall adverse cumulative effects of the linear development proposed.

3.2.2.1 Major Rivers

The six major rivers (Salmon, Stewart, Endako, Morice, Wedeene and Little Wedeene) along the KSL Pipeline Looping Project route proposed required a boat and additional equipment to carry out detailed inventories of fishes and their habitat. A crew consisting of a senior fish biologist, fish biologist and technician investigated all crossings proposed on these major rivers between September 10-19, 2006.

3.2.3 2007

In spring 2007, between May 22-31st, three crews, each consisting of a fish biologist and technician, carried out investigations along the entire route proposed (KP 0-462.2) at watercourse crossings that had not yet been assessed. These crossings were a result of minor changes to the route alignment proposed and also included several crossings that were not able to be accessed previously. Access to all sites was made using a combination of trucks and/or all terrain vehicles. Ten watercourse crossings were still unable to be accessed and assessed as a result of spring snow conditions.

3.3 Fish and Fish Habitat Assessments

Fish species composition, relative abundance and distribution were documented at fish-bearing streams along the KSL Pipeline Looping Project route proposed. Fieldwork was conducted under scientific collection permits granted by the Victoria regional office of the BCMOE and the Prince Rupert, Pacific Regional Office of DFO. Presence-absence sampling was conducted at locations where fish were likely to be present. Inventory methods were consistent with 1:20,000 RISC standards [138] and augmented for the purpose of qualifying pipeline construction methods. Site cards and fish collection forms were completed as per the field guides provided by the former Resources Inventory Committee of BC [164, 165]. Protocols outlined in the British Columbia Fish-Stream Identification Guidebook [89] and Riparian Management Area Guidebook [88] were also incorporated in the field program design.

All fish captured were identified to species. Electrofishing was the primary method of fish inventory and was only used when water temperature was above the provincial and federal minimum conditions of 4 and 5° C (DFO and BCMOE, respectively). If no fish were captured or observed with one sampling method, a second was undertaken where feasible as per RISC standards (*e.g.*, trapping, snorkelling, or angling). In instances where there was insufficient water for either electrofishing or the use of minnow traps, the watercourse was identified to be fished in an alternate season. Electrofishing was not carried out at sites where spawning salmon

were observed or in the vicinity of redds. All sampling data were recorded on BCENV fish collection forms.

For each crossing, aquatic habitat and fish population inventories were carried out following RISC standards [138]. In all cases, a minimum distance of 100 m (or 10 bankfull widths, which ever was greater) was fished. Where the fish habitat potential was considered moderate – high by the biologist (Qualified Aquatic Environmental Professional (QAEP)), inventories were conducted over a distance of 400 m (100 m upstream and 300 m downstream from the crossing site). Variations in the methods were developed on a stream by stream basis as needed. For example, if less than 300 m existed between a site and its downstream parent stream, the entire channel was sampled and conditions at the confluence of the mainstem river were recorded and photographed. In some cases, distances greater than 300 m were surveyed (*e.g.,* Morice River where ~10 km was investigated) because habitats present were sensitive, or there was appreciable variation in habitat types. In other cases, the inventory effort was reduced to avoid excessive contact with sensitive species (*e.g.,* salmon). Deviations from this standard methodology were noted on the fisheries data summary sheets and Site Cards.

Riverine habitat inventories upstream and downstream of the visited crossings followed RISC standards [138]. Habitat parameters measured by the field crews included channel bankfull and wetted widths across a minimum of six transects, bank height and stability, flood sign and nature, disturbance indicators, channel shape, pattern, morphology and confinement, residual pool depths, instream and overhead cover, riparian vegetation and canopy closure (both as percent of channel). Water quality parameters including conductivity (µS/cm), water temperature (°C), and pH were all measured with MultiLine P4^{TM} computerized water quality multi-meters *in situ*. Where water levels permitted, water velocity was measured with a Swoffer digital current meter and wading rod at vertical stations across a single transect. Discharge was then calculated using the velocity-area method summed across vertical stations [96]. Where water levels were either too low or too high to use a digital current meter, a floating chip method was used [146]. Each site was photographed to provide a visual record as per the RISC Standard.

3.4 Data Interpretation

Data collected during the 2005 and 2006 sampling programme were used to complete a summary crossing table of all crossings (Appendix A). The summary crossing table presents key data components taken from the site cards and fish collection forms. Additional information on fish habitat potential was also incorporated into the summary crossing table.

3.4.1 Stream Classification

All watercourse crossings along the KSL Project route proposed were classified using the provincial stream classification (Table 4) as defined in the Riparian Management Area Guidebook [88].

TABLE 4

BRITISH COLUMBIA STREAM AND WETLAND CLASSIFICATION [88]

Classification	Definition
S1	>20 m channel width, Fish-Bearing
S2	>5 - ≤20 m channel width, Fish-Bearing
S3	1.5 - ≤5 m channel width, Fish-Bearing
S4	<1.5 m channel width, Fish-Bearing
S5	>3 m channel width, Non-Fish-Bearing
S6	≤3 m channel width, Non-Fish-Bearing
W1-W4	Simple wetlands –classification based on area and biogeoclimatic unit
W5	Wetland complex
NCD	Non-Classified Drainage, Non-Fish-Bearing
NVC	No Visible Channel, Non-Fish-Bearing

3.4.2 Fish-Bearing vs. Non-Fish-Bearing Classification

Fish-bearing status of each watercourse was assigned based on existing inventory information or fish presence-absence sampling conducted over one or two seasons. Sites where no fish were sampled or observed in fall 2005, but were considered to have habitat potential to support fishes, were investigated again in the summer of 2006. Sites being investigated for the first time in 2006 where no fish were sampled or observed and having a moderate to high habitat potential have been defaulted to a fish-bearing status. These sites, along with several that were unable to be visited, will be treated as fish-bearing until an assessment in 2007 can confirm their fish-bearing status.

To classify a water body having moderate to high fish habitat potential as "non-fish-bearing" in British Columbia, it is necessary to visit and sample that water body in two different seasons (Figure 2). Classification of each watercourse followed the criteria and protocols presented in the British Columbia Fish-Stream Identification Guidebook [89]. While protocols outlined in this Guidebook [89] allow sites with a gradient >20% to be classified as non-fish-bearing, full assessments were still carried out on some sites with gradients approaching 25-30%. Sites with fish habitat potential at the ROW but gradient barriers above and below were still investigated prior to classifying them as non-fish-bearing, to confirm the absence of extant fish populations within the habitable reach. Criteria for the derivation of non-fish-bearing streams provided by the former BC Ministry of Environment Lands and Parks [31] was also used throughout the inventory programme.

