Fish Passage Assessment of Kispiox Forestry Road Stream Crossings

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Summary

The purpose of this report is to present background information and survey results for fish passage assessments conducted at Kispiox forestry road stream crossings. In 2006, Gitksan Watershed Authorities was retained by the Pacific Salmon Commission to conduct a Fish Passage and Culvert Inspection (FPCI) throughout the roaded portions of Kispiox Watershed on all non-bridged stream crossings distinguished with fish presence. The Kispiox fish passage assessment is part of a larger regional effort to improve fish passage that is restricted by highways and secondary roads throughout the Skeena Basin.

The primary objective of this project was to focus on increasing the abundance of fish stocks by opening freshwater habitat to salmon spawning and rearing. This project utilized the fish passage culvert inspection procedure that has been developed to evaluate one of the most easily addressed fish habitat constraints: access to existing habitat. The fish passage culvert inspection methodology is based on the BC Government fish passage protocol outlined in *Fish Passage – Culvert Inspection Procedures,* Parker, 2000 (FPCI). Essentially, the FPCI fieldwork includes: measuring the stream and culvert characteristics, noting the fish bearing qualities and quantities, evaluating barriers, and taking upstream and downstream photographs from the culvert inlet and outlet. Office calculations are followed by prioritization of assessed culverts.

This fish passage project examined 404 stream crossings, 287 were determined to be fish bearing stream crossings. These crossings are comprised of 171 distinct stream reaches. Partial barriers are reported at 30 stream crossings with no apparent all-season full barriers. 117 crossings were determined to have no fish presence due to limiting stream gradient or unsuitable habitat. Deactivation is recommended with 28 stream crossings. 96 sites require maintenance due to a variety of issues. Beaver activity was observed at 35 crossing sites; this activity frequently contributes to the need for maintenance.

The 30 partial barriers consist of various types and degrees of barriers, along with variable amounts of fish abundance and differing upstream fish habitat values. Of these 30 streams, 4 are rated as high priority restoration sites. These sites include culverts passing Clifford, Skunsnat, and Murder creeks, which have extreme velocities and varying degrees of outfall barriers. These crossings have been problematic since their installations in the early 1960s and are long overdue for fish passage mitigation with low-cost, simple, long-lasting solutions.

Table of Contents

Acknowledgements

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Introduction

The purpose of this report is to present background information and survey results for the assessment of fish passage at Kispiox forest road stream crossings. In 2006, Gitksan Watershed Authorities (GWA) was retained by the Pacific Salmon Commission to conduct a Fish Passage and Culvert Inspection (FPCI) on all non-bridged crossings of fish bearing streams in the Kispiox Watershed. The Kispiox Watershed fish passage assessment is part of a larger regional effort to improve fish passage limited by highways and secondary roads throughout high and very high value fish habitat in the Skeena Basin.

The connectivity of diverse fish habitats for various fish life stages is fundamental to supporting fish abundance in Kispiox Watershed's freshwater habitats. Tributary streams, lakes, off-channels, back channels, ponds, and sloughs all provide critical habitat. Ensuring that these components remain connected for the free migration of spawning adults and rearing juvenile fish is a critical component in maintaining healthy populations.

The maintenance of healthy fish populations requires that streams crossed by roads and non-open bottom structures such as culverts permit the free migration of spawning adult fish and rearing juveniles to upstream habitat. The purpose of this project is to serve as an initial program phase to restore fish passage to diverse fish habitats disconnected in the past by culverts, which were installed primarily to facilitate forest development.

Many kilometres of critical habitat that used to support salmonids are inaccessible due to improperly designed and installed fish passage structures along these forestry roads. Streams crossed with culverts at or downstream of viable fish habitat were assessed to determine the degree of obstruction posed, which led to the restoration feasibility, extent of restoration, and applicable priority. Restoring access to additional upstream habitat through culvert rehabilitation is one of the most timely and cost effective activities to benefit fish abundance and habitat productivity.

Deliverables from this project include this narrative report, an updated database of all fish bearing streams crossed by culverts and bridges in Kispiox Watershed, and 1:50,000 TRIM based maps showing the roads, streams, known fish presence, topography, and culvert locations.

OBJECTIVES

The primary goal of this project is to focus on increasing the abundance of fish stocks in a coordinated and planned manner by reopening freshwater habitat to salmon spawning and rearing for the benefit of fish habitat and water quality. Objectives include:

- Conducting stream crossing assessments and prioritizing obstructions;
- Developing conceptual restoration prescriptions for prioritized obstructed stream crossings;
- Increasing the abundance of fish stocks, particularly coho, chinook, and steelhead, by restoring access to important fish habitat that is now disconnected;
- Developing partnerships that further habitat stewardship among DFO, BC Ministry of Environment (MoE), and Gitksan Watershed Authorities.

FISH PASSAGE

The movement of fish through culverts can be restricted by many factors including culvert length and gradient, stream levels and velocities, and inlet and outlet configurations. Improper culvert design and installation can block fish passage to spawning and rearing areas such as small streams, lakes, and wetlands. In some cases, depending on culvert location, large portions of sub-basins may be inaccessible due to full or partial obstruction at crossings.

When adult salmon enter freshwater, the maturing fish stop feeding and rely on energy reserves stored in body fat and protein to carry them through migration and spawning. The rate of sexual maturity is established by heredity and most often cannot adjust to delay (Powers and Orsborn 1985). Barriers that cause excessive delay and/or abnormal energy expenditures can result in pre-spawning mortality either during migration or in spawning areas.

The direction and length of migration vary with the fish species and life stage; consequently, the necessary timing, frequency, and duration for unimpeded access to required habitats also vary. On a finer scale, juvenile salmonids and resident freshwater species need to freely disperse to find optimal rearing conditions that ensure their survival, such as habitat with reduced competition, high quality and low velocity refuge habitat, and fewer predators.

Restoring fish passage increases the amount of available habitat within a stream system. If habitat abundance is the limiting factor, increased access to additional habitat will likely result in a rise in fish populations. However, the population response to habitat gain is also frequently dependent on numerous other factors, which may include the quality and quantity of new habitat, the nature and abundance of predators, and the presence of competitors.

When impassable culverts are replaced, restoring fish passage may change the transport of sediments, woody debris, and other materials to downstream reaches. This could change the slope or elevations of upstream or downstream channel reaches, as elevation differences are reconciled. These changes, which can lead to both positive and negative effects, can affect the aquatic environment by altering habitat preferences and characteristics affecting fish use and behavior. Consideration of potential changes, especially by flood stage stream flows and sediment transport events, is necessary in the Kispiox Watershed due to the topographical and climatic conditions.

Figure 2. View upstream of Site No. 145 culvert outlet. This outfall drop is a barrier to most fish.

Beaver activity in the lower elevation portions of Kispiox Watershed is extensive and has not been well-studied. It is important to note the relatively significant amount of beaver activity that controls anadromous fish spawning and rearing. Riley and Lemieux (1998) examined the lower 2 km of three relatively small tributaries: Cullon, Clifford, and Murder creeks. Their findings indicated that beaver impoundments made up between 5.5 and 15.1% of the channel lengths and resulted in 8 to 54% increases in wetted areas.

Riley and Lemieux (1998) found that the large ponded areas created by beaver generally supported high (up to 1.35 fish/m^2) densities of juvenile salmonids, particularly for coho, and to a lesser extent, steelhead. Beaver impoundments were especially important in providing suitable coho winter habitat, which is relatively uncommon in those small creeks. Beaver ponds established low water velocity, sufficient depth, and complex habitat that promoted healthy and productive populations.

Findings from this stream crossing assessment indicated that road grades provide excellent dam bases; however, frequently culvert inlets were plugged to create ponds. Rainstorm events on May 23 and June 2, 2007 contributed 32.5 and 32.4 mm respectively that caused some beaver dams to fail with subsequent flood waves and peak flows. Observations following those beaver dam outbursts showed that flood waves were mostly attenuated by downstream beaver pond or wetland complexes.

The of benefits beaver activity include creating large amounts of high quality juvenile rearing habitat, particularly for coho. Negative effects are primarily due to dam failures, which potentially can cause dramatic channel changes, bank erosion, and scour.

Figure 3. Typical ponded area following beaver dam failure. Site 132 located on a tributary to Ironside Creek.

Methods

Pre-field Planning

In order to generate a list of stream crossings to assess in the field portion of the project, an office-based overview was compiled and reviewed to identify all non-bridged stream crossings. Data used included forest road inventory data, GIS analysis of Terrain Resource Inventory Maps (TRIM), and a compilation of the existing fisheries information using the Fish Information Summary System (FISS), GWA fish presence and habitat databases, and reconnaissance level 1:20,000 fish and fish habitat inventory mapping (Williams 2000, Silvicon 2003). Traditional fisheries knowledge and anecdotal material regarding important fish streams in the Kispiox Watershed were also rolled into the review. Other general fisheries information is listed the References. A GIS-based 1:20,000 map series was created for the field work and included the following sheets: 93M 031, 032, 041, 042, 051, 052, 061, 071, and 103P 050, 060, 069, 070, 078, 079, 080.

Fieldwork

The fish passage culvert inspection methodology is based on the BC Government fish passage protocol outlined in Fish Passage–Culvert Inspection Procedures, (FPCI) (Parker 2000). Essentially, the FPCI fieldwork data collection includes: administrative categories such as stream name, location coordinates, and watershed code; measuring stream and culvert characteristics; noting the fish bearing qualities and quantities; evaluating barriers, and photographs taken upstream and downstream from the culvert inlet and outlet. Stream measurements were taken at distances of 25 m and 50 m so as to avoid the influence of the culvert and road right-of-way on stream characteristics. Fieldwork was conducted from late May to late July.

The objectives of this assessment were to:

- Identify all culvert and bridge crossing sites;
- Identify that the channel upstream and downstream are viable fish habitat and determine the quality and quantity of that habitat;
- Identify to what degree the culvert blocks or impedes fish passage;

The following field gear was used to collect stream and culvert characteristic data:

- Culvert length was measured with a Bushnell Yardage Pro laser range finder.
- Culvert and stream widths and depths were measured with a meter stick or tape.
- Stream velocities were measured with a Swoffer 2100 Current Meter.
- Stream and culvert gradients were measured with a Suunto clinometer.
- Location coordinates were recorded with a Garmin eTrex Summit.
- Photographs were taken with Olympus Stylus 730 and a HP Photosmart R707, 5.1 MP digital camera.
- Stream lengths were measured with a hip chain.

Post-Field

Following completion of the fieldwork, calculations were prepared for each barrier culvert site evaluating the type and degree of obstruction, stream length upstream of the barrier as well as overall length, and the Q100. These calculations were then scored using the criteria in the FPCI (Parker 2000) followed by the prioritization of assessed culverts. Three primary report sections

were prepared to describe all stream crossings in text format, in a database, and on 1:50,000 scale maps.

Fish bearing streams receiving the fish passage culvert inspection were prioritized using the FPCI scoring matrix. The matrix considers fish species present, fish habitat values, barrier type, length of habitat upstream, proportion of stream habitat barred, and the presence of further upstream barriers. In short, prioritization is based on maximizing fish access to habitat segregated by a barrier culvert. The priorities do not take into account sediment movement or maintenance issues. The FPCI scoring matrix can be used to prioritize and to base restoration or rehabilitation efforts on funding availability or other considerations.

Fish species		Habitat value		Barrier		Length of new habitat		Stream barred %		Limiting to upstream barrier	
Multiple or significant	10	H	10	Full	10	≥1 km	10	>70%	10	Yes	5
Single	6	M	6	Partial	6	<1 km	6	51–70%	6	No	0
Other	3	L	3	Underter	3	<500 m	3	<50%	3		

Table 1. FPCI scoring matrix.

Fish species are classed as single, multiple, or significant, to note the degree of restorative benefits. Information in regard to fisheries values was generated through professional judgement by subjective analysis that included:

- Fish populations known to be conservation risks and their habitats and concerns;
- Fish species of Provincial significance, including species that have been identified provincially as being particularly sensitive to forest harvesting activities (Haas 1998). In this fish passage assessment, these species are bull trout (BT), Dolly Varden (DV), and/or cutthroat trout (CT);
- Fish populations and habitat identified by First Nations as being traditionally or contemporarily important.

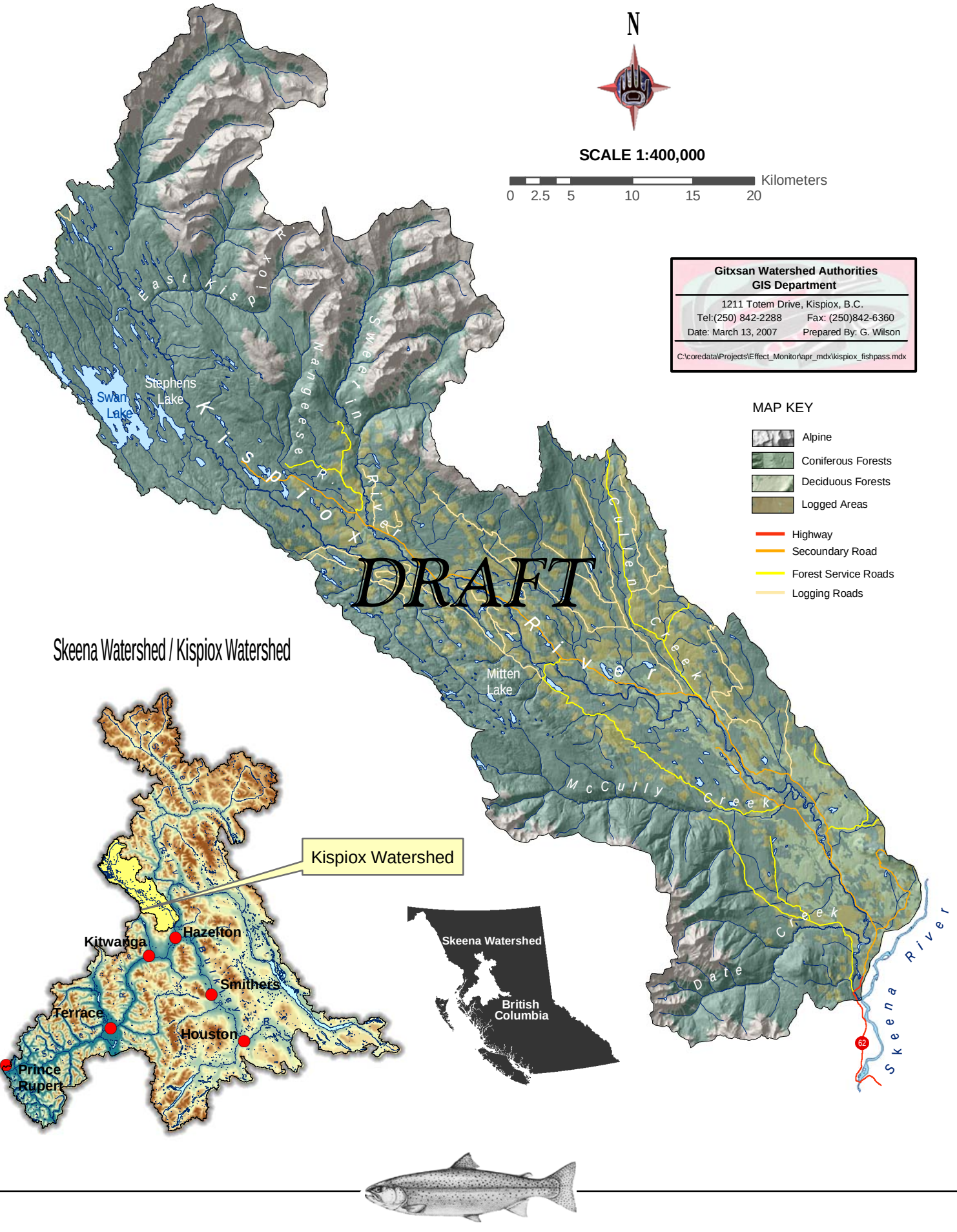
Habitat value is a subjective rating based on the known value of the stream habitat to be gained and is based on complexity, productivity, and limiting habitats. Different values for different habitat types are based on species preference and known distributions. The barrier factor is used to give higher priority for sites with more severe obstructions to fish. Barriers are based on outfall drop, culvert water velocity, culvert gradient, and culvert length.