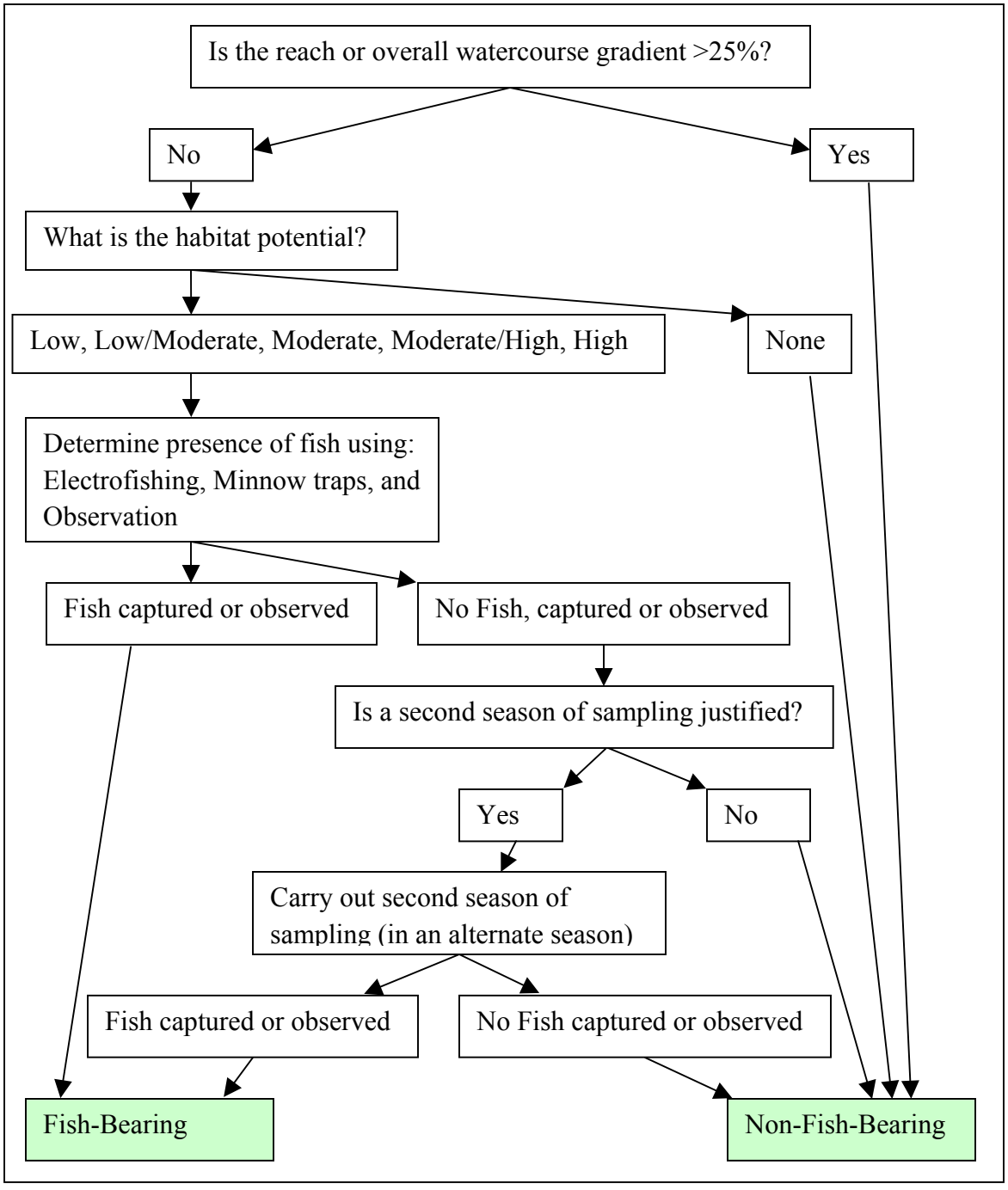

Figure 2 Assessment and Classification of Fish Bearing and Non-Fish-Bearing Watercourses

3.4.3 Fish and Aquatic Habitat Sensitivity Rating

All crossings investigated, with the exception of those with no visible channel (NVC) were given a Sensitivity Rating. Ratings were given as Low, Moderate or High (see Appendix A).

Determining the Sensitivity Rating followed a process that combined:

- Fish presence or absence.
- The diversity of fish species present and their respective life-history stages.
- Average riverine habitat potential to support fishes at the time of sampling.
- Potential for that habitat to support fishes at other times (*e.g.,* winter low-flow).

A sensitivity rating was then assigned based on the species found to be inhabiting the watercourse, the respective life-history stage(s), the habitat potential and an extrapolation of habitat potential and conditions that might exist at different times of the year (Figure 3). Watercourses found to contain species that are endangered, threatened or of special concern [54] would automatically default to a High sensitivity. Where salmon were observed spawning or redds were visible at the ROW or within the reach being investigated, the watercourse was also assigned a High sensitivity. If multiple species or many different life-history stages of a species were present (*e.g.,* young-of-the-year, juveniles and adults) then the value and subsequent sensitivity of watercourse was considered to be High. Non-fish-bearing streams were generally rated as Low.

3.4.4 Derivation of Least Risk Biological Windows

Instream work windows are intended to protect each 'critical life-history stage' (spawning adults, incubating eggs, newly emerged fry) of each species. These windows represent the period when construction activities should occur to avoid or minimize adverse effects on fish and their habitat and should be viewed as times of *reduced* risk to instream biota, and do not necessarily reflect a time of *no* risk. Generalized instream work windows have been identified by both DFO and BCMOE based on average life-history attributes recorded for species over a broad geographic range. Specific instream work windows have also been proposed by BCMOE for certain timber supply areas (TSA's). These designated work windows will be reviewed for the KSL Pipeline Looping Project against defined species-specific least risk periods derived from sampling

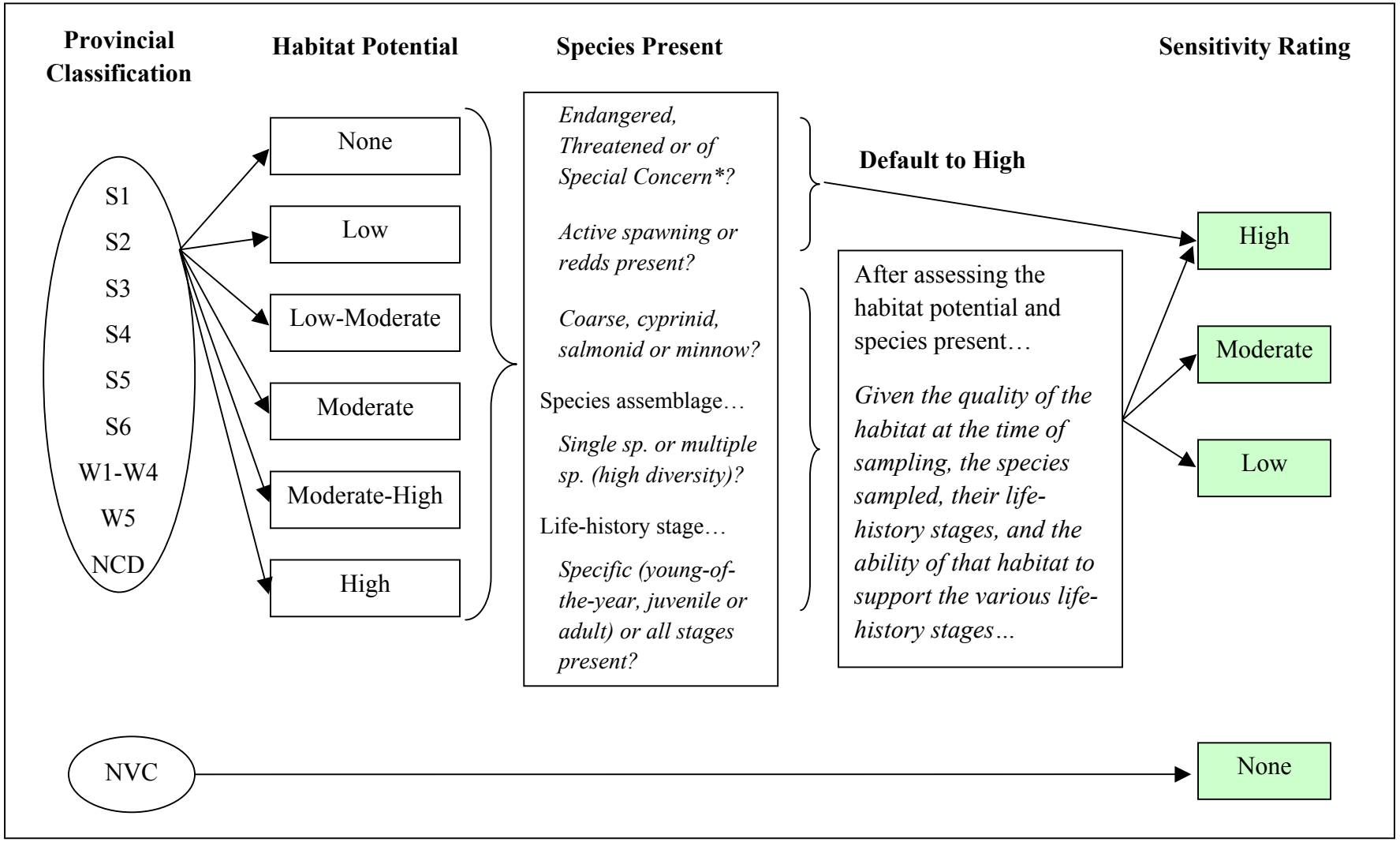

Figure 3 Deriving Fish and Fish Habitat Sensitivity Rating [54]

results and the actual life-history of populations found within each watercourse (Appendix A). Least risk biological windows were proposed for all crossings, based on the species present, the specific life-history stages present, and the habitat available. The process is detailed in a memo prepared for Pacific Trail Pipelines and circulated to the DFO and BCMOE project working group [184]. The following hierarchy or priority within each component was applied at each watercourse.

- **The species sampled at each crossing.** In order of priority…

    1. SARA-listed fauna,
    2. provincially listed or regionally significant fauna,
    3. salmonids, no listed or regionally significant fauna,
    4. non-salmonids only, no listed or regionally significant fauna,
    5. no fish or non-native species.

- **The specific life-history stage(s) of each species known to occur at each crossing** (*i.e.,* young-of-the-year, juveniles, adults, spawning adults). It was acknowledged that…

    1. incubating eggs and fish cannot be salvaged,
    2. rearing fish can be salvaged,
    3. holding up a large number of migrating fish for a long time is unacceptable,
    4. holding up a small number for a short time may be acceptable.

- **The habitat available and its suitability for spawning, rearing, over-wintering, and migration.** Priority was given in the following order

    1. regionally-significant spawning or rearing areas,
    2. spawning areas, particularly large areas,
    3. overwintering or rearing (depending on construction season),
    4. migration.

Where multiple species occur within a watercourse, all life-history windows were overlapped and the period with few or no sensitive life-history stages was defined as the combined "least risk" work window. Non-fish-bearing watercourses were generally allocated an "Open" instream work window, unless the sensitivity of the water body was rated as "High", or where there was a potential to affect fish or their habitat immediately downstream (within the zone-of-influence).

3.4.5 Derivation of Pipeline and Vehicle Crossing Methods Proposed

Pipeline and vehicle crossing methods that protect fishes and their habitat will be proposed for each crossing. These will be presented in documents outside of this technical report.

The crossing methods proposed for both the pipeline and vehicles will consider the sensitivity and habitat potential at each crossing and immediately within the defined zone-of-influence, the species present and their respective life-history stages and the timing (season) proposed for construction. In addition, the vehicle crossing method proposed will also consider the availability of suitable existing crossings.

4.0 RESULTS AND CONCLUSIONS

4.1 Key Findings

A total of 589 potential watercourse crossings were identified along the KSL Pipeline Looping Project route proposed. Upon investigation many of these were classified as having No Visible Channel (NVC) and lacked defined bed or banks. These do not represent fish habitat and are therefore not considered watercourses or rated for fish sensitivity.

When NVCs are excluded a total of 497 watercourses were documented along the proposed KSL Pipeline Looping Project, between KP 0 and KP 462.2. Final classification of 34 of the 497 watercourses is still to be determined. A summary of the key variables and recommendations for each investigated crossing is provided in the KSL Pipeline Looping Project Watercourse Crossing Table (Appendix A).

A total of 32 different fish species were captured along the KSL Pipeline Looping Project route between KP 0 and KP 462.2 (Table 5). This included 10 of the 16 fish species identified as Valued Ecosystem Components (VEC's) in Table 6.2 of the Draft Terms of Reference (155). These are highlighted in Table 6 below.

Dolly Varden were present in 26 of the watercourses sampled and is a "Blue" listed species in BC [143], but is not listed on either the Committee on the Status of Endangered Wildlife in Canada [54] or Environment Canada, Species At Risk [82] status lists. Leopard dace were sampled in both the Salmon and Stuart rivers and is listed as "Yellow" in BC [143] but has been assigned a "Not At Risk" status by COSEWIC [54]. The only other species listed are chinook, coho and sockeye salmon, which all have a "Yellow" status in BC [143]. Sockeye were present in six of the watercourses sampled, while chinook and coho salmon were found in 18 and 31 of the watercourses sampled, respectively. COSEWIC and Environment Canada both list chinook salmon as "Threatened" and coho and sockeye salmon as "Endangered". It should be noted that both the COSEWIC and Environment Canada lists specify geographic populations outside the study area for the KSL Project where this status applied to these salmon. The Nechako River population of white sturgeon is listed by COSEWIC as "Endangered". No crossing of the Nechako River is proposed and no white sturgeon were found within tributaries of the Nechako River, or the Stuart River along the route proposed. It should be noted that no specific sampling of white sturgeon was carried out.

TABLE 5

FISHES CAPTURED OR OBSERVED WITHIN WATERSHEDS AND WATERCOURSES CROSSED BY THE PROJECT ROUTE AND THEIR STATUS AT THE LOCATIONS

Species		Status		
Common Name	**Latin Name**	**BC List[1]**	**COSEWIC[2]**	**SARA[3]**
Burbot	*Lota lota*	(not listed)	(not listed)	(not listed)
Western brook lamprey	*Lampetra richardsoni*	(not listed)	(not listed)	(not listed)
Brassy minnow	*Hybognathus hankinsoni*	(not listed)	(not listed)	(not listed)
Bridgelip sucker	Catostomus columbianus	Yellow	(not listed)	(not listed)
Bull trout	*Salvelinus confluentus*	Blue	(not listed)	(not listed)
Coastrange sculpin	*Cottus aleuticus*	Yellow	(not listed)	(not listed)
Prickly sculpin	*Cottus asper*	Yellow	(not listed)	(not listed)
Unknown sculpin	*Cottus sp*			
Slimy sculpin	*Cottus cognatus*	Yellow	(not listed)	(not listed)
Chinook salmon	*Oncorhynchus tshawytscha*	Yellow	(not listed)	(not listed)
Pacific staghorm sculpin	*Leptocottus armatus*	(not listed)	(not listed)	(not listed)
Chum salmon	*Oncorhynchus keta*	(not listed)	(not listed)	(not listed)
Chisselmouth	Acrocheilus alutaceus	(not listed)	(not listed)	(not listed)
Coho salmon	*Oncorhynchus kisutch*	Yellow	Endangered (Interior Fraser population)	(not listed)
Carp	Cyprinus carpio	(not listed)	(not listed)	(not listed)
Largescale sucker	*Catostomus macrocheilus*	(not listed)	(not listed)	(not listed)
Cutthroat trout	*Oncorhynchus clarki*	(not listed)	(not listed)	(not listed)
Coastal cutthroat trout	*Oncorhynchus clarki clarki*	(not listed)	(not listed)	(not listed)
Dolly Varden	*Salvelinus malma*	Blue	(not listed)	(not listed)
Eastern brook trout	Salvelinus fontinalis	(not listed)	(not listed)	(not listed)
Eulachon, candlefish	*Thaleichthys pacificus*	Blue	(not listed)	(not listed)
Green sturgeon	*Acipenser medirostris*	(not listed)	(not listed)	(not listed)
Kokanee	*Oncorhynchus nerka*	(not listed)	(not listed)	(not listed)