Length of new habitat is the length of potentially restored stream, measured on the 1:20,000 scale map, to the next known barrier, using gradient classes to differentiate the fisheries values of different habitat types. Stream barred percent is the length of new habitat divided by the total fish bearing stream length. Limiting to upstream barrier is scored if there is another culvert upstream of the site that has been assessed as a full, partial, or undetermined barrier (Parker 2000).

The relative numerical scores associated with each category are then summed. The ranking of high, moderate, or low is given based on the scoring classes listed below.

- High ranking score 39–55
- Moderate ranking score 26–38
- Low ranking score 15–25

Assessment of Fish Passage at Kispiox Forest Road Stream Crossings



Kispiox Watershed Overview

ENVIRONMENTAL SETTING

Location

The Kispiox River is a large tributary of the Skeena River. It flows 140 km southeast from its headwaters to the confluence with the Skeena River (right bank) at Kispiox Village, approximately 12 km north of Hazelton. The watershed is bounded in the north and the east by the Southern Skeena Mountains, to the south predominantly by the Kispiox Range, and to the west by the low relief Nass Basin.

Hydrology

The Kispiox is a fifth order stream with a catchment area of 2,088 km^2. Elevation ranges from approximately 200 m at the mouth to 2090 m on Kispiox Mountain and 1850 m in the Skeena Mountains. This major tributary contributes about 9% of the Skeena River flows (Remington 1996). Kispiox River peak discharges occur typically in May and June due to spring snowmelt, then decrease through July and August. In September, fall rains and runoff from early snow melt increases stream flows once again through to October. Stream flows decrease through November and December when precipitation falls as snow, with low discharges recorded January through March. The Hydrometric Station (08EB004), located downstream from the McCully Creek confluence, recorded a monthly mean discharge of 128 m^3/s for June, while low flows in February averaged 7.8 m^3/s over a 42 year observation period (1963–2005). Summer low flows are typically four to eight times greater than winter stream flows and are principally sustained by high elevation snowmelt draining from the Skeena Mountains, while winter low flows are derived from groundwater, lakes, and unfrozen wetlands (Wilford 1985).

Climatic information from the Murder Creek weather station (AES 1993), located in the lower Kispiox, shows mean annual precipitation of 631 mm over a twenty-year period, of which rainfall accounts for 71% (Environment Canada 2005). Total annual precipitation (TAP) is much greater in the upper watershed, particularly at higher elevations; Stockner and Shortreed (1979) reported 1500 mm TAP at Swan Lake. The Skeena Mountains to the north, and the Nass Basin, which broaches the northwest and western perimeter of the watershed, exert the major hydrological influences. The low elevation watershed divide to the Nass drainage in the west allows coastal weather systems to enter the watershed, leading to heavy snow packs in the mountains and the upper half of the drainage.

The watershed as a whole has a moderately high response from water input due to the steepness of the upper Kispiox and many major tributaries. In general, the streams flowing from the west into the upper Kispiox River arise from a myriad of lakes and bogs; hence, they are relatively stable in flow, temperature, and water quality characteristics. The Kispiox Range to the southwest is principally drained by Date and McCully Creeks, both of which transport large amounts of bedload and suspended sediment originating from natural sources; both have active alluvial fans at their confluences with the Kispiox River (Weiland 2000a). Tributaries to the upper Kispiox from the northeast, principally the East Kispiox River, Sweetin River, and to a lesser extent the Nangeese River, drain glacial headwaters and transport moderate amounts of sediment from natural sources. The wide variations in water flows in the Kispiox mainstem are primarily attributed to these tributaries. Through the summer season these streams generally have glacially turbid, unstable flows.

Pinsent and Chudyk (1973) noted the variation in water temperature between Stephens Creek at the Kispiox River confluence, at 8.0 °C, and the mainstem at 2.5 °C. The difference is attributed

to Stephens Creek draining Stephens Lake, while high elevation snow and glacial melt are the main contributors to the Kispiox mainstream.

Swan and Stephens Lakes, the two most important high fish value lakes in the watershed, are located close to the Nass drainage divide in the upper watershed. These two clear water lakes have ice cover for up to six months of the year, receive approximately 1500 mm of total annual precipitation, and lie at an elevation of 520 m (Stockner and Shortreed 1979).

Figure 5. View northwest across Swan Lake.

Swan Lake and the adjacent Stephens Lake are the principal sockeye nursery lakes in the Kispiox Watershed.

Stephens Lake is small, relatively shallow with a mean depth of 11m, and located 3 km downstream of Swan Lake. The results of limnological sampling showed a pronounced thermal stratification with a strong thermocline at a depth of 4.8 m and maximum surface temperatures not exceeding 18°C (Stockner and Shortreed 1979). Average euphotic zone depth was 13.1 m. Although there was no data on phosphorous levels and photosynthetic rates, the lake appears to be oligotrophic and is likely nutrient-limited (Shortreed *et al.* 2001). Macrozooplankton biomass is relatively high, as is *Daphnia* abundance (Rankin and Ashton 1980). Simpson *et al.* (1981) reported mean sockeye fry weight of 3.1 g for Stephens Lake, which is moderate to high in relation to other sockeye lakes in the Skeena system.

Swan Lake discharges through Club and Stephens Lakes into the Kispiox River. Swan Lake's physical environment is excellent for juvenile sockeye, with a 15.3 m euphotic zone depth, a stable cool epilimnion, and a large hypolimnion (Shortreed *et al.* 2001). *Daphnia* was abundant relative to other northern lakes (Rankin and Ashton 1980); however, despite a good physical environment, an abundant food supply, and low planktivore densities, Swan Lake fall fry averaged only 1.0 g (Simpson *et al.* 1981).

Given the apparently good rearing conditions, it is unclear why Swan Lake sockeye fry do not exhibit higher growth rates. Shortreed *et al.* (2001) suggested that the productive capacity of most BC sockeye nursery lakes has been, and continues to be, degraded by the harvesting of a substantial proportion of returning adults in various fisheries, thus preventing them from contributing their marine-derived nutrients to natal streams and lakes. It is possible that the majority of sockeye fry in the Swan–Club–Stephens system rear in Stephens Lake.

Water Quality

In 1982, the MELP Waste Management Branch initiated a five-year water quality monitoring program with a station (Site 0400205) on the Kispiox River close to the Skeena confluence. The

program concluded that Kispiox River is a soft water river, with neutral to slightly alkaline pH and clear, slightly tea-coloured waters for most of the year. This coloration is due to natural organic substances, such as humic acids, contributed by swamps and wetlands in the drainage. Alkalinity and calcium concentrations are in a range that would provide moderate buffering from acidic inputs. Total suspended solid loadings are much higher during freshets than the remainder of the year. Nutrient concentrations are low. Mean total levels of metals are generally very close to MELP criteria for the protection of aquatic life at the hardness levels present (Wilkes and Lloyd 1990).

Community watersheds located on Dale and Quinmas Creeks supply domestic water for Kispiox Village. Licensed water withdrawals within the Kispiox Watershed are mainly from small tributaries presenting minor impacts on instream flows for fisheries. The effects of clearcut logging on increased peak flows in the Kispiox River have been a persistent issue raised by the public. Keeping logging debris out of small creeks, particularly in winter logged areas, was reported to be a major difficulty (Remington 1996). Loedel and Beaudry (1993) noted that their investigation of interception and throughfall water at Date Creek was initiated by concerns from waters licensees, native peoples, and others that clearcutting may increase peak flows, decrease low flows, and/or alter the timing of these flows.

The Kispiox WRP Overview (Jyrkkanen *et al.* 1995) concluded that logging-related erosion, obstructions, sedimentation, gravel aggradation, and altered water yield are the primary sources of impacts to the Kispiox system. Concerns about turbidity and poor water quality from tributaries, as well as the impact on sports fishing were also noted. Nortec (1997) reiterated that water quality was impacted from forest development activities. Weiland (2000b) conducted a reconnaissance sediment source mapping survey, which identified natural sources and activity in the watershed. This study reported that apparently natural sources supply by far the most sediment in the Kispiox River and the mountainous sub-basins, and that currently, sediment transport in the watershed appear to be in an overall steady-state equilibrium.

Geography

Three physiographic units are present in the Kispiox Watershed: the Nass Basin, the Kispiox Range, and the Skeena Mountains to the north and northeast. The Nass Basin is an area of low relief, which generally falls below 700 m and forms the valley floor. The Kispiox Range, which bounds the watershed to the southwest, is largely drained by Date and McCully Creeks. The southern Skeena Mountains form the headwaters of the Kispiox River and its major tributaries, the Sweetin and East Kispiox Rivers.

The broad northwest-southeast trending Kispiox Valley, approximately 100 km long and averaging 20 km wide, resulted from a block fault zone associated with plate tectonics and accreted terranes on the west coast of North America. The down-faulted block fault lines control the break between the valley and the mountains. This form of basin and range topography has resulted in the broad, linear down-faulted Kispiox Valley being separated by the uplifted mountain blocks, which are the southern Skeena Mountains, the Kispiox Range, and the Babine Range that lies east of the Skeena River.

Folded and faulted Bowser Basin marine sediments characterize the underlying bedrock in the Kispiox Watershed; minor amounts of an intrusive granitic stock appear in the Kispiox Range. The ice that covered and flowed down the Kispiox Valley during the last glacial period strongly glaciated the mountain slopes and the basin, leaving a legacy of drumlin fields, hundreds of small lakes, and a generally linear drainage pattern. Thick blankets of glacial till cover the main valley and mountain valleys and extend up the valley sidewalls.

On the lower elevations of the Kispiox Valley south of Swan Road, alluvial terraces of gravel and sand, often separated by moderately steep scarp faces, dominate the surficial materials. This is primarily due to the river downcutting into outwash materials from the end of the Pleistocene glaciation. On the very lowest elevations, within the current Kispiox River floodplain, recent alluvial deposits range from sand and gravels to predominantly silty materials.

The soils of the watershed have been influenced by the sedimentary origins of the parent materials, with relatively fast weathering and a higher natural fertility than comparable till from granitic bedrock (Kerby 1997). The forest cover, climatic factors, topography, drainage, and elevation differentiate the six basic soil types found. Soil series identified in the valley bottom primarily include the Moricetown Series, the Kispiox Series, Barrett Series, and the McCully Series (Farstad and Laird 1954, RDKS 1991). The majority of soils of the higher river terraces north of Elizabeth Lake possess limitations to agriculture.

The coastal/interior transition climate is reflected in the major ecological zones. Vegetation in the wide, gently sloping valley below approximately 750 m is represented by the Interior Cedar Hemlock (ICH) biogeoclimatic zone, dominated by forest stands of hemlock, spruce, subalpine fir, and in the southern half, red cedar. Before industrial logging, the majority of forest stands were mature hemlock and fir. These stands have been replaced with plantations of spruce and pine, while a major portion of the valley bottom has been replaced by deciduous forests. With increasing elevation, the ICH zone passes into a forest dominated by mature and overmature subalpine fir, representing the Engelmann spruce–subalpine fir (ESSF) biogeoclimatic zone (Pojar *et al.* 1988).

Stream Channels

Kispiox River is divided into three distinct reaches from the Skeena River upstream to Sweetin River. These lower three reaches are composed of a mix of pools, riffles and runs, which offer holding, rearing, and spawning habitat. The mainstem channel presents a regular profile with a gradient of 0.3% slope or less (MoE 1979). Bedrock outcrops are infrequent and bank erosion is common. Minor amounts of sediment are received from most tributaries other than Date Creek and McCully Creek, which contribute comparatively large amounts of natural sediment. Low summer flows may compromise off-channel habitat rearing capacity.

Figure 6. Upper Kispiox River.

Reach Four, from Sweetin River upstream to Gitangwalk Canyon is frequently confined by bedrock, which becomes more evident in reach five starting at the bottom end of Gitangwalk

Canyon. Gitangwalk Canyon, defined as Reach Five, is approximately 1 km in length with an average gradient of 0.6%. The lower end of the canyon presents a 200+ m long cascade with two 1-2 meter drops that restrict pink and chum salmon access to the upper reaches of the river. In some years of low water flows, late running sockeye have been unable to ascend these falls and were observed spawning just below.

Adjacent to this section of the river is the ancient village site of Gitangwalk and the river crossing for the grease trail (Rabnett *et al.* 2001). Wadley and Gibson (1998) noted that the DFO carried out blasting in the cascade-falls section to facilitate fish passage. Above Gitangwalk Canyon, the river has gravel banks and a lower gradient. Reach 7 and 8 both have average gradients of 0.4%. Another falls, about three meters in height, is found past the confluence of the East Kispiox River.

Three major assessments of the mainstem and tributary channels were conducted between 1998 and 2001. The Kispiox River channel assessment in 1998 noted that of the ten reaches surveyed, one was considered stable, six reaches were relatively stable, and three reaches indicated light disturbance (Nortec 1998). Floodplain stability mapping of the Kispiox River mainstem and selected tributaries was conducted with sequential air photos for the periods from 1950-1975 (period 1) and from 1975 to 1992 (period 2). Hudson (2001) reported that for 10 of the 11 reaches surveyed, maximum bank retreat numbers were greater during period 1; bank retreat was most dramatic in Reach 1 for both periods and the active channel area and width for most of the reaches expanded from 1975 to 1992.

Hudson's (2002) further analysis of the floodplain stability mapping indicated that channel impacts are greatest in the lower gradient reaches where sediment storage occurs. Direct effects of forestry-related peak flows are obscured by scale effects such as lake and channel storage, and groundwater effects. Channels with high natural levels of overbank flooding, lateral migration, and avulsion (for example, Reach 1 of Sweetin River) can be expected to display the greatest degree of instability.