Species		Status		
Common Name	**Latin Name**	**BC List[1]**	**COSEWIC[2]**	**SARA[3]**
Leopard dace	*Rhinichthys falcatus*	Yellow	Not At Risk	(not listed)
Lake chub	*Couesius plumbeus*	(not listed)	(not listed)	(not listed)
Longnose dace	*Rhinichthys cataractae*	(not listed)	(not listed)	(not listed)
Longfin smelt	*Spirinchus thaleichthys*	(not listed)	(not listed)	(not listed)
Longnose sucker	*Catostomus catostomus*	Yellow	(not listed)	(not listed)
Lake trout	*Salvelinus namaycush*	(not listed)	(not listed)	(not listed)
Lake whitefish	*Coregonus clupeaformis*	Yellow	(not listed)	(not listed)
Mountain sucker	Catostomus platyrhynchus	Yellow	Not At Risk	(not listed)
Mountain whitefish	*Prosopium williamsoni*	(not listed)	(not listed)	(not listed)
Northern pikeminnow	*Ptycheilus oregonensis*	(not listed)	(not listed)	(not listed)
Peamouth chub	*Mylocheilus caurinus*	(not listed)	(not listed)	(not listed)
Pink salmon	*Oncorhynchus gorbuscha*	(not listed)	(not listed)	(not listed)
Pacific lamprey	*Lampetra tridentata*	(not listed)	(not listed)	(not listed)
Pygmy whitefish	*Prosopium coulteri*	(not listed)	(not listed)	(not listed)
Rainbow trout	*Oncorhynchus mykiss*	(not listed)	(not listed)	(not listed)
Northern redbelly dace	*Phoxinus eos*	(not listed)	(not listed)	(not listed)
River lamprey	*Lampetra ayresi*	(not listed)	(not listed)	(not listed)
Redside shiner	*Richardsonius balteatus*	(not listed)	(not listed)	(not listed)
Unknown stickleback	*Gasterosteus sp.*	(not listed)	(not listed)	(not listed)
American shad	*Alosa sapidissima*	(not listed)	(not listed)	(not listed)
Sockeye salmon	*Oncorhynchus nerka*	Yellow	(not listed)	(not listed)
Steelhead (summer-run)	*Oncorhynchus mykiss*	(not listed)	(not listed)	(not listed)
Steelhead	*Oncorhynchus mykiss*	(not listed)	(not listed)	(not listed)
Unknown sucker	*Catostomus sp.*			
Unknown trout				
Unknown species				

Species		Status		
Common Name	**Latin Name**	**BC List[1]**	**COSEWIC[2]**	**SARA[3]**
Threespine stickleback	*Gasterosteus aculeatus*	(not listed)	(not listed)	(not listed)
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*	Blue	Special Concern	(not listed)
White sturgeon	*Acipenser transmontanus*	Red (Nechako River Population)	Endangered	Endangered (Nechako River Population)
Steelhead (winter-run)	*Oncorhynchus mykiss*	(not listed)	(not listed)	(not listed)
White sucker	*Catostomus commersoni*	Yellow	(not listed)	(not listed)

This table combines those species previously documented in watersheds and watercourses crossed by the KSL Project route proposed, and those sampled during recent (2005/06) inventories carried out AAR (shaded)

[1] NatureServe [143]

Red: Includes any indigenous species or subspecies that have- or are candidates for- Extirpated, Endangered, or Threatened status in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed. Not all Red-listed taxa will necessarily become formally designated. Placing taxa on these lists flags them as being at risk and requiring investigation.

Blue: Includes any indigenous species or subspecies considered to be of Special Concern (formerly Vulnerable) in British Columbia. Taxa of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed taxa are at risk, but are not Extirpated, Endangered or Threatened.

Yellow: Includes species that are apparently secure and not at risk of extinction. Yellow listed species may have Red- or Blue-listed subspecies.

[2] COSEWIC: Committee on the Status of Endangered Wildlife in Canada [154]

ENDANGERED: A species facing imminent extirpation or extinction.
THREATENED: A species that is likely to become endangered if limiting factors are not reversed.
SPECIAL CONCERN: A species of special concern because of characteristics that make it is particularly sensitive to human activities or natural events.
NAR: NOT AT RISK: A species that has been evaluated and found to be not at risk.

[3] SARA: Environment Canada [82]

Endangered: A wildlife species that is facing imminent extirpation or extinction.
Threatened: A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

The following volumes contain all data recorded from fall 2005 to summer/fall 2006:

- Fish-Bearing Atlas: KSL Project (KP 0 to KP 462);
- Non-Fish-Bearing Atlas: KSL Project -
  - Volume A: KP 0 – KP 70
  - Volume B: KP 70 – KP 120
  - Volume C: KP 120 – KP 230
  - Volume D: KP 230 – KP 340
  - Volume E: KP 340 – KP 462
- Appendix A: KSL Pipeline Looping Project – Summary Watercourse Crossing Table.
- Appendix B: KSL Pipeline Looping Project – Fish and Fish Habitat Map Set

4.2 Route Evaluation

The KSL Pipeline Looping Project route proposed crosses 497 watercourses (10 yet to be visited). Of the 497, 143 crossings have been classified as fish-bearing and 354 classified as non-fish bearing. The total of fish-bearing watercourses includes 34 watercourses that have had their status defaulted to fish-bearing, pending further assessment in 2007. Of the fish-bearing watercourses that have been visited and investigated in the field, 14 are classified as S1, 34 classified as S2, 50 classified as S3 and six classified as S4. Five watercourses classified as wetlands were also found to contain fish (Table 6).

From the total of 497 watercourses, 54 were assigned a “High” sensitivity rating, 42 a “Moderate” rating, 371 assigned a “Low” sensitivity and 92 assigned “None” -or having no sensitivity. The total number of watercourses yet to be assigned a sensitivity rating is 30 (Table 6). Dolly Varden and bull trout were the only provincially “Blue” listed species sampled, with Dolly Varden present in 26 of the watercourses sampled, and bull trout in only three of the watercourses. No SARA, COSEWIC or provincially “Red” listed species were found in any of the watercourses sampled (Table 5). The Interior Fraser population of coho salmon is listed by both COSEWIC and on Environment Canada’s SARA list as “Endangered”, however no coho from this population were sampled within watercourses along the KSL Project route proposed.

TABLE 6

SUMMARY OF FISH AND FISH HABITAT RATINGS ALONG THE KSL PROJECT ROUTE

Factor		Totals	
Number of potential watercourses investigated		**589**	
Number of Fish-Bearing S1 (>20 m) watercourses		14	
Number of Fish-Bearing S2 (>5 – 20 m) watercourses		34	
Number of Fish-Bearing S3 (1.5 – 5 m) watercourses		50	
Number of Fish-Bearing S4 (<1.5 m) watercourses		6	
Number of Non-Fish-Bearing S5 (>3 m) watercourses		35	
Number of Non-Fish-Bearing S6 (<3 m) watercourses		146	
Number of W1 wetlands		9	
Number of W2 wetlands		11	
Number of W3 wetlands		1	
Number of W4 wetlands		2	
Number of W5 wetlands		0	
Number of Non-Classified Drainages (NCDs)		150	
Number of potential watercourses with No-Visible-Channel (NVC)		92	
To-Be-Determined (TBD)	-Requiring a second visit	29	34 crossings defaulted to Fish-Bearing status
	-Have yet to be visited	10	
Total number of watercourses (less NVCs)		***497***	
Number of High sensitivity watercourses		54	
Number of Moderate sensitivity watercourses		42	
Number of Low sensitivity watercourses		371	
Number of watercourses with no sensitivity (None) (i.e., excluding NVC's)		0	
Number of watercourses yet to have their sensitivity assigned		30	
Number of SARA listed fish species found in KSL Project sampling[1]		0	
Number of COSEWIC listed fish species found in KSL Project sampling [2]		0	
Number of provincially Red listed fish species found in KSL Project sampling [3]		0	
Number of provincially Blue listed fish species found in KSL Project sampling [3]		2	

[1] Environment Canada 2006 [82]

[2] Committee on the Status of Endangered Wildlife in Canada 2006 [54]

[3] NatureServe 2006 [43]

4.3 Instream Work Windows

Instream work windows for each watercourse were proposed, based on the least risk biological windows established for each major species within each of the biogeoclimatic regions crossed by the KSL Project pipeline proposed (Appendix A). The least risk biological windows were taken from existing reduced risk instream work windows for the Skeena and Omineca Regions, provided by the former BC Ministry of Water, Land and Air Protection [141, 142].

4.4 Supplementary Studies Required

Further field investigations will be required at 39 watercourses in summer/fall of 2007 and spring of 2008 to confirm their fish-bearing or non-fish-bearing status, classification and sensitivity. Of the 39, 10 have yet to be visited for the first time.

5.0 REFERENCES

5.1 Literature Cited

1. Aitken, D. 1993. Salmon River Biophysical Assessment - Preliminary Results. 63 pp.

2. Aitken, D. 1994. Salmon River Downstream trapping Program catch results 1 May 1994 - 2 June 1994. Prepared for BC Ministry of Environment - Fisheries Section. 60 pp.