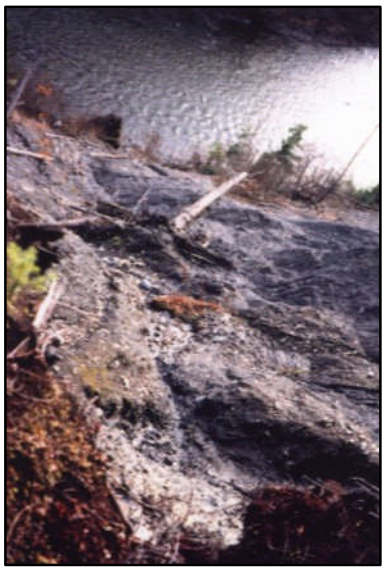


Figure 7. Cutblock slumping into Sweetin River

Weiland (2000b) noted that several tributaries in their lower reaches have very low gradient channels with very low sediment transport capability. Overall, most Kispiox River tributary channels downstream of Hodder Creek have received a degree of impacts ranging from low to high when compared to ambient, natural conditions prior to large-scale industrial logging. Triton (2001) stated that forestry impacts to fish habitat are extensive through the low-gradient reaches

of most tributaries due to obstructions to fish passage, logged riparian zones, surface erosion, reduced instream habitat complexity, sub-surface flows, and degraded habitat quality.

Murder and McCully Creeks have avulsions in their lower reaches due to the combined effects of agricultural clearing of the floodplain and riparian zones, followed by high stream flows, and resultant downstream sediment deposition.

Low-gradient reaches of many tributaries in the watershed contain relatively large numbers of beavers. Nortec (1997) described twelve creeks where channel changes, bank erosion, and decreases in riparian suitability for conifers were due to beavers and their dams. Riley and Lemieux (1998) found that beaver activity on Kispiox River tributaries created large areas of habitat that supported high densities of coho fry. They recommended no removal of beaver dams unless it could be demonstrated that beaver activity had resulted in negative effects on coho populations. They suggested that beaver dam removal contravened the DFO's No Net Loss policy.

Figure 8. Beaver impoundment on Ironside Creek tributary crossed by Bridge Mainline.

FISH VALUES

The Kispiox River Watershed is composed of approximately 100 km of mainstem and 300 km of tributary streams that are considered high value fish habitat, provide a migration corridor, and support spawning and rearing (Nortec 1997). The numerous salmonids utilizing this habitat include: sockeye, coho, pink, chum, chinook, and steelhead salmon; rainbow, lake and cutthroat trout, Dolly Varden, bull trout char, and mountain whitefish. Lamprey and several coarse fish (*Cottidae* and *Cyprinidae*) are also found in the watershed. Gottesfeld *et al.* (2002) rated the Kispiox sub-basin as the most productive in the Skeena Watershed.

Chinook Salmon

Kispiox River chinook salmon are one of the large and important stocks in the Skeena Watershed. Since the 1950s, there was a long-term population decline due in part to the coastal mixed-stock fishery with related incidental interception and to a targeted sports fishery. This has slowly turned around with escapement numbers recovering in the last two decades. Chinook escapement has varied widely in the past, from about 400 in many years of the 1970s and 1980s to 15,000 in 1957 and 1992 (DFO 2005). The ten-year mean escapement for the 1950s was 12,560, for the 1980s 2,801, and for the 1990s 5,493 chinook. Three years of surveys between 2000 and 2005 averaged 6,270 chinook annually, showing overall increased abundance.

Typically, chinook salmon enter the Kispiox system in June and July and disperse to their spawning areas where they spawn from late July through August. The bulk of the spawning is concentrated in the mainstem. Critical chinook spawning areas include: portions of reach three upstream and downstream of Murder Creek; pockets south of Elizabeth Lake; and dispersed areas throughout the mainstem (DFO 1991c, Wadley and Gibson 1998). These are often just downstream of tributary outlets that provide sources of fresh sediment and increased hyporheic or shallow intragravel flow.

A variety of bedrock pools in reach three support holding areas for mature chinook, coho, and steelhead (Wadley and Gibson 1998). Reach four contains moderate to heavy spawning in suitable sections with good holding pools. Reach five is essentially Gitangwalk Canyon with no known reports of chinook spawning. Reach six, located above the canyon upstream to the mouth of Stephens Creek, has excellent spawning beds in the upper section. Dispersed, heavily-used spawning areas exist in reach seven, especially in the upper portion.

Tributaries with noted chinook spawning in their lower reaches include: Date Creek, McQueen Creek, Cullen Creek, Sweetin River, Nangeese River, and Stephens Creek particularly near the mouth, Lower Club Creek, and lower Williams Creek (Smith and Lucop 1966, Hancock *et al.* 1983, DFO 1991c).

Stuart (1981) conducted a biophysical assessment of the Kispiox mainstem and thirteen of the major tributaries, reporting that chinook fry were present only in Date Creek and in the Kispiox mainstem. Recent juvenile trapping efforts by GWA has yielded juvenile chinook in the Nangeese and Kispiox Rivers; other known chinook spawning streams have not been sampled (Wilson 2003).

Pink Salmon

The Kispiox River is one of the major pink salmon producing areas of the Skeena River system. Kispiox River pink salmon are distinguished by their early run timing. Pink escapement fluctuates widely from cycle to cycle. Relative to recent escapements in the Skeena, Kispiox River pink salmon have not experienced a dramatic increase in escapement. The ten-year mean escapement for the period of 1990–1999 shows 33,500 for the even year mean and 56,800 for

the odd year mean (DFO 2005). Odd year returns are often significantly larger and range from 750,000 in 1959 to 35,000 in 1963.

Typically, pink salmon enter the system in mid to late August and disperse to spawn throughout the mainstem and its lower tributaries. Gitangwalk Canyon is a barrier to upstream movement and is consequently the upriver limit of pink salmon spawning. The area of heaviest spawning occurs from Seventeen Mile Bridge upstream to Cullon Creek (Smith and Lucop 1966). Wadley and Gibson (1998) reported moderate mainstem pink spawning in areas of suitable substrate upstream from McQueen Creek; heavy pink spawning from McCully Creek up to Cullon Creek; and dispersed patchy spawning in reach 4. Pink salmon also utilize the lower reaches of the following tributaries: Date Creek, McQueen Creek, McCully Creek, Murder Creek, Cullon Creek, Ironside Creek, Twin Creek, Corral Creek, Skunsnat Creek, Clifford Creek, Sweetin River and the Nangeese River. Upon emerging from the gravel in spring, pink salmon fry migrate immediately to the saltwater.

Chum Salmon

Kispiox River chum are the farthest upstream of any large chum population spawning in the Skeena system, but the escapement has been severely depressed since the late 1950s. The ten year mean escapement for the 1950s decade was 4,083; for the 1960s, 553; for the 1970s, 1,108; the period from 1980–1989 recorded 131 chum, while the ten-year mean escapement for the period from 1990–1999 was 400 spawners (DFO 2005). Since 2000, no chum escapement surveys have been recorded.

Generally chum move into the Kispiox system in August, spawning in selected sections of the mainstem, principally reach one and two. Chum spawners have also been observed scattered along the mainstem close to the mouths of Date Creek, McCully Creek, McQueen Creek, Murder Creek, Elizabeth Creek, Steep Canyon Creek, Sweetin River and Nangeese River, and in the lower reach of Date Creek and Nangeese River. Migration downstream to the saltwater begins immediately following fry emergence in the spring.

Sockeye Salmon

The Kispiox River Watershed is among the eight most important sockeye producing watersheds in the Skeena system. Kispiox River sockeye are a unique population with spawning taking place primarily in streams tributary to the Swan, Club, and Stephens Lakes.

Figure 9 shows the historical escapement estimates for the Swan Lake system. Estimates prior to 1992 were based primarily on Club Creek (upper and lower) counts. In 1992 the GWA included Jackson and Barnes Creeks, and in 2001 the GWA enumerated all known spawner areas in the Swan Lake system including Club Creek. A counting weir was set up in 2001 to obtain accurate escapement for the Swan Lake drainage; 10,109 sockeye were enumerated. Mean annual Kispiox aggregate escapement between 2000 and 2005 was 7,010 sockeye.

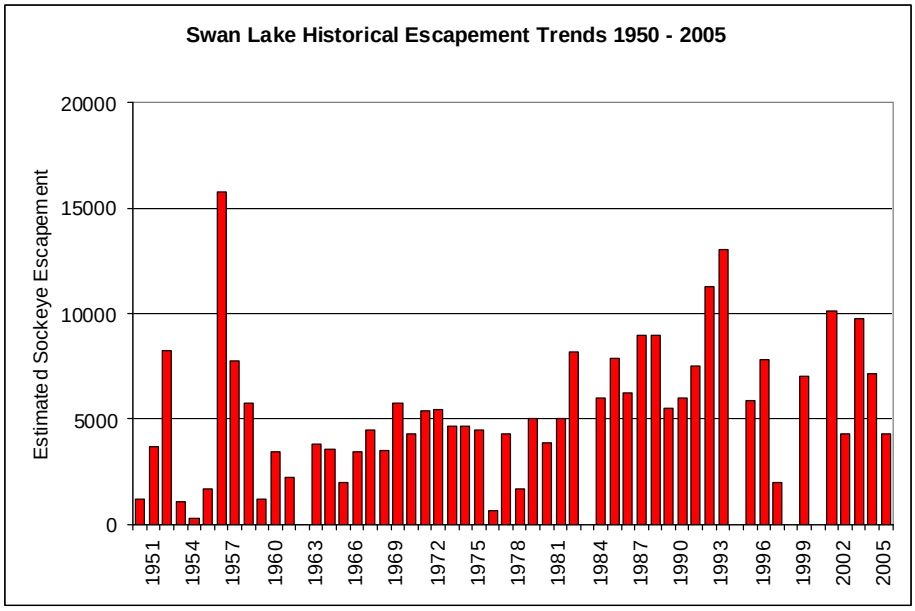


Figure 9. Historical escapement estimates for Swan and Stephens Lake sockeye.

Sockeye adults typically enter Stephens Creek in August and the beginning of September and migrate upstream to spawn in Club Creek and other Swan Lake tributaries (Sterritt and Gottesfeld 2002). A small number of sockeye also spawn in the lower reaches of Stephens Creek. Once through Stephens Creek, the sockeye will hold in either Stephens Lake or Swan Lake until spawning conditions occur.

The major spawning grounds are located on upper and lower Club Creeks (Fisheries Research Board. 1948, Sterritt and Gottesfeld 2002). The spawning habitat in Club Creek is relatively unique in the Skeena system in that the spawning substrate is primarily boulder size. Other spawning areas are found on four creeks tributary to Swan Lake, of which Falls Creek is the most important. Some sockeye spawn in Swan Lake and possibly also Stephens Lake. Following emergence from the spawning beds most juvenile sockeye (>95%, Rutherford *et al.* 1999) spend one year in Swan, Club, or Stephens lakes before migrating to the sea.

Small numbers of sockeye regularly spawn in downstream sections of Ironside, Clifford, and Skunsnat Creeks and in the Nangeese River (GWA, unpublished data). It is presumed that these fish are river-type sockeye. River-type sockeye are rare in the Skeena Watershed, although this life history type is common in Asia and makes up a significant part of the total escapement of sockeye to the Stikine River and to a lesser extent the Nass River.

Figure 10. Sockeye in lower Falls Creek.

Coho Salmon

Coho salmon are widely distributed throughout the Kispiox River system with 28 recorded spawning stream localities. The greatest abundance is within the Kispiox mainstem where escapements as high as 35,000 (1958) have been recorded. Coho escapement within the watershed has decreased by an order of magnitude over the last few decades (Plate *et al.* 1999). Coho synoptic and stock assessment studies were conducted by the Gitxsan Watershed Authority and reported on by Plate *et al.* (1999, GWA (2000), GWA (2001), Wilson and Gottesfeld (2001), and Sterritt (2001). Kispiox Watershed coho escapement declined steadily from the 1950s until the last few years, when widespread fishing restrictions and improved ocean survival led to a marked rebound. There were not any Kispiox coho escapement records between 1994 and 2000. Escapement records show the annual aggregate mean between 2000 and 2005 as 4,320 coho.

Generally, coho return to the Kispiox system throughout September, spawning from late September through December, usually dependent on water flow and levels. Coho spawning grounds are concentrated in the upper half of the mainstem; however, select areas adjacent to creek mouths in the lower portion are also used. The Nangeese River and the Stephens Watershed have large escapements. Approximately twenty other streams support smaller spawning groups.

The majority of tributaries support coho rearing, while mainstem rearing principally occurs in side-channels. Comprehensive mark and recapture sampling, as well as smolt out-migration fence counts conducted by the GWA, have resulted in determining wild smolt and enhanced smolt habitat distribution, density, and migration timing. These studies also identified under-utilized stream sections that are potentially suitable for future coho hatchery releases (Plate *et al.* 1999, GWA 2000, GWA 2001, Sterritt 2001).

Steelhead

The world-renowned Kispiox River steelhead population is distinct from other Skeena River stocks due to the large average size of the returning adults. Though uncertainties exist as to steelhead escapement levels, given the large estimated population size (Tautz *et al.* 1992), as well as the continuing high sports fishery catches, the steelhead population appears to be relatively stable. Ward *et al.* (1993) calculated commercial harvest rates of Kispiox River steelhead for the period of 1986 to 1991, with the mean being 41.2% incidental harvest in the Area 4 commercial fishery.

It was estimated that 4,027, and 2,514 steelhead returned in 1994 and 1995 respectively (Koski *et al.* 1995, Alexander and English 1996).

Steelhead migrating up the Skeena River enter the Kispiox system in late August and September and overwinter in deep pools, mainly in the lower Kispiox River below Cullon Creek, and in the mainstem Skeena below the confluence (Lough 1980, 1983). Steelhead have been observed spawning from mid-May through to mid-June, primarily in mainstem side channels, though Stephens Creek and the Club Creek system are likely the most concentrated spawning grounds (Chudyk 1972b).

In 1979, a radio tagging study showed 80% of the radio tagged steelhead spawned in tributaries including Cullon Creek, Ironside Creek, Skunsnat Creek, and the Nangeese River (Lough 1980). Lough (1983) reported a small concentration of fish spawning in the mainstem between Date and McQueen creeks. As well, two steelhead left the Kispiox and spawned in Skeena River side channels, while one steelhead moved over to the Shegunia River to spawn. Other tributaries known to support steelhead spawners include the lower reaches of Williams Creek and Sweetin River (DFO 1991c, Baxter 1997a).

Kelts leave the river in late May. In a detailed study of Kispiox River steelhead during 1975, Whately (1977) found that 12.1% of steelhead adults were repeat spawners (S1+) and 0.6% second time repeat spawners (S1S1+). Most of the repeat spawners were females, because males experience a higher mortality during spawning.

Steelhead juveniles remain in the Kispiox system for 1+ to 4+ years. Scale sample analysis of upstream migrating adults showed an average age of three years in the river before moving to the ocean (Whately 1977). Fry densities are generally lower in the mainstem than in sampled tributary sites; however, parr densities in both rearing areas are largely similar. Cullen Creek has the highest fry densities by a factor of five, in relation to other monitored or sampled sites (Stuart 1981, Tredger 1983a). Recent mark and recapture sampling conducted by the GWA reported generally lower fry densities that averaged 0.01-0.31/m^2 (Gottesfeld *et al.* 2000). Their results suggest that the Kispiox Watershed as a whole is underutilized. It is likely juvenile recruitment is low due to incidental catch from high exploitation rates in the coastal mixed-stock fisheries.

Indigenous Freshwater Fish

In comparison to salmon, information is sparse on resident, non-anadromous or freshwater fish in both fluvial (or river) and lacustrine (or lake) habitats of the Skeena Watershed; indeed, much of the watershed is poorly known and may contain populations of special interest or status that are presently unknown. Ecological and life history information that permits good conservation planning is simply not available. Of the twenty-one known species of fish in the Kispiox Watershed system, fifteen are freshwater species (McPhail and Carveth 1993).

Known freshwater populations inhabiting the Kispiox Watershed include rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarki clarki*), kokanee (*O. nerka*), bull trout (*Salvelinus confluentus*), lake trout (*S. namaycush*), Dolly Varden char (*S. malma*), mountain whitefish (*Prosopium williamsoni*), lake whitefish (*Coregonus clupeaformis*), Northern pikeminnow (*Ptychocheilus oregonesis*), largescale sucker (*Catostomus macrocheilus*), longnose sucker (*Catostomus catostomus*), river lamprey (*Lampetra ayresi*), longnose dace (*Rhinichthys cataractae*), redside shiner (*Richardsonius balteatus*), and prickly sculpin (*Cottus asper*).

FISHERIES

First Nations Traditional Use

For the Gitxsan, salmon are a very important cultural foundation, icon, and food source. Traditionally, sockeye followed by coho have been the most important species to First Nations groups harvesting Kispiox River fish stocks. Kispiox Village, also called Ans'payaxw, is one of seven main Gitxsan villages spread along the Skeena River and its tributaries. Gitangwalk and Lax Didax, both abandoned in the early 1900s, were villages logistically located to intercept the upstream migration of the sockeye and coho salmon to the Upper Kispiox River spawning areas.

Many seasonal fish camps positioned along the mainstem were used to harvest fish. The "grease trail," which runs from Kispiox Village to the Nass, passed along the eastern side of the Kispiox River and provided access to many of the fish harvesting sites listed below, as well as many other resource gathering localities.

Currently, Kispiox Watershed salmon harvested for personal, societal, and ceremonial use are primarily gillnetted and to a small degree dip-netted. The importance of the fishery, which is a blend of food resource, trade capital, cultural expression, and connection to ancestral practices, cannot be overstated.

Fishing Site Name	Site Location
Anspayaxw	Mouth of Kispiox River
Agwi'tin	Kispiox River R & L banks
Xsi Ankalamsit	Kispiox River R & L banks
Xsa Gailexan	Kispiox River R. bank
Xsa Angexlast	Kispiox River L. bank
Antkilakx	Kispiox River R. Bank
Tsihl 'niit'in	Kispiox River L. Bank
Xsa An Seegit	Kispiox River R. Bank
Wiluuskeexwt	Kispiox River L. Bank
Miinhlgwoogoot	Kispiox River R & L banks
An'Uxwsdigehlxw	Kispiox River L. Bank
Katgaidem	Kispiox River R & L banks
Xsi Luukailgan	Kispiox River L. Bank
Wiluuwak	Kispiox River R. Bank
Nadak	Kispiox River L. Bank
Sgansnat	Kispiox River L. Bank
Luu'Andilgan	Kispiox River L. Bank
Gitangwalk	Stephens Creek
Lax Didax	

Table 2. Traditional fishing sites and fishing villages on the Kispiox River.

Recreational Fisheries

The Kispiox Watershed attracts a large sports fishery that includes local residents and non-residents. Adult steelhead that return to the Kispiox River are among the largest in the world and the river is an international destination for anglers. Generally, angler access to fishing sites is easy.

Figure 11. Anglers at Kispiox-Skeena confluence.

River angling effort is directed primarily to steelhead, coho, and chinook from mid summer to late October. Since 1969, various creel surveys have estimated or determined the angling effort, catch per unit effort (CPUE), gear fished, rate of release, and use of guide services (Pinsent 1970, Remington *et al.* 1974, Whately 1977, Lewynsky and Olmstead 1990, Tallman 1997). There are currently three licensed guides who operate on the river, and an additional guide who is inactive, with a total allocated quota of 393 angler days (Baxter 1997a). Seldom are quotas fully utilized, because water conditions, and thus fishing conditions, can deteriorate rapidly due to seasonal heavy rains in the Kispiox River Watershed. Local anglers fish trout and char in the easily accessible lakes.

The Kispiox River is designated a Class II Water, September 1 to October 31, and a Steelhead Stamp is mandatory. Tallman (1997) reported that in the fall of 1996, according to those anglers interviewed, all steelhead caught were released, 62% of the anglers were of foreign residence, fly fishing was the predominant method used (80%), and compliance with required regulations was fairly high (over 90%). Throughout B.C, steelhead are now catch and release only, with no fishing in any stream from January 1 to June 15 (BC Fisheries). No power boats are allowed and there is no fishing from drift boats or rafts.

Salmon and Habitat Enhancement

In 1977, Fisheries and Oceans Canada announced the Salmon Enhancement Program (SEP) with the primary goal of doubling salmon production. The Kispiox Hatchery was established as one of the five major hatcheries in the Skeena Watershed under the Community Economic Development Program. Under the auspices of SEP, habitat projects conducted throughout the watershed include incubation boxes, bioengineering investigations, biophysical studies, and habitat inventories.

The Kispiox Hatchery was initiated as a pilot project operated by the Kispiox Band in 1977. Water quantity and quality problems were not resolved until 1983, when three wells were developed that supplied stable quality and constant water temperature. The hatchery was designed to

increase the severely depressed Kispiox River chinook and coho stocks (DFO and MoE 1984). The hatchery continued to operate until 1995, when it was closed due to SEP program budget review cuts.

Re-opened in 1997, under the auspices of the GWA and with funding from a variety of sources, the hatchery allows for a flexible fish culture program. The total chinook and coho fry and smolts released by the Kispiox Hatchery between 1984 and 2001 were 893,684 coho and 1,086,252 chinook. These chinook and coho were prioritized to stock rebuilding efforts on the Nangeese River and Clifford and Skunsnat Creeks. Recent hatchery activities have focused on small-scale custom enhancement such as incubating, rearing, and out-planting sockeye fry for stock rebuilding initiatives.

DEVELOPMENT ACTIVITIES

The principal activities are forestry, settlement, and linear development.

Forest Resource Development

The Kispiox River Watershed is located within the Ministry of Forests Skeena Stikine Forest District. With completion of the railroad through the Skeena in 1914, forest development activity began with agricultural clearing by settlers, and by 1920 the pattern of land use and settlement was established. Small-scale lumbering led to small bush mills when the post-WW II demand for lumber skyrocketed. In the early 1950s, Columbia Cellulose was granted TFL # 1, which initiated the centralization of license holding and milling capacity.

In 1958, 23 km of road were present on the Kispiox River, with logging operations concentrating on easily available, high quality timber. In 1959, some 70 km of road bordered the river, while by 1966, approximately 90 km of road accessed the east side of the river (Taylor and Seredick 1968). Over the years up to the present, industrial forest activities have waxed and waned, as the cut was concentrated on other watersheds such as the Kitseguecla and the Suskwa, as the distance to timber off the highway increased, and the quantity and quality of timber decreased.

The 1980s and the early 1990s saw the volume and rate of development expand dramatically, particularly across the northern, low elevation portion of the watershed, from Murder Creek through to the Nangeese River. The early 1980s also saw completion of the Mitten Main connecting the Kispiox Valley to Highway 37; this road facilitated development on the northwestern flank of the river and transport of logs to the saltwater Port of Stewart. The 1990s also saw logging and road development in Date and McCully Creeks.

In the Kispiox Watershed, impacts are complex and result from the interactions of: naturally unstable soils when disturbed, high-energy stream systems, and low-gradient valley-bottom reaches incapable of transporting large amounts of sediment, much of it related to forestry harvesting practices. Completed and potential restoration activities under the auspices of the Watershed Restoration Program include road deactivation to prevent erosion and landslide potential, off-channel habitat restoration, riparian zone restoration to stabilize channels and diverse habitats, and stabilization of highly mobile stream channels and gravel bars often associated with logged alluvial fans. In the Kispiox Watershed, fish access is the major overall impact, due to road crossings that were originally constructed as, or have become, barriers to fish migration.

Specific recommendations were developed based on the review of the Watershed Assessment Procedure results, uncompleted WRP works reported by Triton (2001), and the Kispiox LRMP equivalent clearcut area (ECA) strategy. The ECA strategy stated that no more than 22% of the forested land in a watershed will be in a clearcut hydrological condition (Ministry of Forests 2001b). Specific recommendations arising from the review were directed to the seventeen sub-basins in the watershed. Seven sub-basins including Brown Paint, Clifford, Corral, Cullon, Deep Canyon, Ironside, and Skunsnat had either priority WRP works that were uncompleted, or an ECA at or above 22%; no further conventional harvesting is recommended. A conservative rate of cut is recommended for Date and McCully sub-basins. Nangeese, Hevenor, Lower Kispiox, and the Sweetin sub-basins were recommended for alternative silviculture systems due to high fisheries values, terrain stability issues, riparian concerns, or peak flow risks.

Mineral Resource Development

Exploration and utilization of rocks, crystals and minerals within the watershed have been occurring since Gitxsan people settled into the watershed many thousands of years ago. Currently, mining development in the Kispiox Watershed is limited to exploration of mining claims

for coal and vein metallic mineralization located in the southern portion of the watershed close to Kispiox Village. The main type of mineral occurrence is in sedimentary rock types, with five coal showings, one marl showing, and one fireclay occurrence. There are three polymetallic veins containing silver, lead, zinc, and gold, as well as three porphyry copper-molybdenum-gold showings. The watershed is rated as having a low mineral-potential rating.

Transportation and Utilities

Kispiox Trail is the major road passing for approximately 85 km up the east side of the Kispiox River from Kispiox Village. The road branches twice to accommodate two crossings of the Kispiox River and provides access to the west side of the valley. Both west side roads, the Helen Lake Forest Service Road (FSR) and Mitten Main FSR, converge 58 km upstream to provide access northwest out of the drainage and into the Nass Watershed. The Kuldo FSR, located at 45.5 km on the Kispiox Trail, swings north providing access to the Upper Skeena and Shedin drainages. There are numerous branch access roads, in various states of deactivation and repair that accommodate forest development within the majority of tributary basins. Utility corridors consisting of transmission and phone lines parallel roads up the east side of the valley for approximately 40 km and to a limited extent on the west side of the river.

Population and Settlement

The Kispiox valley has been home to Gitxsan people for thousands of years. Euro-Canadian settlers arrived following completion of the railroad in 1914, attracted by the agricultural possibilities. This population base remained relatively stable until the early 1970s, when rural living and hobby farming became a more popular lifestyle. Currently, approximately 650 people reside in Kispiox Village (SNDS 1998), and an additional 250 people reside on valley bottom lands north of the village and are mostly located adjacent or close to the Kispiox River.

Historically and up to the recent past, many Gitxsan people derived their income from the fishing and forestry sectors; however, severe job losses have curtailed this income. There are currently an estimated 18–23 relatively small ranches in the Kispiox, with approximately 460 breeding cows that graze on Crown land. Most residents derive their income from service sector employment in the Hazelton area. Land parcels are typically large (greater than 60 ha), with Agriculture Land Reserve restrictions regulating the majority of holdings. Population trends project growth for Kispiox Village and a stable rural resident community in the rest of the valley. Recreational and tourism-based incomes are projected to grow over the next decade.

Kispiox Fish Passage Assessment Results

Results from this FPCI project indicates 404 stream crossings were examined; of these 287 were determined to be fish bearing streams crossings. These crossings are comprised of 171 distinct stream reaches. Partial barriers were reported at 30 stream crossings with no apparent all-season full barriers. 117 crossings were determined to have no fish presence due to stream gradient or lack of suitable habitat. Deactivation is recommended with 28 stream crossings. 96 sites require maintenance action due to a variety of issues. Beaver activity was observed at 35 crossing sites and frequently contributes to maintenance issues.

The 30 partial barriers consist of various types and degrees of barriers along with variable amounts of fish abundance and differing qualitative values of upstream fish habitat. Of these 30 streams, four are rated as high priority and include: Site 340 Murder Creek, Site 103 Clifford Creek, Site 112 Skunsnat Creek, and Site 100 Hodder Creek. 5 sites are rated as moderate priority while 19 sites are rated as low priority.

Due to past surveys, first to third order and larger streams at the 1:20,000 scale in the surveyed areas have a relatively complete inventory of fish species presence; however, fish occurrence in many first and second order streams are inferred and have not been field verified. Habitat quality and quantity values are for the most part, unknown. This survey adds to the overall knowledge base of fish presence and habitat quality in Kispiox Watershed.

Table 3, which follows, summarizes overall data presented in Appendix 1.

Table 3. Kispiox Fish Passage Site Summary

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
1	Unknown	563701	6164122	Culvert	Inferred	Culvert inlet is plugged, 3/4 filled with dirt		Yes		
2	Unknown	563586	6164152	Culvert	Inferred	Culvert Inlet is buried. Beaver ponds at inlet and outlet.		Yes		Yes
3	Unknown	563583	6163675	Log	Inferred	Logs placed in creek to afford vehicle passage. Low flow				
4	Unknown	562794	6164157	Culvert	Confirmed	Beaver ponds upstream and downstream, 25 cm of gravel on bottom, both ends submerged.		Yes		Yes
5	Unknown	561495	6164077	Culvert	Confirmed	Creek in good condition, relatively undisturbed				
6	Unknown	561140	6163961	Culvert	Confirmed	Beaver dam built around inlet of culvert. No measurements taken upstream, juveniles present, fish observed in culvert. Low restoration priority.		Yes	Partial	Yes
7	Unknown	560058	6164405	Culvert	NVC	NVC=No visible channel				
8	Unknown	559773	6165345	Culvert	Confirmed					
9	Unknown	569650	6158578	Culvert	NFP	Good culvert				
10	Unknown	568150	6160268	Culvert	Confirmed	Juveniles present. Velocity barrier. Low restoration priority.			Partial	
11	Tahtlum Creek	566844	6162732	Bridge	Confirmed					
12	Tahtlum Creek	566947	6163289	Bridge	Confirmed	Bridge				
13	Unknown	567602	6165168	Culvert	Inferred	Water flow on surface below outlet, no surface water flow at inlet.				
14	Unknown	5667184	6163943	Culvert	Inferred	Stream down side of road (upstream). Velocity barrier. Low restoration priority.			Partial	
15	Unknown	567927	6165410	Culvert	Inferred	Small volume surface flow, unable to see material used for culvert.				
16	Tahtlum Creek	568310	6165724	Culvert	Confirmed	Flow is good.				
17	Unknown	568110	6165505	Culvert	Inferred	Corduroy culvert.				
18	Unknown	566263	6163309	Culvert	Inferred					
19	Unknown	566269	6163330	Culvert	Inferred					
20	Unknown	565334	6163809	Culvert	Inferred	Velocity barrier. Low restoration priority.			Partial	