3. Aitken, D. 1996. Collecting Permit - Salmon River. 4 pp.

4. Aitken, D. 1997. Salmon River Collecting Permit. 2 pp.

5. Alberta Environment. 2001. Code of Practice for Watercourse Crossings. Queen's Printer for Alberta, Calgary, Alberta. 26 pp.

6. Algard, J. 1976. Memorandum to W. Chudyk re: Morice River Interim Report - July 1976 (46-550).

7. Algard, J. 1977. A Preliminary Survey of Juvenile Steelhead/rainbow trout distribution and rearing Habitat in the Morice River System (46-5500).

8. Andersen, B. 1985. Results of Reconnaissance sampling for Juvenile Salmonids in the upper Fraser River and selected tributaries, August and October, 1984. Can. Data Rep. Fisheries Aquat. 549:27.

9. Anonymous. 1950. International Pacific Salmon Fisheries Commission Study.

10. Anonymous. 1951. A Partial Reconnaissance Survey of Fraser Lake.

11. Anonymous. 1961. Lake Survey Data, 1961, Collins Lake.

12. Anonymous. 1970. Sockeye Salmon Production in Francois Lake and the Nadina River.

13. Anonymous. 1972. Zymoetz River. August 1972.

14. Anonymous. 1975. Stream Survey - Morice River and Tributaries (46-5500).

15. Anonymous. 1976. Stream Survey and Flight Notes - Coldwater Creek (42-1200).

16. Anonymous. 1979. Sockeye Salmon Production in Francois Lake and the Nadina River.

17. Anonymous. 1980. Fish Sampling Information for the Gosnell Creek Watershed.

18. Anonymous. 1980. Stream Survey - Lamprey Creek (46-5500-100).

19. Anonymous. 1980. Stream Survey - Morice River and Tributaries (46-5500).

20. Anonymous. 1986. Salmon Spawning Distribution maps. Prepared from Subdistrict Stream Files - 1986. Department of Fisheries and Oceans, Terrace.

21. B.C. Fish and Wildlife Branch. 1976. An Inventory of the mainstem Salmon River. 73 pp.

22. Balkwill, J.A. 1978. Biophysical Stream Inventory of the Upper Kitimat River. BCF&WB Unpublished Report.

23. Beere, M.C. 1991. Untitled. MOELP letter to Skeena Cellulose Inc.

24. Bell, L.M. 1976. The Kitimat River Estuary Status of Environmental Knowledge to 1976.

25. Berezay, G. 1979. Coho Survey of the Morice System October 17, 1979 to October 23, 1979. D.F.O. Memorandum to R. Kadowaki. FILE # 5903-85-M391.8.

26. Berezay, G.F. 1999. Biophysical Reconnaissance of the Morice River System, 1978-1980. Prepared for Fisheries and Oceans, SEP Operations, New Project Unit. 77 pp.

27. Berry, F.C. 1982. Catalogue of selected Fraser and Thompson River tributaries important to chinook and Coho Salmon and a preliminary Assessment of their Enhancement potential. MS Rep. of Fraser River, Northern B.C. and Yukon Division. 227 pp.

28. Birch, G.J. 1980. Investigation of downstream migrations and rearing distributions in Juvenile Salmonids of the Kitimat River 1980. F.F. Slaney and CO. LTD. Report for DFO Fisheries Operations. 103 pp.

29. Bonner, L. 1975. A Fisheries & Wildlife Survey for the Burnie Lakes Park Proposal. Parks Branch, Department of Recreation & Conservation.

30. British Columbia Conservation Foundation. 1997. Mid-Bulkley overview Fish and Fish Habitat Assessment for Watershed Restoration. 208 pp.

31. British Columbia Ministry of Environment, Lands and Parks. 2001. Guidelines for Non-Fish Bearing Status Report Preparation. Skeena Region, Ministry of Environment Lands and Parks. Revised March, 2001.

32. Brownlee, M.J. 1985. An update on the Fisheries Resources and Habitat issues of the Skeena River Watershed.

33. Burns, J.F. 1974. A Reconnaissance Survey of Lamprey Lake.

34. Bustard, D. and C. Schell. 2002. Conserving Morice Watershed Fish Populations and Their Habitat Stage II Biophysical Profile. David Bustard and Associates LTD. Prepared for Community Futures Development Corporation of Nadina.

35. Bustard, D. 1975. Proposed Smithers Tree Farm License, Preliminary Resource Presentation - Fish and Wildlife values (Zymoetz R 44).

36. Bustard, D. 1977. Miscellaneous Fishery Observations - Morice Watershed.

37. Bustard, D. 1982. Memorandum RE Buck Creek; Fish Sampling (46-5600).

38. Bustard, D. 1988. Francois Lake tributary assessment for rainbow trout. Prepared for B. C. Fish and Wildlife Branch.

39. Bustard, D. 1992. Juvenile steelhead surveys in the Kitwanga, Morice, Sustut and Zymoetz rivers 1991. Prepared for BC Environment, Smithers.

40. Bustard, D. 1993. Juvenile steelhead surveys in the Kitwanga, Morice, Sustut and Zymoetz rivers 1992. Prepared for BC Environment, Smithers.

41. Bustard, D. 1998. Stream Inventory Fenton Creek and adjacent tributaries 1997. Prepared for Forest Renewal B.C. (Houston Forest Products Ltd.).

42. Bustard, D. 1998. Stream Inventory Owen Creek Watershed 1998. Report prepared for Forest Renewal B.C. (Houston Forest Products Ltd.).

43. Bustard, D. 1999. 1998 Stream Inventory Report Gosnell Creek Watershed. Report Prepared for Forest Renewal B.C. (Northwood Inc.).

44. Bustard, D. 1999. Sustut and Bulkley rivers Juvenile Steelhead Surveys 1999. Prepared for Ministry of Environment, Lands and Parks, Smithers.

45. Bustard, D.R. No Date. Fisheries Consultant. Dave Bustard & Associates. Smithers, B.C. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

46. Carswell, R. 1979. An Inventory of Gosnell Creek and Tributaries. F&WB.

47. Carveth, R. 1994. Field Guide to the freshwater Fishes of British Columbia draft for 1994 field testing. Aquatic Inventory Task Force of the Resources Inventory Committee. Victoria B.C.

48. Chudyk, B, R. Tetrault, and G. Shultze. No Date. M.O.E. Fisheries Branch Personnel. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

49. Chudyk, W.E. 1983. Canoona River Steelhead Trout 1983. BC F&W Memorandum.

50. Chudyk, W.E. No Date. An outline of the Steelhead of the Skeena River System (an initial basis for management). F&WB.

51. Community Futures Development Corp. of Nadina. 1999. Upper Bulkley River and Morice River beaver monitoring. 17 pp.

52. Community Futures Development Corp. of Nadina. 1999. Upper Bulkley River fry salvage. 19 pp.

53. Community Futures Development Corp. of Nadina. 2000. Buck Creek Juvenile Salmonid emigration Program: Autumn 2000. 10 pp.

54. COSEWIC (Government of Canada Committee on the Status of Endangered Wildlife in Canada. Available at http://www.cosewic.gc.ca/index.htm. Accessed 2006.

55. Cox. 1974. Lake Survey Data, 1974, Bulkley Lake.

56. D.R. Bustard and Associates. 1989. Francois Lake Creel Survey 1987-1988. Prepared for Ministry of Environment Smithers, BC.

57. D.R. Bustard and Associates. 1991. Fish population Monitoring in Foxy and Buck Creeks, September 1991 on the Skeena River in 1987. Prepared for Equity Silver Mines.

58. D.R. Bustard and Associates. 1991. Lower Skeena River Fisheries Studies: Exchamsiks River to Andesite Creek. Prepared for Ministry of Transportation and Highways.

59. D.R. Bustard and Associates. 1993. Fish Population Monitoring in Foxy and Buck Creeks.

60. D.R. Bustard and Associates. 1994. Fisheries Assessment of Pipeline Crossings in the Kasiks and Khyex Rivers. For Pacific Northern Gas Ltd.