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
21	Unknown	564661	6164341	Culvert	Inferred	Low flow volume.				
22	Unknown	563951	6165293	Culvert	Confirmed	2 M falls/cascades approximately 5 m below culvert limiting anadromous fish passage.				
23	Unknown	564130	6166808	Culvert	Unknown	Kispiox Hatchery coho released here. Velocity barrier. Low restoration priority. Recommend fish presence/absence survey.			Partial	
24	Unknown	564101	6166835	Bridge	NFP	Moderate quality habitat.				
25	Unknown	565343	6167257	Culvert	NFP	No fish habitat				
26	Unknown	565722	6166901	Culvert	NFP	No fish habitat.				
27	Unknown	563278	6165249	Log	Inferred	Corduroy crossing, needs deactivation, inlet subsurface flow, outlet flow low.	Yes	Yes		
28	Unknown	563075	6166119	Log	Inferred	Deactivated, used to be log corduroy crossing.	Yes			
29	Unknown	562806	6166439	Culvert	Inferred	Beaver dam on upstream side of road, multiple dams on downstream side, pipe is plugged on upstream side.	Yes	Yes		Yes
30	Unknown	562504	6167424	Culvert	Inferred	Inlet 80% blocked with debris, old CMP laying as garbage beside drainage.	Yes	Yes		
31	Unknown	562590	6167465	Culvert	Inferred	No channel, seepage	Yes			
32	Unknown	562560	6168135	Unknown	Inferred	Beaver dam on downstream side of road. Road is flooded.	Yes	Yes		Yes
33	Unknown	562473	6168418	Log	Inferred	Water flowing across road. Pull corduroy, deactivate.	Yes	Yes		
34	Unknown	562383	6168997	Culvert	Inferred	Partially plugged inlet, inlet submerged. Past beaver activity. Culvert needs to be removed	Yes	Yes		
35	Unknown	562649	6166185	Culvert	NFP	Culvert buried, seepage.		Yes		
36	Unknown	562568	6166173	N/A	N/A	No culvert, water running across road.		Yes		
37	Unknown	562388	6166160	Bridge	Confirmed	Decking pulled and set on road, a lot of bridge debris in stream directly below bridge. High sediment risk and delivery with potential destabilization of channel. High priority clean up because of high fish habitat stream.	Yes	Yes		
38	Unknown	565982	6158683	Culvert	Inferred	Inlet 25% blocked. Beaver pond on inlet side. Beaver guard installed on inlet. Fry observed at outlet.		Yes		Yes

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
39	Kline Creek	565291	6159093	Culvert	Confirmed	Stream flow enters culvert 2.5 m down from inlet through a breach in the culvert, inlet bent up at a 40 degree angle. 500 overflow pipe is crushed and dysfunctional. Shoulder of road failing. Creek above culvert flows down into ditchline. Velocity barrier. Medium restoration priority.		Yes	Partial	
40	Elizabeth Lk. Outlet stream	562979	6159561	Culvert	Confirmed	Culverts x 2, beaver guards on both, maintenance constant issue in outlet pond. Grader grades into pond. Past use of sediment fences. Consider armoring road sides.		Yes		Yes
41	Ironside Creek	559572	6161517	Bridge	Confirmed					
42	Ironside Trib.	558887	6162637	Culvert	Inferred	Either a failed box or log corduroy crossing.	Yes	Yes		
43	Sweetin trib	541969	6174700	Culvert	Inferred	Channel braided on lower end. Culvert damaged at outlet resulting in destabilizing road, outlet fill is severely eroded. Holes in culvert at outlet ~1.56 m. Velocity barrier. Low restoration priority.		Yes	Partial	
44	Unknown	541465	6175814	Culvert	Inferred	Seepage from block.				
45	Unknown	540100	6176892	Culvert	No Fish Suspected	Culvert is in good condition				
46	Unknown	539929	6177040	Culvert	Inferred					
47	Unknown	539549	6177070	Culvert	NFP					
48	Unknown	539157	6177009	Culvert	NFP					
49	Unknown	538605	6177363	Bridge	NFP	Heavy sediment source. Loose sediment on bridge deck, all ditchline sediment filtered. Water runs down road onto bridge.		Yes		
50	Unknown	539883	6172016	Culvert	Inferred	Pond at inlet, draining north, culvert partially clogged with beaver debris. Beaver dam 4 meters upstream from inlet. Good fish habitat.		Yes		Yes
51	Unknown	539251	6171865	Culvert	Confirmed	Culvert and corduroy. Crossing drainage deranged. Logs piled in creek above and below culvert. Logs do not effect fish passage and have improved fish habitat.				
52	Unknown	537910	6172949	Culvert	Confirmed					
53	Nangeese	541356	6172221	Bridge	Confirmed					

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
54	Unknown	563750	6168078	Culvert	Inferred					
55	Unknown	563531	6168761	Culvert	Inferred					
56	Unknown	563430	6170446	Culvert	Confirmed	Culvert is placed well.				
57	Unknown	563271	6170778	Culvert	Confirmed	2 m drop 25 M below culvert and multi channeled				
58	Unknown	563082	6173227	Culvert	Inferred					
59	Unknown	563042	6173335	Culvert	Inferred	Small flow volume.				
60	Mooluck Creek	562209	6175354	Culvert	Inferred					
61	Unknown	562293	6177959	Culvert	Inferred					
62	Unknown	562486	6177821	Culvert	Inferred					
63	Kuitan Cr	561995	6177111	Bridge	Confirmed	Bridged crossing, beaver dam 10m upstream of bridge at outlet of lake.				Yes
64	Unknown	569596	6158480	Culvert	NFP	Series of boulders at outfall approximately 2 meters drop. Fish habitat quality: none.				
65	Unknown	570468	6157743	Culvert	Unknown	Grate at culvert inlet. Falls ~ 40 m below culvert limiting fish passage. Changing culvert wouldn't improve access to upstream fish habitat				
66	Unknown	571260	6156494	Culvert	Inferred					
67	Unknown	572178	6156711	Culvert	Inferred	Small flow volume				
68	Murder Creek	572530	6159249	Bridge	Unknown					
69	Murder Creek	573691	6157478	Bridge	Unknown	Beaver dam 3m above bridge				Yes
70	Sammon Creek	575152	6152515	Culvert	Unknown	Ditch south of culvert intake delivers mod-high amounts of sediment		Yes		
71	Cullon Creek	569226	6158592	Bridge	Confirmed	Beaver dam ~20m upstream of bridge. Breached due to high water levels.				Yes
72	Unknown	546539	6169440	Culvert	Unknown					
73	Unknown	546081	6169590	Culvert	Unknown	May be fish bearing further below culvert - very steep directly below culvert, 11 meters downstream is good habitat.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
74	Unknown	542936	6172376	Culvert	Confirmed	Need to back water pipe 2.5 to 3 m downstream. Good habitat lots of cover upstream. Beaver guard on inlet. 18.4m downstream- backwatered by Sweetin. Minor debris at outlet. Velocity barrier. Medium restoration priority.		Yes	Partial	Yes
75	Unknown	542994	6172416	Culvert	Confirmed	Beaver guard at inlet, culvert good.				Yes
76	Unknown	543071	6173447	Culvert	Unknown	Stream down ditchline for 25 m then piped.				
77	Unknown	543021	6173710	Culvert	Unknown	Good culvert and outlet pool, high quality fish habitat.				
78	Unknown	543012	6174012	Culvert	Unknown	Good				
79	Unknown	543009	6174114	Culvert	NFP	Stream down ditchline for 72 m then piped.				
80	Unknown	542996	6174406	Culvert	Unknown	Needs two 7cm backwater steps installed at outlet.		Yes		
81	Unknown	543210	6172228	Culvert	Unknown	Upstream side is dry, stream backwatered 2/3 way up pipe				
82	Unknown	543512	6172087	Culvert	Inferred	Culvert good, high quality fish habitat.				
83	Unknown	544883	6172461	Culvert	Inferred	Inlet needs maintenance, 95% clogged and submerged		Yes		
84	Unknown	545308	6172594	Culvert	Inferred	Dry				
85	Unknown	545335	6172714	Culvert	Inferred	Dry				
86	Unknown	545481	6172785	N/A	Inferred	Very little flow.				
87	Unknown	545541	6173433	N/A	Unknown	Inlet buried, submerged in veg. outlet is partially blocked with sediment.		Yes		
88	Unknown	545651	6173748	N/A	Inferred					
89	Unknown	545735	6173943	N/A	Confirmed					Yes
90	Unknown	544199	6171745	Culvert	Inferred	Culvert works. Log has made a 2 m drop in center, but no problem at sides of stream. Step pools.				
91	Unknown	545029	6171255	Culvert	Inferred					
92	Unknown	545389	6170926	Culvert	Inferred					
93	Unknown	545517	6170759	Culvert	Inferred	High gradient culvert. Velocity and outfall drop barrier. Low restoration priority.			Partial	
94	Unknown	545653	6170588	Culvert	NFP	Clean brush from inlet.		Yes		
95	Unknown	545828	6170355	Culvert	NFP					

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
96	Unknown	546166	6169974	N/A	NFP	Low flow volume.				
97	Nangeese R.	541446	6173516	Bridge	Confirmed					
98	Nangeese trib.	534431	6178923	Bridge	Unknown	Bridge on Hodder Main.				
99	Unknown	534501	6176267	Culvert	Unknown					
100	Hodder Cr.	533796	6176388	Culvert	Confirmed	Beaver dam 20m above culvert. Outfall a barrier for juveniles at low flow. Boulder and 25% bedrock. 3 by 4 m outlet pool good. Replace with open bottom structure. Coho known to spawn in culvert. High restoration priority.			Partial	
101	Unknown	535492	6176294	Culvert	Confirmed	Culvert is good.				
102	Unknown	546732	6169329	Culvert	NFP	Not a fish stream				
103	Clifford Creek	548943	6168230	Culvert	Confirmed	Replace with bridge structure. Extreme velocity and outfall barrier. High restoration priority. This crossing is overdue for replacement.			Partial	
104	Unknown	549483	6169057	Culvert	Unknown	Deactivate	Yes			
105	Unknown	549580	6169060	Culvert	Unknown	Inlet needs cleaning, could be upgraded to a 600 CMP or deactivated. Evidence of water running over road causing erosion around pipe outlet, scour and downstream deposition. Most likely due to upstream beaver dam failure.	Yes	Yes		Yes
106	Skun- trib.	550053	6169696	Log	Confirmed	Deactivate, creek runs through log corduroy.	Yes			
107	Skunsnat Creek	550452	6169314	Culvert	Confirmed	Culvert in good condition	Yes			
108	Skunsnat N/W	550479	6169342	Bridge	Confirmed	Bridge				
109	Skun-trib	551058	6169654	Culvert	Inferred	Culvert good				
110	Skun-trib	552182	6169425	Log	Inferred	Deactivate log corduroy crossing.	Yes			
111	Unknown	552231	6169374	Log	Inferred	Deactivate log corduroy crossing	Yes			
112	Skunsnat Creek	549534	6168485	Culvert	Confirmed	Remove culvert and put in bridge. Beaver pond 50m above culvert. Extreme velocity and outfall barrier. High restoration priority. This crossing is overdue for replacement.		Yes	Partial	Yes
113	Trib-Corral	552444	6167983	Culvert	Inferred	Working good.				
114	Unknown	553039	6166659	Culvert	Inferred	Clean debris inlet		Yes		

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
115	Unknown	553463	6166497	Culvert	NFP	Clean inlet.		Yes		
116	Nobody Much Cr	553827	6166223	Culvert	Inferred	High gradient below culvert. Outlet right bank requires armoring		Yes		
117	Nobody Much Cr	554168	6166205	Culvert	Inferred	Upstream inlet ditchline transporting sediment from exposed bank. Recommend backwatering outlet with onsite rock.		Yes		
118	Nobody Much Cr	554487	6166442	Culvert	Inferred	Install open bottom structure or deactivate. 10% fine silt. Velocity and outfall drop barrier. Low restoration priority.	Possibly	Yes	Partial	Yes
119	Unknown	555263	6167642	Culvert	Inferred	Clean dam from inlet and culvert.		Yes		Yes
120	Unknown	555224	6168345	Culvert	Unknown	Remove debris from inlet and outlet.		Yes		
121	Unknown	554824	6168620	Deact	Inferred	Deactivated				
122	Unknown	554932	6168887	Log	Unknown	Log corduroy crossing.				
123	Ironside trib	555026	6168897	Culvert	Inferred	Easily backwatered with on site materials.		Yes		
124	Ironside trib	554788	6169187	Deact	Inferred	Culvert deactivated.				
125	Unknown	555416	6166475	Culvert	Inferred					
126	Unknown	555434	6164855	Culvert	NFP	Clean brush from inlet.		Yes		
127	Unknown	557536	6162797	Culvert	NFP	Outlet needs cleaning. Culvert and inlet with beaver guard are good.		Yes		Yes
128	Unknown	557717	6163110	Deact	NFP	Road deactivated, creek runs down road.		Yes		
129	Unknown	558244	6160948	Log	Unknown	Log corduroy, no flow, seepage.				
130	Kispiox River	557877	6161205	Bridge	Confirmed	Mitten Bridge				
131	Ironside trib	559546	6162260	N/A	Unknown	No culvert, stream running across road. No drainage structure.		Yes		
132	Ironside trib	559512	6162581	N/A	Unknown	Failed beaver dam. Road flooded. Dam built on road.		Yes		Yes
133	Unknown	561415	6161285	Culvert	NFP	Drains swamp on upper side of road.				
134	Unknown	561374	6161416	Deact	NFP					
135	Unknown	561324	6161758	Deact	NFP					
136	Unknown	561228	6162738	N/A	Unknown					
137	Unknown	561572	6161836	Log	Unknown	Water seeping under road through corduroy. Deactivate road.	Yes			
138	Unknown	561554	6162100	Log	Inferred	Water running under road through corduroy.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
139	Unknown	557176	6159563	Culvert	NFP	Clean up site, remove discarded pipe. Not a fish stream. Cut above road is slumping and producing moderate sediment.		Yes		
140	Unknown	557251	6159523	Culvert	NFP	Ditchline drainage.				
141	Unknown	557313	6159469	Culvert	NFP	Ditchline drainage. Some failures on cutslope above road, minor sed source.		Yes		
142	Unknown	557452	6159279	Culvert	NFP	Inlet crushed. Ditchline drainage.		Yes		
143	Unknown	557585	6159122	Culvert	NFP	Ditchline drainage. Culvert inlet requires repair.		Yes		
144	Unknown	557678	6159056	Culvert	Confirmed	Culvert a barrier to juveniles. Fix by cutting ~ 5m from lower end. Stream splits ~30m above culvert. Velocity and outfall drop barrier. Medium restoration priority.		Yes	Partial	
145	Unknown	557690	6159044	Culvert	NFP	Culvert good. Natural barrier ~ 5m upstream with 1.2m falls.				
146	Unknown	558439	6158726	Culvert	Confirmed	Culvert good. Good fish habitat above and below culvert.				
147	Unknown	558802	6157922	Culvert	Inferred	Culvert good.				
148	Unknown	559037	6158080	log	Inferred	Log corduroy crossing working fine.				
149	Unknown	559283	6158714	N/A	Inferred	Road crossing flooded by beaver dam.		Yes		Yes
150	Unknown	558903	6157910	Culvert	NFP	Some sediment deposited at outlet of culvert. Stream slightly turbid.		Yes		
151	Unknown	559457	6157853	Culvert	Inferred	Good fish habitat, new culvert. Pond/swamp upstream and downstream.				
152	Unknown	559582	6157784	Culvert	Inferred	Culvert good.				
153	Unknown	559872	6157599	Culvert	Inferred	Culvert good.				
154	Unknown	560081	6157481	Culvert	Unknown	Culvert good.				
155	Unknown	560111	6157255	Culvert	Unknown	Recently installed culvert.				
156	Unknown	560184	6157188	Culvert	Unknown	Culvert good.				
157	Unknown	559607	6156975	Culvert	Inferred	Culvert good, stream gradient steep ~ 20%.				
158	Unknown	559368	6157059	Culvert	NFP	No fish habitat above culvert, gradient too steep.				
159	Unknown	559896	6156790	Culvert	Inferred	Good culvert				
160	Unknown	559056	6157137	Culvert	NFP	Too steep for fish habitat.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
161	Unknown	558702	6156834	Culvert	NFP	Half culvert at outlet to prevent scour and erosion. Stream very steep gradient				
162	Unknown	558826	6156689	Culvert	NFP	Half pipe at outlet and large rocks placed to prevent scour and erosion. Gradient steep downstream.				
163	Unknown	558897	6156278	Culvert	NFP	Steep gradient upstream.				
164	Unknown	558852	6156061	Culvert	NFP					
165	Unknown	558851	6156054	Culvert	NFP	Steep gradient downstream.				
166	Unknown	557874	6157380	Culvert	NFP	Two culverts side by side, extremely steep stream. Stream flowing over the road. Little water flowing thought culvert. Potential for road destruction and massive erosion event.		Yes		
167	Unknown	557961	6157373	Culvert	NFP	Culvert is good, steep gradient.				
168	Unknown	557997	6157358	Culvert	NFP	Steep gradient.				
169	Unknown	558064	6157344	Culvert	NFP	Steep gradient.				
170	Unknown	560480	6156937	Culvert	Inferred	Good culvert				
171	Unknown	560538	6156815	Culvert	Inferred	Velocity and small outfall drop barrier to juvenile fish. Low restoration priority.			Partial	
172	Unknown	560502	6156527	Culvert	NFP	Ground water seepage, Culvert good				
173	Unknown	561092	6155522	Culvert	Unknown	Ground water seepage, Culvert good				
174	Unknown	561160	6155452	Culvert	Unknown	Small outfall drop, potential juv. barrier. Stream branches upstream of culvert. Fairly small stream with moderate gradient and swampy with low fish habitat values above culvert. Velocity barrier. Low restoration priority.			Partial	
175	Unknown	561399	6155230	Culvert	NFP	Very small stream.				
176	Unknown	561421	6155179	Culvert	NFP	No fish in stream. Gradient is too steep.				
177	Unknown	561423	6155173	Culvert	NFP					
178	Unknown	561579	6154911	Bridge	NFP	Bridge in good condition. Very low sediment input				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
180	Unknown	560965	6155095	Culvert	Inferred	Stream parallels road and goes down to ditch. Significant sediment source. Ditch is armored. Road is likely built on top of creek. Stream flows through ditch 74.3m. No rehab prescribed for this site. Poor original road placement. Velocity barrier. Low restoration priority.		Yes	Partial	
181	Unknown	561052	6154778	Culvert	NFP					
182	Unknown	561078	6154716	Culvert	NFP	Culvert good. Intermittent stream.				
183	Unknown	561227	6154422	Culvert	NFP	Velocity barrier. Low restoration priority.			Partial	
184	Unknown	561346	6154287	Culvert	NFP	Culvert good. Intermittent stream.				
185	Unknown	561389	6154236	Culvert	NFP	Clean logs from outlet. Velocity barrier. Low restoration priority.		Yes	Partial	
186	Unknown	561468	6154082	Culvert	Unknown	Velocity barrier. Low restoration priority.			Partial	
187	Unknown	561495	6154075	Culvert	Unknown	Velocity barrier. Low restoration priority.			Partial	
188	Unknown	562172	6153286	Culvert	Inferred					
189	Unknown	561875	6153320	Culvert	Inferred	Intermittent stream.				
190	Unknown	561719	6153476	Culvert	Inferred	Fish habitat quality is low. Low restoration priority.			Partial	
191	Unknown	561753	6153112	Culvert	NFP	Culvert good.				
192	Unknown	561605	6153188	Culvert	NFP					
193	Unknown	561351	6153344	Culvert	NFP					
194	Unknown	561083	6153494	Culvert	NFP					
195	Unknown	561694	6152912	Culvert	NFP	Outfall drop, but no fish habitat. Intermittent stream and high gradient.				
196	Unknown	561165	6153068	Culvert	NFP	Outfall drop, but no fish habitat. High gradient.				
197	Unknown	561045	6153000	Culvert	NFP	Culvert is 50% embedded. Velocity barrier to juveniles. Low restoration priority.			Partial	
198	Unknown	560411	6152761	Bridge	Inferred	Bridge in good condition				
199	Unknown	560600	6157016	Culvert	Confirmed	Juvenile fish presence observed.				
200	Unknown	560684	6156990	Culvert	Confirmed	Juvenile fish presence observed.				
201	Unknown	561619	6156983	Bridge	Confirmed	Bridge in good condition.				
202	Unknown	561717	6156990	Culvert	NFP	Outfall drop, but very steep gradient stream.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
203	Unknown	561860	6156988	Culvert	NFP	Stream directed down ditch ~350m. Poorly defined channel on upstream side. Very small discharge probably intermittent flow.				
204	Unknown	562763	6156139	Culvert	Inferred					
205	Unknown	563688	6154967	Culvert	Unknown					
206	Unknown	564444	6154559	Culvert	Inferred	Juvenile velocity barrier. Culvert is possibly under sized. Outfall drop could be backwatered with small steps using nearby rocks. Good fish habitat! Low restoration priority.		Yes	Partial	
207	Unknown	565606	6153466	Culvert	NFP	Large out fall drop. No fish habitat due to steep gradient downstream.				
208	Unknown	565809	6153027	Culvert	NFP	Intermittent stream.				
209	Unknown	565771	6152977	Culvert	NFP					
210	Unknown	565478	6152824	Culvert	Inferred					
211	Unknown	565100	6152995	Culvert	NFP					
212	Unknown	564876	6152902	Culvert	NFP					
213	Unknown	565270	6152390	Culvert	NFP					
214	Unknown	565498	6152212	Culvert	NFP					
215	Unknown	565089	6152590	Culvert	Inferred	Intermittent stream				
216	Unknown	564428	6153279	Culvert	NFP	Large out fall drop, but gradient is steep downstream, no fish habitat.				
217	Unknown	564176	6153385	Culvert	NFP	Steep gradient, no fish habitat.				
218	Unknown	563967	6153247	Culvert	NFP					
219	Unknown	564090	6153213	Culvert	NFP					
220	Unknown	561522	6157944	Culvert	NFP	Recommend deactivation.	Yes			
221	Unknown	561948	6158077	Deact	NFP	No culvert, road washed out remnants of possible box culvert and road still in channel. Remainder of debris needs to be removed from channel.	Yes	Yes		
222	Unknown	561766	6158248	Log	NFP	Log corduroy crossing, Seepage very little flow.				
223	Unknown	563622	6153106	Culvert	NFP	High gradient stream, not fish passage issue.				
224	Unknown	563612	6152786	Culvert	NFP	Natural barriers downstream.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
225	Unknown	566023	6153075	Culvert	Unknown	Logs in stream from past road construction creating barrier. Recommend further stream assessment below and above culvert to see if it is in fact good fish habitat. Gradient steep on upstream side of culvert.		Yes		
226	Unknown	566178	6153011	Culvert	Unknown	Culvert good				
227	Unknown	566645	6152585	Culvert	Unknown	Culvert good				
228	Unknown	566986	6152390	Culvert	Unknown	Culvert good				
229	Unknown	567994	6151771	Culvert	NFP	Culvert good				
230	Unknown	568491	6151137	Culvert	NFP	Culvert good				
231	Unknown	568748	6151385	Culvert	NFP	Culvert good.				
232	Unknown	567728	6152760	Bridge	Unknown					
233	Unknown	567256	6152838	Bridge	Inferred					
234	Unknown	568054	6152971	Bridge	Confirmed	Wood bridge in good shape. Large number of fry present in stream.				
235	Unknown	567229	6154148	Culvert	Inferred	Culvert good placement.				
236	Pentz Lk. Outlet	573083	6152254	Culvert	Confirmed	Fish present below culvert ~80mm in length. Fish also present above culvert. Culvert placement is good				
237	Unknown	573136	6151767	Culvert	NFP	Good placement. Seepage. ~0.3 m of culvert bottom rusting out at outlet.				
238	Unknown	573689	6150999	Culvert	NFP	Good placement, Seepage.				
239	Unknown	574248	6150273	Culvert	Confirmed	Clean debris from inlet. Fill consists of logs, small wood debris, and gravel. Recommend replacement with a larger diameter, embedded culvert or open bottom structure. Fry present below the culvert, but none observed above. Good habitat above culvert. Velocity and outfall drop barrier. Medium restoration priority.		Yes	Partial	

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
240	Unknown	575053	6150351	Culvert	Confirmed	Fry between 60-110 mm observed trying to jump into the culvert, none successful. Species unknown. Beaver grate on inlet and beaver dam above culvert. Recommend replacing the culvert with an open bottom structure. Clean inlet. Velocity and outfall drop barrier. Medium restoration priority.		Yes	Partial	
241	Unknown	576142	6149447	Culvert	Inferred	Clean inlet. Low flow.		Yes		
242	Unknown	575804	6149244	Culvert	Inferred	Clean inlet. Low flow. Good culvert placement.		Yes		
243	Unknown	575133	6149075	Culvert	Inferred	Culvert good.				
244	Unknown	574869	6149040	Culvert	NFP	Very low flow, Seepage. Culvert is good . Gradient a barrier below and above culvert.				
245	Unknown	575397	6148845	Deact	Inferred	Deactivated.				
246	Unknown	574847	6148927	Culvert	NFP	Collapsed wood box culvert. Water running over road. Not fish passage issue, 75% gradient below road. Recommend deactivation or new culvert before road washes into creek. Road may provide access to residents.	Possibly	Yes		
247	Unknown	573772	6148972	Culvert	Unknown	Culvert placement good, no flow.				
248	Unknown	572849	6149158	Culvert	Unknown	Culvert placement good.				
249	Unknown	571917	6149202	Culvert	Unknown	Clean inlet and outlet. Inlet is damaged		Yes		
250	Unknown	571042	6149588	Culvert	NFP	Seepage, very Little flow.				
251	Unknown	570563	6150059	Culvert	Inferred	Clean debris from inlet. Culvert placement good.		Yes		
252	Unknown	570231	6150375	Culvert	Inferred	Water flowing under the road beside culvert. Beaver plugged inlet of culvert. Possibly old box culvert beside newer culvert.		Yes		Yes
253	Unknown	571445	6154123	Log	NFP	Log corduroy draining seepage with little flow.				
254	Unknown	570408	6155062	Bridge	Confirmed					
255	Unknown	568894	6155907	Culvert	Confirmed	Culvert placement good. Observed red sided shiners above and below culvert				
256	Unknown	566872	6156014	Bridge	Confirmed	Fry present, no I.D.				
257	Unknown	565541	6157682	Culvert	Confirmed	Good placement.				
258	Unknown	565496	6157219	Culvert	Unknown	Sink hole on road. Collapsed box culvert. Very little flow. Consider deactivation.	Yes	Yes		
259	Unknown	565897	6156972	Log	NFP	No flow, seepage.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
260	McCully Cr	576582	6149589	Bridge	Confirmed					
261	Unknown	579290	6146980	Culvert	Unknown	Repair outlet.		Yes		
262	Unknown	579354	6146585	Culvert	Unknown	Dry channel.				
263	Unknown	579805	6146012	Culvert	Unknown	No flow. Water dripping out of outlet				
264	Unknown	580254	6144781	Culvert	NVC	No visible channel above road.				
265	Unknown	579965	6144219	Culvert	NFP	Clean debris from inlet. Very little flow.		Yes		
266	Unknown	579925	6144015	Culvert	Inferred	Clean inlet. Beaver guard installed on inlet, guard getting plugged with debris, needs cleaning. Beaver pond above and below culvert. Culvert placement good.		Yes		Yes
267	Unknown	579790	6143794	Culvert	Unknown	Clean inlet. Water seeping through culvert, Swamp above culvert. Inlet buried.		Yes		
268	Unknown	579663	6143372	Culvert	Confirmed	Top of culvert showing through road, place fill. Fry upstream of culvert. Upstream channel runs along road ditchline.		Yes		
269	Unknown	580048	6143502	Bridge	Confirmed					
270	Unknown	580333	6145141	Bridge	Confirmed					
271	Unknown	581262	6143775	Culvert	Confirmed	Culvert poses a barrier. Habitat above culvert looks good. Recommend armoring bank to prevent further erosion. Use material from the armoring to build two rock lines across the outlet of the pool to increase the outfall pool depth and provide fish access. Low restoration priority.		Yes	Yes	
272	Unknown	576963	6147174	Culvert	Inferred	Culvert placement is good.				
273	Unknown	576190	6147271	flooded	Inferred	Road flooded. Assume culvert is submerged.		Yes		Possibly
274	Unknown	578117	6147646	Culvert	Inferred	Culvert is good				
275	Unknown	582011	6142395	Culvert	NFP	Culvert outfall has eroded channel below culvert. High gradient to river.		Yes		
276	Unknown	578641	6150436	Culvert	NFP	Culvert buried on both ends. Seepage culvert with swamp on lower and upper side of road.		Yes		
277	Unknown	578240	6150761	Culvert	Confirmed	Culvert placement good. Beaver guard on inlet. Observed 1 fish ~ 80 mm in pool below culvert.				Yes