61. Dave Bustard and Associated LTD. 1997. Assessment of Juvenile Coho population levels in selected lakes and Streams within the Skeena River Watershed 1997. Prepared for DFO, Northern Coho Studies Unit, Pacific Biological Station, Nanaimo, B.C. 34 pp.

62. Degisi, J.S. 1995. A Reconnaissance Survey of Anders Lake.

63. Delaney, P.W. 1980. Chinook salmon fry and smolt enumeration/marking project Nechako and Quesnel Horsefly Rivers, B.C. Prepared for DFO by EVS Consultants Ltd. and F.F. Slaney Company Ltd. 126 pp.

64. Delavault, R.E. 1970. Heavy Metal Content of Some Fresh Water Fishes in British Columbia. Fisheries Technical Circular No. 2.

65. Department of Fisheries and Oceans. 1964. Fisheries Problems Associated with the Development of Logging Plans within the Morice River drainage System.

66. Department of Fisheries and Oceans. 1995. FISS Map/Form Information (source not indicated).

67. Department of Fisheries and Oceans. 1995. SISS Map Information (source not indicated).

68. Department of Fisheries and Oceans. 1998. Decision framework for the determination and authorization of harmful alteration, disruption or destruction of fish habitat. Department of Fisheries and Oceans, Habitat Management and Environmental Science, Habitat Management Branch, Ottawa, Ontario.

69. Department of Fisheries and Oceans. 2001. Buck Creek juvenile Salmon trapping Program 2001 Upper Skeena strategic stock Enhancement Program. 39 pp.

70. Department of Fisheries and Oceans. 2001. Moricetown Coho conservation and tagging Program HRSEP 2000/2001 Final Report. 10 pp.

71. Department of Fisheries and Oceans. 2002. Moricetown Coho conservation and tagging Program HRSEP 2001/02 Final Report. 9 pp.

72. Department of Fisheries and Oceans. No Date. Salmon Escapement Data System (SEDS); Pacific Biological Station; Nanaimo.

73. Dolighan, R.B. No Date. DFO Fisheries Personnel. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

74. Donas, B. 2001. Upper Bulkley River and Toboggan Creek Overwintering Study 2000-2001. 91 pp.

75. Eccles, B. 1975. Kitimat River Watershed Stream Survey. BC F&W B Unpublished Report. 73 pp.

76. Eccles, B. 1975. Streams Survey: Kitimat River System in June 1975.

77. Eccles, B. 1976. Preliminary Survey of Juvenile Salmonid rearing Habitat, Kitimat BC. BC F&W B Unpublished Report. 83 pp.

78. Eccles, B. 1976. Preliminary Survey of Steelhead Spawning Habitat, Kitimat River, B.C. BC F&WB Skeena Fisheries Report. 6 pp.

79. EDI Environmental Dynamics Inc. 1997. 1995 and 1996 Fish and Fish Habitat Inventory within the lower Salmon River and Salmon River Watersheds. Prepared for Canadian Forest Products LTD.

80. Envirocon LTD. 1981. Kemano Completion Hydroelectric Development Baseline Environmental Studies Volume 4 Fish Resources: Morice River System. Publication for Alcan.

81. Envirocon Ltd. 1984. Fisheries resources of the Morice River system: Baseline information. Vol. 4. In: Environmental studies associated with the proposed Kemano Completion Hydroelectric development. Aluminum Company of Canada, Vancouver.

82. Environment Canada. 2006. Species at Risk. Available at: http://www.speciesatrisk.gc.ca/ search/default_e.cfm.

83. Estabrooks, R.N. 1979. A Study of Salmon Migration and Spawning in the Nechako River System and the Morice and Nonika Rivers.

84. Fielden R.J. 1995. Endako and Nadina Rivers biophysical and fishery survey, 1994. An unpublished report produced by Aquatic Resources Ltd. for the Carrier Sekanni Tribal Council.

85. Finnegan, B. 1993. Upper Bulkley River & Morice River Juvenile Sampling 1993. Unpublished Data.

86. Fins Consulting LTD. 2000. Operational Stream Inventories for FL A-16825 and A-16823.

87. Fins Consulting LTD. 2000. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Subdrainages in the Bulkley River Watershed Crow Creek (WSC 460-917900) Maxan Creek (WSC 460-924300).

88. Forest Practices Code of British Columbia. 1995. Riparian Management Area Guidebook. FPC Technical Circular. 68 pp.

89. Forest Practices Code of British Columbia. 1998. Fish Stream Identification Guidebook. Second edition, Version 2.1. 70 pp.

90. Freshwater Fisheries Society of BC. 2006. Fish Wizard (www.fishwizard.com) accessed May-June, 2006

91. Girodat, D. 1994. Fisheries Officer. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

92. Giroux, P.A. 2001. Wizard - The Morice River.

93. Golder Associates Ltd. 1998. Reconnaissance level (1:20000) Fish and Fish Habitat Inventory of Slocan Group Plateau (Vanderhoof) Division Operation Area - 1997 - Volume 4, 93K Green.

94. Goodman, J. 1962. Francois Lake Kokanee.

95. Gordon, D. 1999. Reconnaissance (1:20 000) Fish and Fish Habitat Inventory of Clore River Planning unit WSC: 440-2569. Prepared for Skeena Cellulose Inc.

96. Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. Stream Hydrology: An Introduction for Ecologists. John Wiley and Sons Ltd.

97. Government of British Columbia. 1997. Fish Protection Act. SBC 1997. Chapter 21.

98. Government of British Columbia. 2002. British Columbia Environmental Assessment Act. 2002, Chapter 43.

99. Government of British Columbia. 2002. British Columbia Utilities Commission Act. 1996, Chapter 473

100. Government of British Columbia. 2005. Terrain Resource Inventory Mapping (TRIM) Data.

101. Government of Canada. 1985. Canada Water Act. R.S. 1985, Chapter C-11.

102. Government of Canada. 1985. Fisheries Act. R.S. 1985, Chapter F-14.

103. Government of Canada. 1985. Navigable Waters Protection Act. R.S. 1985, Chapter N-22.

104. Government of Canada. 1992. Canadian Environmental Assessment Act. 1992, Chapter 37.

105. Government of Canada. 2002. Species at Risk Act. 2002, Chapter 29.

106. Hancock, M.J., Leaney-East, A.J., Marshall, D.E. 1983. Catalogue of salmon streams and spawning escapements of statistical Area 4 (Upper Skeena River). Canadian Data Report of Fisheries and Aquatic Sciences. No.394.

107. Harding, E.A. 1969. A Reconnaissance Survey of Ormond Lake.

108. Hatlevik, S. 1981. A Fisheries Inventory of the Gosnell Watershed April 1981. Skeena Fisheries Report No. 80-6. Smithers.

109. Hatlevik, S.P. 1985. Memo Regarding Bill Nye Lake Stocking Possibilities.

110. Hawthorn, R.S. 1969. A Reconnaissance Survey of Clauminchil Lake.

111. Hayward Associates Ltd. 1982. Preliminary Environmental and Social Impact Assessment of the Stikine / Iskut Transmission System. Ian Hayward & Associates LTD. Volumes 1 - 4.

112. Helm, R. 1980. A review of the Nechako River Watershed. Department of Fisheries and Oceans. Internal report. 128 pp.

113. Hickey, D.G. 1981. Salmonid Enhancement Baseline Investigations at Stuart River, B.C. in 1980. Part II. Prepared for Department of Fisheries and Oceans by D.B.Lister & Associates Ltd. 70 pp.

114. Hickey, D.G. 1981. Salmonid Enhancement Baseline Investigations at Stuart River, B.C. Part I. Prepared for Department of Fisheries and Oceans by D.B.Lister & Associates Ltd. 65 pp.

115. Hildebrandt, S. 1989. Salmon Escapement and Timing Data for Statistical Area 4 of the North Coast of B.C., 1st edition, 1989. Department of Fisheries and Oceans, Prince Rupert, B.C.