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
278	Unknown	579150	6149782	Culvert	Confirmed	Culvert placement good. Observed ~20 small Coho in pool below the culvert. Ave size between 40-60 mm. Good rearing habitat.				
279	Unknown	579884	6149628	Log	Inferred	No visible crossing structure. Visible channel on upper and lower end, no flow, seepage. Probably corduroy crossing.				
280	Unknown	581230	6150963	Culvert	Inferred	Culvert filled ~40% gravel on bottom. Placement is good, fish passage not a problem. Culvert collapsed a bit near center. Recommend deactivation.	Yes	Yes		
281	Unknown	581135	6150710	Culvert	Unknown	Road failing. Old box culvert inlet failed and blocked causing water to flow through corduroy beside it. Deactivate.	Yes	Yes		
282	Unknown	581274	6150691	Culvert	Inferred	Possible old wooden box culvert. Water flowing through corduroy. Evidence of water flowing over road. Needs deactivation.	Yes	Yes		
283	Finlay Cr	581074	6147656	Culvert	Inferred	Beaver guard on both inlet and outlet. Beaver guard moved out of place at inlet and plugged full of debris at outlet. Both need to be cleaned and reset into place. Culvert placement good.		Yes		Yes
284	Finlay Cr	581111	6147657	Culvert	Inferred	Clean inlet and outlet. Beaver guards on inlet and outlet. Guard plugged with debris at inlet, outlet needs cleaning. Placement good.		Yes		Yes
285	Unknown	581129	6147658	Culvert	Inferred	Beaver plugged inlet. Overflow culvert.		Yes		Yes
286	Unknown	581320	6147663	Culvert	Inferred	Culvert is good. Beaver guard on inlet and outlet.				Yes
287	Unknown	582245	6147650	Culvert	Unknown	Culvert placement good				
288	Unknown	582671	6147893	Culvert	Inferred	Culvert is good. Natural barrier above falls in creek 13m above culvert 70cm high.				
289	Unknown	582775	6147879	Culvert	Unknown	Placement is good. Works.				
290	Kispiox River	557885	6161219	Bridge	Confirmed	Mitten Bridge.				
291	Unknown	556718	6159989	Bridge	Inferred	Sediment on deck.		Yes		
292	Unknown	556390	6160561	Bridge	Unknown	Sediment on deck.		Yes		
293	Unknown	556606	6160146	Culvert	NFP	Culvert placement good. Sediment deposit at inlet needs cleaned out.		Yes		
294	Unknown	554658	6160580	Culvert	NFP	No fish habitat upstream due to high gradient.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
295	Unknown	554323	6160733	Culvert	NFP	Good culvert.				
296	Unknown	555212	6160849	Bridge	NFP					
297	Unknown	553996	6161819	Culvert	Confirmed	Observed fish In stream ~60 mm length. Culvert placement good.				
298	Unknown	553710	6161997	Bridge	Unknown	Bridge needs new deck.		Yes		
299	Unknown	553863	6162148	Culvert	Confirmed					
300	Unknown	552827	6164605	Culvert	Inferred	Culvert good.				
301	Unknown	553778	6161924	Culvert	Confirmed					
302	Unknown	552223	6162901	Culvert	NFP	Ditchline, works.				
303	Unknown	551955	6163159	Culvert	NFP	Deactivate. Plugged at inlet.	Yes	Yes		
304	Unknown	551944	6162728	Culvert	NFP	Culvert good.				
305	Unknown	550868	6163289	Culvert	Inferred	Deactivate. Pond on inlet side of road. Main flow running down ditch on outlet side.	Yes			
306	Unknown	550776	6163290	Culvert	Inferred	Inlet plugged, deactivate.	Yes	Yes		
307	Unknown	549779	6162746	Flood	NFP	Beaver dam on road. Lake outlet.		Yes		Yes
308	Unknown	550030	6162460	Culvert	NFP	Culvert good, high gradient stream.				
309	Unknown	549830	6162349	Culvert	NFP	Culvert good, high gradient stream.				
310	Unknown	549460	6162029	Culvert	NFP	Culvert good.				
311	Unknown	552986	6162779	Culvert	Unknown	Culvert good, not fish habitat above culvert, steep gradient.				
312	Unknown	552517	6163158	Culvert	Inferred	Culvert good, good placement.				
313	Unknown	551920	6163949	Culvert	Inferred	Culvert good.				
314	Unknown	549872	6165693	Culvert	NFP	Creek is ephemeral.				
315	Unknown	548731	6165658	unk.	Inferred					
316	Unknown	548516	6165939	Culvert	Inferred	Culvert works, bottom of box culvert is bedrock.				
317	Unknown	547758	6166888	Culvert	Inferred	Culvert good.				
318	Unknown	547508	6166879	Deact	Deactivated	No culvert, deactivated. No flow.				
319	Unknown	547102	6167286	Culvert	Confirmed	2 culverts 700 + 600. 700 pipe good, 600 has 500mm outfall drop. Beaver guard. Drop extended pipe outlet down to reduce outfall drop.		Yes		Yes
320	Unknown	546934	6167482	Culvert	Inferred	Beaver guard installed.				Yes

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
321	Trib. Steep Canyon	546325	6167526	Culvert	Inferred	Culvert good, beaver guard on inlet.				Yes
322	Unknown	547108	6167170	Rock drain	Inferred	No crossing structure, water drains through rock fill. If restored, put in 1000 mm pipe. Low priority.		Yes		
323	Steep Canyon Cr	546112	6167489	Bridge	Confirmed	Bridge. ~1 m clearance from bottom of bridge to stream bed.		Yes		
324	Beaverlodge Cr	544778	6168485	Deact	Confirmed	Bridge pulled.				
325	Unknown	545500	6166366	Culvert	NFP	Swamp-seepage.				
326	Beaverlodge Cr	545449	6165656	Bridge	Inferred	Bridge rail and stringer damaged. Bridge needs repair before stringer falls into creek.		Yes		
327	Beaverlodge Cr	543337	6167850	Bridge	Confirmed	Bridge				
328	Unknown	543200	6167223	Deact	Inferred	Culvert removed, road deactivated.				
329	Brown Paint Cr	542370	6167144	Bridge	Unknown	Part of bridge deck rotting. Main structure is steel.		Yes		
330	Brown Paint Cr	543030	6167919	Bridge	Confirmed					
331	Unknown	542463	6168059	Culvert	Inferred	Culvert good, Placement good. Dry stream channel.				
332	Unknown	542566	6168613	Deact	Inferred	Road deactivated, culvert pulled.				
333	Unknown	542049	6168448	Culvert	NFP	Placement good, not a fish bearing stream. Water seeping out of mossy channel above road.				
334	Unknown	541611	6168777	Culvert	NFP	Culvert placement good. No flow, seepage.				
335	Unknown	537959	6169804	Culvert	Inferred	Culvert placement good.				
336	Unknown	538083	6169629	Culvert	NFP	High gradient below culvert.				
337	Unknown	537163	6170211	Bridge	Inferred					
338	Corral Cr.	552059	6167438	Culvert	Confirmed	Culvert good. Series of 3 falls downstream, all impassable.				
339	Unknown	561898	6159780	Unknown	Unknown	Road flooded, couldn't determine crossing type.		Yes		
340	Murder Creek	576807	6152169	Culvert	Confirmed	Inlet damaged. Extreme velocity and outfall barrier. High restoration priority. Recommend pulling culvert and installing a bridge. This crossing is overdue for replacement.		Yes	Partial	

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
341	Unknown	577026	6153672	Culvert	Inferred	Dry channel, not fish passage issue.				
342	Murder Creek	576960	6151828	Bridge	Confirmed					
343	Unknown	576513	6151464	Bridge	Inferred					
344	Unknown	583420	6148938	Culvert	NVC	No flow, seepage. No visible channel.				
345	Unknown	580035	6152944	Culvert	Inferred	Culvert good, very little flow.				
346	Unknown	579574	6153132	Culvert	Inferred	Culvert good, no flow.				
347	Unknown	578532	6155632	Culvert	Inferred	Outlet damaged. Log corduroy as well as a culvert.		Yes		
348	Finlay Creek	580488	6146106	Culvert	Confirmed	Culvert good. Fry observed in pool at outlet.				
349	Finlay Creek	580549	6146161	Deact	Inferred	No crossing structure, road washed out or structure removed.				
350	Unknown	583474	6140599	Culvert	Inferred	Beaver guard installed on inlet, little flow.				Yes
351	Unknown	581996	6135384	Culvert	NFP	Culvert good, very little flow. 2 culverts side by side.				
352	Unknown	581996	6135384	Culvert	NFP	High gradient, very little flow.				
353	Unknown	582106	6135678	Culvert	NFP	Dry channel.				
354	Unknown	582219	6137523	Culvert	Unknown	High gradient stream, low flow.				
355	Unknown	581795	6137803	Culvert	NFP	Inlet ~ 50% plugged with wood + gravel. 400mm overflow pipe taking flow during high water judging by the scour at the outlet. High gradient, low flow.		Yes		
356	Unknown	580340	6138947	Unknown	Unknown	No apparent crossing structure, water flowing under road.				
357	Unknown	579744	6138822	Culvert	Unknown	Beaver guard on inlet. Culvert good. CMT's beside creek, cedar bark strip (3).				Yes
358	Unknown	578996	6139061	Culvert	NFP	Culvert good, seepage.				
359	Unknown	578784	6139122	Culvert	NFP	Culvert good. ~15cm of gravel and rock deposited on the bottom of culvert.				
360	Date Creek	581437	6139558	Bridge	Confirmed					
361	Date Creek	580007	6139539	Deact	Confirmed	No crossing structure				
362	Unknown	578702	6140345	Culvert	Confirmed	Culvert good. Also plastic overflow pipe 300mm.				
363	Unknown	578575	6140604	Culvert	Confirmed	Culvert placement good. Fry observed jumping in pond above road.				
364	Unknown	577635	6141329	Culvert	Inferred	Culvert good.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
365	Unknown	576787	6141553	Culvert	Inferred	Culvert good.				
366	Hevenor Creek	576070	6142403	Bridge	Confirmed					
367	Unknown	575919	6144224	Culvert	Inferred	Culvert good, very little flow, seepage.				
368	Unknown	575525	6146583	Culvert	Inferred	Culvert good, dry channel.				
369	Unknown	575633	6147258	Culvert	Inferred	Culvert good.				
370	Unknown	575743	6147435	Culvert	Inferred	Culvert good.				
371	Unknown	573511	6148351	Culvert	Inferred	Culvert good, deep pool at outlet.				
372	Unknown	574878	6144448	Culvert	Inferred	Culvert good.				
373	Unknown	578304	6140229	Culvert	Confirmed	Culvert good, fry holding in pools below and above culvert. Rb and Cutthroat ~50-130mm.				
374	Unknown	576537	6140658	Culvert	Inferred	No flow, seepage. Culvert good.				
375	Unknown	576149	6140444	Culvert	Inferred	Culvert good.				
376	Unknown	575653	6141347	Culvert	Confirmed	Culvert good. 2 fry observed above culvert in stream ~ 20 mm length.				
377	Unknown	575415	6141408	Culvert	Confirmed	Culvert good.				
378	Unknown	575128	6141721	Culvert	Inferred	Culvert good, very little flow.				
379	Unknown	574228	6142357	Culvert	Unknown	No fish habitat above culvert, high gradient.				
380	Unknown	574145	6142603	Bridge	Inferred					
381	Unknown	573346	6143999	Culvert	NFP	Culvert good, high gradient stream.				
382	Hevenor Creek	572904	6145514	Culvert	Inferred	Culvert good.				
383	Hevenor Creek	572737	6145629	Culvert	Inferred	Culvert good.				
384	Unknown	572357	6146367	Bridge	Inferred	Bridge. Gauging station.				
385	Unknown	572372	6146339	Culvert	Unknown	800 overflow culvert. Channel appears to change annually.				
386	Unknown	572116	6147526	Culvert	Inferred	Culvert good.				
387	Unknown	571350	6148227	Culvert	Unknown	Culvert good, no flow, swamp.				
388	Unknown	569161	6148646	Culvert	NFP	Culvert good, very low flow.				
389	Unknown	572875	6144042	Culvert	NFP	Culvert good, high gradient stream.				

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS	DEACT REQ'D	MAINT REQ'D	BARRIER	BEAVER ACTIVITY
390	Unknown	539105	6170639	Culvert	Confirmed	Culvert outfall spilling onto large rocks creating outfall drop barrier. Recommend moving rocks to outer edge of pool to add depth or deactivate. 2 small fry ~30 mm in pool below culvert. More fry above culvert. Velocity and outfall drop barrier. Medium restoration priority.	Possibly	Yes	Partial	
391	Unknown	538626	6170739	Culvert	Confirmed	Culvert good. Dry channel.				
392	Unknown	538468	6171037	Culvert	Inferred	Dry channel.				
393	Unknown	538069	6171404	Culvert	Inferred	Culvert good, dry channel				
394	Unknown	537581	6172233	Culvert	Inferred	Culvert good, stream running through bedrock channel, natural barriers throughout stream (bedrock steps).				
395	Unknown	549020	6164928	Culvert	Inferred	Dry channel.				
396	Unknown	549011	6164583	N/A	NFP	Beaver dam on road. No visible crossing structure.		Yes		Yes
397	Unknown	548711	6164705	Culvert	NFP	Culvert good. High gradient stream, very little flow.				
398	Unknown	541554	6167404	Bridge	Unknown	Good condition.				
399	Unknown	540456	6167293	Culvert	Unknown	Culvert good. No flow, dry channel.				
400	Unknown	554589	6163667	Log	Confirmed	No flow.				
401	Unknown	582022	6144237	Bridge	Confirmed	Little flow.				
402	Unknown	582086	6144062	Culvert	Unknown	No flow.		Yes		
403	Dale Creek Culvert #1	582189	6135019	Culvert	Confirmed	3 culverts- 2 1800mm and 1 500mm overflow. 500 mm overflow damaged, looks as if the overflow is utilized judging by the erosion around inlet and outlet. Fry observed in pool below and above culvert. High gradient stream with large boulders and coble creating step pools. Pipe 1. Velocity and outfall drop barrier. Low restoration priority.			Partial	
403	Dale Creek Culvert #2	582189	6135019	Culvert	Confirmed	Pipe 2. Velocity and outfall drop barrier. Low restoration priority.			Partial	

Table 3. Kispiox Fish Passage Site Summmary

HIGH PRIORITY FISH PASSAGE SITES

Kispiox Fish Passage High Priority Restoration Sites					
Site No.	**Stream Name**	**Comment**	**Fish Species**	**Fish Passage Issue**	**Restoration Site Priority**
100	Hodder Creek	Culvert controls access to high value spawning and rearing fish habitat in lake and tributary systems upstream	CO, ST, SK, DV, BT, RB, and CT	Culvert is undersized and a velocity and outfall drop barrier with insufficient outlet pool depth.	High. Recommend open bottom arch or open bottom structure
103	Clifford Creek	Culvert has caused fish access problems since it was installed in the early 1960s. Various attempts at mitigating the problem have failed. Culvert replacement is long overdue.	CO, PK, ST, SK, RB, DV, BT, and CT	Culvert has extreme velocity and outfall drop issues, At high flows stream velocity is well above fish swim speeds.	High. Recommend bridge to allow access to 6.75 km of high value habitat upstream.
112	Skunsnat Creek	Culvert has caused difficult fish access since the early 1960s. Baffle installation in1998 slowed velocities, but not enough to ease passage Culvert replacement is long overdue.	CO, PK, ST, DV, BT, RB, and CT	Culvert has extreme velocity and outfall drop issues, Average velocity at all flows inhibit juvenile fish passage; moderate and high flows constrain adult spawner movement upstream.	High. Recommend bridge to allow juvenile fish access to approximately 12 km of high value spawning and rearing habitat upstream.
340	Murder Creek	Culvert installed in early 1960s has continued to provide problems for upstream juvenile fish access Culvert replacement is long overdue.	CO, CH, PK, ST, DV, BT, RB, and CT	Culvert has outfall drop, extreme velocity, and bank scouring issues.	High. Recommend replacing culvert with bridge easing upstream fish passage to approx 14.5 km of high value habitat.