116. Hipp, J. 1987. Fisheries Officer. Department of Fisheries & Oceans - Terrace. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

117. Hooton, R.S. 1992. Untitled. Letter to Mr G. Savard, District Supervisor, DFO, Prince Rupert re: Intended Stocking and Barrier Removal at Jesse Lake.

118. Huber, B.A. 1986. Fisheries Officer, DFO, Prince George. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

119. J.A. Taylor and Associates. 1995. Letter re: Results of Fish Sampling in the Skeena Region. to Ministry of Environment, Smithers.

120. Jaremovic, L. 1988. Review of Chinook Salmon escapements in the Nechako River, B.C. Can. MS. Rep. Fisheries Aquat. Sci. 1963. 135 pp.

121. Jassen, R.G. 1970. Fish Sample of Fraser Lake.

122. Jedrzecyk, M. 1997. Fish and Fish Habitat Inventory for Forest licences A-16823 and A-16825. 4 Volumes, prepared for Babine Forest Products Company.

123. Karanka, E.J. 1990. Fish sampling and Habitat impact Assessment along the route of the Proposed Skeena-Kitimat substation 287KV transmission line twinning. E.J. Karanka and Associates report prepared for Westland Resource Group and B.C. Hydro.

124. Labach, M.G. 1987. A Reconnaissance Survey of Green Timber Lake.

125. Larocque, L.A. 1986. Patrolman for Fort Fraser, Prince George Subdistrict, DFO. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

126. Loggia, A. 1987. Kitimat Sub-District 1987 Annual Sport Fish Report. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

127. Longworth, G.R. 1987. Letter to R. Hooton re: Fish Collection Permits - Owen C (46-5500-050).

128. Manzon, C.I. 1980. Catalogue of Salmon Streams and spawning escapements of Prince George Subdistrict. Fisheries Mar. Serv. Data Report 79. 252 pp.

129. Manzon, C.I. 1981. Catalogue of Salmon Stream and Spawning Escapements of Statistical Area 6 north (Kitimat Arm). DFO C.D.R.F.A.S. No. 300.

130. McDonald, J. 1989. Untitled. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

131. McDonald, J. No Date. Previously DFO Area 6 Personnel, Presently Located at Subdistrict 14-S. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

132. McLean, R. 2003. Guidelines for pipeline applications under the Navigable Waters Protection Act. Letter to Applied Aquatic Research Ltd., Calgary, Alberta from Navigable Waters Protection Program, Sarnia, Ontario.

133. McNeill, D. 1996. Untitled. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

134. McNeill, D. No Date. Manager, Kitimat Hatchery (S.E.P.). Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

135. McPhail, J.D. and R. Carveth. 1993. Field Key to the Freshwater Fishes on British Columbia. Resources Inventory Committee. 234 pp.

136. MELP: Resource Analysis Branch. No Date. Aquatics Biophysical Maps - 1:50000. Maps-BC, Victoria, B.C.

137. Ministry of Environment, Lands and Parks. No Date. Skeena River Lake Management Files. B.C. Ministry of Environment, Smithers, B.C.

138. Ministry of Sustainable Resource Management. 2001. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory Standards and Procedures. Prepared by BC Fisheries Information Services Branch.

139. Ministry of Sustainable Resource Management. No Date. Release Database.

140. Ministry of Sustainable Resource Management. No Date. STEELHEAD Database.

141. Ministry of Water, Land and Air Protection (MWLAP). 2004. Reduced Risk Timing Windows and Measurements for the Conservation of Fish and Fish Habitat for the Omineca Region, Effective May 3, 2004. Environmental Stewardship Division. 13 pp

142. Ministry of Water, Land and Air Protection (MWLAP). 2005. Reduced Risk In-stream Work Windows and Measures: Skeen Region. May, 2005. 17 pp

143. NatureServe. 2006. Heritage Status: Global, National, and Subnational Conservation Status Ranks. Available at: http://www.natureserve.org/ explorer/ranking.htm.

144. Neill, S. 1990. Summit Lake Pike Investigations, Year 4: 1990.

145. Nelson, J.S. 1977. 1977 Summary Report - Fish Collecting Permit no. 13-13a.

146. Nielson, L.A. and O.L. Johnson. 1983. Fisheries Techniques. American Fisheries Society Publication, Bethesda, Maryland, USA. 468 pp.

147. Northcote, T.G. 1973. Limnology and Fish of the Gitnadoix River-Alastair Lake System in Relation to Ecological Reserve Considerations.

148. O'Neill, M. 1996. 1996 Upper Skeena River Creel Survey. Prepared by the Toboggan Creek Salmon Enhancement Society.

149. O'Neill, M. No Date. Toboggan Creek Hatchery Manager. Personal Communication. Source Fish Wizard, Freshwater Fisheries Society of BC.

150. Osmond-Jones, E. 1979. A Reconnaissance Survey of Summit Lake.

151. Osmond-Jones, E. and L. Bonner. 1975. Reconnaissance Inventory of North Burnie Lake. Technical Report Prepared by the Ministry of Environment, Smithers, BC.

152. Osmond-Jones, E. and L. Bonner. 1975. Reconnaissance Inventory of South Burnie Lake. Technical Report Prepared by the Ministry of Environment, Smithers, BC.

153. Pacific Northern Gas Ltd. 1990. PNG Photo Mosaic Alignment Sheets 1:12,000, M.L. P.R-029 –M.L. P.R. – 200. Survey ranges 1975-1990.

154. Pacific Northern Gas Ltd. 2000. PNG Photo Mosaic Alignment Sheets 1:10,000, ML-PR-000 – 247. PNG Engineering Department, Vancouver, BC.

155. Pacific Trail Pipelines. 2006. Kitimat – Summit Lake Pipeline Looping Project, Draft Terms of Reference. Submitted to BC Environmental Assessment Office, Victoria, BC. Prepared by Pacific Trail Pipelines LP, Vancouver, BC. Version 3, December 2006.

156. Pendray, T. 1988. Summary of Juvenile Coho Sampling on the Upper Bulkley and Morice River Systems. 1987 & 1988. Unpublished Report and Data. Department of Fisheries and Oceans, Prince Rupert, B.C.

157. Pendray, T. No Date. Habitat Inventory Biologist. Department of Fisheries and Oceans, Prince Rupert, B.C. Personal Communication and Miscellaneous Fish Sampling. Source Fish Wizard, Freshwater Fisheries Society of BC.

158. Philip, D.F. 1986. Ormond Lake Stock Assessment.

159. Pinsent, M.E. 1969. A Report Regarding the Suitability of Owen Creek, B.C., As a Potential Site for the Construction of Artificial Spawning Facilities for Steelhead trout.

160. Pinsent, M.E. 1970. A Report on the Steelhead Anglers of Four Skeena Watershed Streams during the fall of 1969.

161. Pinsent, M.E. 1971. Memorandum: Request for Spring Closure on Streams Tributary.

162. Ptolemy, J. 1985. Nechako River Tributary Reconnaissance File. 30 pp.

163. R.L. & L. Environmental Services LTD. 1997. Fraser River White Sturgeon Monitoring Program - Region 7 (Omineca-Peace) 1996 Investigations. 78 pp.

164. Resources Inventory Committee of British Columbia. 1999. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory, Fish Collection Form Field Guide. 30 pp.

165. Resources Inventory Committee of British Columbia. 1999. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory, Site Card Field Guide. 42 pp.

166. Rosberg, G. 1973. Fish Collection Data: Francois Lake.

167. Rosenberger, B. 1987. Fisheries Officer, Department Fisheries & Oceans - Prince Rupert. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

168. Saimoto, R. 1993. Survey of Bulkley Lake and its Inlet and Outlet Streams.

169. Saimoto, R. 1994. Data from Coho Counts on the Telkwa R., Zymoetz R., Gosnell Cr., & Toboggan Cr. Prepared for Department of Fisheries and Oceans.

170. Saimoto, R. 1994. Morice River Watershed Assessment 1994. SKR Environmental Consultants Report for MOELP.

171. Saimoto, R. 1997. Letter Including Data re: Coho Helicopter Surveys of the Telkwa River, Gosnell Creek, Owen Creek, Buck Creek, and Bulkley River Upstream of Houston (p.o. #f 1001 7 0372). Prepared for Barry Finnegan, Pacific Biological Station, DFO, Nanaimo, B.C.

172. Saimoto, R. 1999. Upper Bulkley River Overwintering Study 1998-2000 Interim Report. 114 pp.

173. Saimoto, R. 2000. Upper Bulkley River and Toboggan Creek Overwintering Study 1999-2000 Interim Report. 114 pp.

174. Schell, C. 2003. A Brief Overview of Fish, Fisheries and Aquatic Habitat Resources in the Morice TSA. Government of British Columbia. 43 pp.

175. Sekarak, A.G. 1984. Fisheries Investigations in Relation to the Mount Klappan Coal Project Final Report. L.G.L. LTD. Report for Gulf Canada Resources. 66 pp.

176. Seredick, R.W. 1968. Feeding Habits of Some Salmonids in the Upper Morice River.

177. Silvicon Services Inc. 1997. Unpublished notes from several Stream crossing Assessments for cutting permits 539, 572, 573 and 574 within the Gosnell Watershed. Prepared for Northwood Pulp and Timber LTD.

178. SKR Consultants LTD. 1996. Fish-Stream identification: Lakes Forest District Small Business Enterprise Program. Prepared for Small Business Forest Enterprise Program Lakes Forest District Ministry of Forests.

179. SKR Consultants LTD. 1997. Assessment of Overwintering Habitat and Distribution of Coho Salmon in the Mid-Bulkley Watershed (Houston to Bulkley Lake). 57 pp.

180. SKR Consultants LTD. 2000. Buck Creek Juvenile Salmon Trapping Program project number f1528-0-1702.

181. SKR Consulting Ltd. 1995. Untitled. Reference is Lost.

182. Slaney, P.A., M.L. Rosenau, D.H.G. Ableson, and R.L. Morley. 1984. Habitat Capability of Nechako River for Rainbow Trout and Char and the Effects of Various Flow Regimes. Fisheries Technical Circular No. 63. MOE. 34 pp.

183. Smith, G. 1994. Untitled Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

184. Solander Ecological Research. 2006. Memo: Pacific Trail Pipelines – Kitimat - Summit Lake Natural Gas Looping Project; Proposed Rationale for Selection of Instream Work Windows. Distributed to Fisheries and Oceans Canada and BC Ministry of Environment, December 4, 2006.

185. Stanley Consulting Group LTD. 1997. Bulkley River Pipeline Crossing - Fish Habitat Assessment. 15 pp.

186. Stanton, D. 1993. Untitled Personal Communication on file in Smithers MOE office, Source Fish Wizard, Freshwater Fisheries Society of BC.

187. Taylor, G.D. 1961. A Reconnaissance Survey of Collins Lake.

188. Taylor, G.D. 1968. Francois Lake and Associated lake and Stream Fisheries.

189. Taylor, G.D. 1969. The Moricetown Falls Fishery (1967 and 1968). F&WB.

190. Taylor, J.A. 1996. Assessment of Juvenile Coho population levels in selected lakes and Streams within the Skeena River Watershed, British Columbia, between 11 and 31 August, 1995. Prepared for Department of Fisheries and Oceans, Northern Coho studies unit, Pacific Biological Station, Nanaimo, BC. 102 pp.

191. Taylor, J.A. 1997. Synoptic Surveys of Juvenile Coho Populations and Associated Habitat Characteristics in selected lakes and Streams within the Skeena River Watershed, British Columbia, between 10 August and 2 September, 1996. 94 pp.

192. Terrace Salmonid Enhancement Society. 1998. Fish Collection Report for the Zymoetz (copper) Watershed Terrace, British Columbia. 28 pp.

193. Terrace Salmonid Enhancement Society. 2000. 1999 Adult Coho Enumeration Program Terrace Area Watersheds. 56 pp.

194. Terrace Salmonid Enhancement Society. 2000. Zymoetz River year 2000 adult Steelhead helicopter count. 11 pp.

195. Terrace Salmonid Enhancement Society. 2001. 2000 Adult Coho Enumeration Program. 12 pp.

196. Tredger, C.D. 1974. A Reconnaissance Survey of Bulkley Lake.

197. Tredger, C.D. 1981. Assessment of Steelhead Enhancement Opportunities in the Morice River System. Progress in 1980. Fish Habitat Improvement Section, Ministry of Environment, Victoria.

198. Tredger, C.D. 1982. Upper Bulkley River reconnaissance with reference to juvenile steelhead carrying capacity. Fish Habitat Improvement Section, Fish and Wildlife Branch, Ministry of Environment. Victoria, BC.

199. Tredger, C.D. 1983. Assessment of Steelhead Enhancement Opportunities in the Morice River System Progress in 1981 (46-5500).

200. Tredger, C.D. 1983. Upper Bulkley River Steelhead Population Monitoring (46).

201. Tredger, C.D. 1984. Reconnaissance Report: Fish Habitat Improvement.

202. Tredger, C.D. 1986. Bulkley/Morice steelhead stock monitoring report. Fisheries Improvement Unit. Recreational Fisheries Branch, Victoria, B.C.

203. Tredger, C.D. 1986. Stock Monitoring Report.

204. Tredger, C.D. 1988. Summit Lake Pike Investigations, Year 1.

205. Tredger, C.D. 1988. Summit Lake Pike Investigations. Prepared for G.D. Taylor.

206. Triton Environmental Consultants LTD. 1994. South Zone Fisheries Stream Classification. 64 pp.

207. Triton Environmental Consultants LTD. 1997. Fisheries Assessment - Skeena River Side Channels, Middle and Dasque Creek Crossings and Fisheries Assessment - Gitnadoix River and Skeena Side Channels; Fisheries Habitat Assessment - Gitnadoix River - Proposed Pipeline Bridge site. 34 pp.

208. Triton Environmental Consultants LTD. 1997. Habitat Assessment, Mitigation Planning: CN Rail Trestle Reconstruction. 25 pp.

209. Triton Environmental Consultants LTD. 1997. Skeena Eulachon Study 1997. 22 pp.

210. Triton Environmental Consultants LTD. 1998. Reconnaissance (1:20,000) Fish and Fish Habitat Stream Inventory in the Davies Creek Inventory.

211. Triton Environmental Consultants LTD. 1998. Reconnaissance (1:20,000) Fish and Fish Habitat Stream Inventory in the Horetzky Creek Watershed.

212. Triton Environmental Consultants LTD. 1998. Reconnaissance (1:20,000) Fish and Fish Habitat Stream Inventory Kispiox Forest District. Prepared for Skeena Cellulose Inc.

213. Tuominen, T. 1990. Untitled.

214. Turnbull, T. 1987. Fisheries Officer, Department Fisheries & Oceans - Smithers. Personal Communication, Source Fish Wizard, Freshwater Fisheries Society of BC.

215. Unknown. 1996. Untitled, Originally for SISS Catalogue, Source Fish Wizard, Freshwater Fisheries Society of BC.

216. Unknown. 1996. Untitled, Recorded by Envirowest Consultants LTD, Reference Lost, Source Fish Wizard, Freshwater Fisheries Society of BC.

217. Webber, T.N. 1981. A Reconnaissance Survey of Tchesinkut Lake.

218. Westcott, R.G. 1988. A Reconnaissance Survey of Echo (Lily) Lake.

219. Westcott, R.G. 1988. Summit Lake Pike Investigations, Year 2.

220. Whately, M.R. 1968. A Reconnaissance Survey of Goosly Lake.

221. Whatley, M.R. 1980. Memorandum RE: phone call from Mrs. Ferris for Buck Creek.

222. Zemlak, R.J. 1995. A Reconnaissance Survey of Shanley Lake.

223. Zemlak, R.J. 1995. A Reconnaissance Survey of Unnamed (Breadalbane) Lake.

APPENDIX A

KSL PROJECT: WATERBODY CROSSING TABLE

(Separate Volume)

APPENDIX B

KSL PROJECT: FISH AND FISH HABITAT MAP SET

(Separate Volume)