Table 4. Kispiox High Priority Fish Passage Sites

Four culverts are rated high priority for restoration and include Clifford Creek, Skunsnat Creek, Murder Creek, and Hodder Creek. The first three are a higher priority than Hodder Creek. Clifford, Skunsnat, and Murder culverts are constructed of wood staves and were installed in the early 1960s. Since then, the culverts have been a chronic fish passage issue. The following text from the Annual Narrative Report—Terrace-Lakelse Area 1966 (DFO 1966) elucidates and provides some context to the present situation:

Page 3. Coho

"The culvert streams that are in hand for remedial action to overcome velocity blockages on the creeks of Kispiox system had substantial stocks when compared to past year 1965 escapement, it remains to be seen whether a continuing delay will be encountered at the Forestry road wood stave round culverts that might be detrimental if no solution to the problem other than the temporary erection of baffles each year is accepted by the Department. The B.C. Forest service and Resource Development Officers at Hdq are negotiating for permanent remedies to the problem of ascending late fall fish. The main run of salmon to the streams Murder Creek-Cullon Creek-Ironside and Skunsnat and Clifford creeks are the late Coho that do not usually arrive until a high water level in all creeks permit them to arrive, they then find a very difficult ascent through the round stave culverts that cause delay and bruising, a period of up to a week delay in passing through even with temporary wood baffling to break the speed of the culvert runoff will undoubtedly have an adverse effect on future runs if no satisfactory solution to the velocity problem is demanded."

Page 9. Obstructions

"The culvert problems existing on five tributary streams of Kispiox river is also in hand with Resource Development for action, filed reports will show that local patrol staff and F.O. did remedial work by baffling all the difficult passage streams in October 1965 when a good escapement of Coho were blocked by extreme speed of flood runoff waters through the culverts. B.C. F. Service work in construction of logging access road was the cause of the blockage as culverts reduced the flow area and caused extreme velocities. Forestry designed and installed wood baffles for ascent of 1966 Coho, and made cement retaining walls and riprap on two of the streams. Coho passed through with difficulty and delay in October 1966. Observations were reported and it would appear that the only permanent solution is to insist on bridging of the streams."

Clifford Creek Culvert
Site 103

Clifford Creek is a moderate sized third order watershed draining into Kispiox River approximately 47 km upstream of the mouth. The drainage is 35.54 km^2 with approximately 7.5 km of mainstem and an average gradient of 2% before natural barriers limit fish presence. Fish are distributed throughout 8.9 km of tributaries, however, quality habitat in the tributaries is dispersed and fish production is mostly limited to freshwater species. Fisheries values are high due to spawning and rearing by coho, sockeye, and pink salmon, steelhead, bull trout, Dolly Varden, and cutthroat. Coho spawning has been observed throughout up to 5.0 km and pink salmon spawn up to 1.5 km. Annual coho escapement estimates are fairly consistent from 1965 to 1993 and show a range between 25 and 8,000 fish (DFO unpublished BC 16 records). In most years, escapement fluctuates between 100 and 500 coho. Between 1999 and 2001, GWA maintained smolt counting fences from May to July. Since 1980, Kispiox Hatchery has released a total of 106,000 coho in an effort to rebuild the depressed Clifford Creek stock. Gottesfeld *et al.* (2000) indicated that Clifford Creek had the most abundant juvenile steelhead density of surveyed streams in Kispiox Watershed. Clifford Creek has relatively high beaver activity, particularly in Reach 1 and 2, compared to other Kispiox tributaries.

Disturbance in Clifford Watershed is primarily from logging and road building activities. Overall logging related impacts to fish habitat are high for the 800 m reach downstream of the Kispiox Trail due to road, channel, and riparian disturbance. Mid-portions of the watershed were disturbed only by fire and had no development. In the upper half of the watershed, logging related impacts are considered moderate due primarily to the non-fish bearing first and second order creeks; however, Nortec (1997) noted logged riparian zones, bank erosion, and road related sediment generation and transport.

Clifford Creek culvert accommodates the Kispiox Trail at approximately 71 km. Since the early 1960s when the culvert was installed there have been recurring fish passage problems. Baffles were first installed in 1965 to assist fish in low and high flows; as well, it was recommended that the culvert be replaced by a bridge (DFO 1966, Hancock *et al.* 1983).

Since 1965, various attempts to mitigate the Clifford Creek fish passage problem at the Kispiox Trail crossing have included baffling and cutting a new channel downstream of the scoured culvert outlet pool. Forty-one years later, the same situation shows an undersized culvert, extreme culvert velocities, and an outfall drop. The severity of the barriers depends on flow conditions. The culvert is undersized to accommodate a 100 year flood event, which could potentially arise from weather related flows or beaver dam failures or breaching.

Clifford Creek culvert restoration is rated High Priority with a matrix score of 46. A concrete bridge is recommended to restore suitable flows, ease fish passage, and provide low maintenance efforts. The original channel, with an average gradient of 1% and several bedrock outcrops controlling base levels, should be reestablished.

Figure 12. Clifford Creek culvert inlet
View upstream from inlet.

**Figure 13. Clifford Creek culvert outlet.
View downstream from outlet.**

**Figure 14. Clifford Creek culvert outlet.
View downstream from outlet.
Original channel is to the right of photo.**

**Figure15. Clifford Creek outlet.
Side view shows culvert discharge onto boulders.**

Date	01/06/06 & 29/09/06	Stream Name	**Clifford Creek**
Road Name	Kispiox Trail	Watershed Code	470-434800-65200
UTM/GPS Location	09 548943 6168230	Recorders Name	TW/KR & TW/JM
1:20 000 Map Sheet	103P069	Field Number	103P069-046
Site Number	103		

Culvert Characteristics	
Culvert Diameter (mm)	2100 mm
Culvert Length (m)	26 m
Culvert Slope (%)	3.8%
Culvert Material	Wood
Culvert Water Velocity	1.96 m/s
Culvert Shape	Round
Culvert Wetted Width	150 cm
High Water Mark	110 cm
Culvert Water Depth	42 cm
Culvert Outfall Drop	28 cm
Culvert Maintenance	Remove culvert
Comment	Culvert removal overdue

Stream Characteristics		
Pool Depth at Outfall	0	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	4.0 m	6.3 m
Bankfull Width avg	5.6 m	7.9 m
Water Depth avg	22.3 cm	31.8 cm
Bankfull Depth (cm)	49 cm	25.5 cm
Stream Velocity avg	0.60 m/s	0.57 m/s
Stream Gradient (%)	4.2 %	1.3%
Substrate	G25/C70/B5	S5/G95
Fish Habitat Quality	High	High
Beaver Activity/Type	None observed	None observed
Barrier Evaluation:	Barrier at low to high flows	
Barrier Type	Velocity and outfall drop	
Prescription	Install bridge	
Comment	Reactivate the historic channel	

Q100 Estimate	6.6045
Stream Length Above Barrier	15.65 km
% Stream Barred	93%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 5. Clifford Creek Culvert Site 103

Skunsnat Creek
Site 12

Skunsnat Creek is a small third order watershed draining into Kispiox River about 47 km upstream of the mouth. The drainage is 26.01 km^2 with the unique Skunsnat Lake, approximately one km in length, located mid-point in the system. Skunsnat Creek is low gradient and less than three km long flowing from Skunsnat Lake to Kispiox River. The system is a known coho and steelhead producer. The lower section of the creek is used by coho and pink salmon and steelhead for spawning, while the upper portion is used by coho (scattered to 4.5 km from the mouth), bull trout, and Dolly Varden. Tributaries upstream of the mainstem and lake support Dolly Varden, rainbow trout, and robust populations of bull trout and cutthroat. Beaver impoundments are present in most parts of the drainage and the lake attenuates high flows to some degree.

Figure 16. Skunsnat Lake and outlet from the northwest

The Kispiox Trail crosses Skunsnat Creek at approximately 70.3 km. Since the early 1960s when the culvert was installed there have been recurring fish passage problems and implementation of short-term solutions. Baffles were first installed in 1965 to assist fish in low and high flows; as well, it was recommended that the culvert be replaced by a bridge (DFO 1966, Hancock *et al.* 1983). The fish ladder below the road crossing washed out in the October 1978 flood; a jump pool was constructed in 1979 by Department of Highways; and baffles needed to be replaced in 1981 (Hancock *et al.* 1983). The drainage has been heavily harvested except for the mid-portion which is a burn area. Overall logging related impacts are rated moderate to high and primarily consist of road, channel, and riparian disturbance.

Skunsnat Creek culvert outlet pool and the channel for a short distance downstream are bedrock controlled. The culvert is undersized, extreme flow velocities create a velocity barrier, and the outfall barrier causes difficult or no fish passage. These factors combine together to work against fish passage.

Skunsnat Creek culvert restoration is rated High Priority with a matrix score of 46. A concrete bridge is recommended to restore suitable flows, ease fish passage, and provide low maintenance efforts.

Figure 17. Skunsnat Creek culvert outlet.
View of outlet from downstream.

Figure 18. Skunsnat Creek culvert outlet. View downstream from outlet.

Figure 19. Skunsnat Creek inlet. View upstream from inlet.

Figure 20. Skunsnat Creek inlet. View downstream to inlet.

Date	01/06/06	Stream Name	**Skunsnat Creek**
Road Name	Kispiox Trail	Watershed Code	470-4343-0000
UTM/GPS Location	09549534 6168485	Recorders Name	TW/KR
1:20 000 Map Sheet	103P069	Field Number	103P069-045
Site Number	112		

Culvert Characteristics	
Culvert Diameter (mm)	1180 mm
Culvert Length (m)	27 m
Culvert Slope (%)	5.5%
Culvert Material	Wood
Culvert Water Velocity	3.13 m/s
Culvert Shape	Round
Culvert Wetted Width	165 cm
High Water Mark	80 cm
Culvert Water Depth	47 cm
Culvert Outfall Drop	30 cm
Culvert Maintenance	Remove
Comment	Culvert removal overdue

Stream Characteristics		
Pool Depth at Outfall	0	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	m	m
Bankfull Width avg	m	m
Water Depth avg	cm	cm
Bankfull Depth (cm)	cm	cm
Stream Velocity avg	m/s	m/s
Stream Gradient (%)	%	%
Substrate		
Fish Habitat Quality	High	High
Beaver Activity/Type	None observed	None observed
Barrier Evaluation:	Barrier at low to high flows	
Barrier Type	Velocity and outfall drop	
Prescription	Install bridge	
Comment	Culvert has lowered stream productivity	

Q100 Estimate	5.4753
Stream Length Above Barrier	11.3 km
% Stream Barred	94%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 6. Skunsnat Creek Culvert Site 103

Murder Creek Culvert
Site 340

Murder Creek is a moderate sized third order watershed draining into Kispiox River. The drainage is approximately 39.2 km^2 with a low gradient mainstem. Fish are distributed through most low gradient sections. The mainstem is productive with historically high fish values for coho and pink salmon, steelhead, bull trout, and cutthroat. BC 16 records indicated that pink salmon escapement fluctuated significantly, but was on average substantial. Historical coho escapement ranged from between 200 to 500 spawners (DFO unpublished BC 16 records). Prior to the culvert installation in the 1960s, it appears the limiting factor to pink salmon production was summer low flows, which apparently restricted spawner entry some years.

Disturbance includes a loss of most of the riparian zone and channelization on the lower 1.7 km reach due to agricultural development. Logging in the upper portions of the watershed impaired the riparian zone and caused bank erosion, and in turn, aggradation in the lower reach. The Murder Creek culvert accommodating the Kispiox Trail crossing at 35 km has been a fish passage problem since installation in the early 1960s. The culvert was lowered 4 feet in 1965 by the Forest Service (DFO 1966). Subsequent mitigating factors have primarily consisted of baffle installations on a discontinuous basis. The Watershed Restoration Program during the late 1990s attempted to mitigate the fish passage issue by installing more in-culvert baffles and stepping up the channel profile to backwater the outlet, but this likely increased scour activity in the outlet pool and contributed to the partial failure of the road fill.

Overall, significant fish and habitat values upstream and downstream of the culvert have been impacted by this crossing. This crossing situation is similar to Clifford and Skunsnat creeks, except there have been more extreme consequences to ecological connectivity and functioning. The culvert is undersized and is not likely to accommodate 100 year flood events or major beaver impoundment outbursts. The crossing has extreme velocities and an outfall drop that creates problems at a variety of discharge flows. The road prism is beginning to fail and is a risk to safety.

Murder Creek culvert restoration is rated High Priority with a matrix score of 46. A concrete bridge is recommended to restore suitable flows, allow the channel to re-grade, ease fish passage concerns, and ensure low maintenance efforts. Until a bridge is in position, further rehabilitative plans and activities downstream should cease.

Figure 21. Murder Creek inlet.
View downstream to inlet.

Figure 22. Murder Creek inlet.
View upstream from inlet.

Figure 23. Murder Creek outlet.
View downstream from outlet.

Figure 24. Murder Creek outlet.
View upstream to outlet.
Note the few remaining baffles.

Date	28/07/06	Stream Name	**Murder Creek**
Road Name	Kispiox Trail	Watershed Code	470-1610-0000
UTM/GPS Location	09 576807 6152169	Recorders Name	TW/RH
1:20 000 Map Sheet	93M052	Field Number	93M052-013
Site Number	340		

Culvert Characteristics	
Culvert Diameter (mm)	2500 mm
Culvert Length (m)	16.2 m
Culvert Slope (%)	0.5 %
Culvert Material	Wood
Culvert Water Velocity	1.32 m/s
Culvert Shape	Round
Culvert Wetted Width	71 cm
High Water Mark	95 cm
Culvert Water Depth	3 cm
Culvert Outfall Drop	17 cm
Culvert Maintenance	Remove
Comment	Culvert removal overdue

Stream Characteristics		
Pool Depth at Outfall	72	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	2.9 m	2.05 m
Bankfull Width avg	5.3 m	5.85 m
Water Depth avg	13.0 cm	11.1 cm
Bankfull Depth (cm)	62.5 cm	17.5 cm
Stream Velocity avg	0.13 m/s	0.126 m/s
Stream Gradient (%)	5.3 %	2.3 %
Substrate	S5/G45/C45/B5	S5/G75/C15/B5
Fish Habitat Quality	High	High
Beaver Activity/Type	None observed	None observed
Barrier Evaluation:	Barrier at low to high flows	
Barrier Type	Velocity and outfall drop	
Prescription	Install bridge	
Comment	Bridge long overdue	

Q100 Estimate	4.143
Stream Length Above Barrier	14.5 km
% Stream Barred	91%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 7. Murder Creek Culvert Site 340

Hodder Creek Culvert
Site No. 100.

Hodder Creek is a relatively small third order watershed draining into Footsore Lake. The drainage is approximately 8.4 km^2. The Kispiox Trail road is the only disturbance in the drainage. DFO (1991) noted coho spawning up to 3.5 km on upper Hodder Lake Creek and Dolly Varden and rainbow trout observed in Hodder Lake. In addition, GWA unpublished records indicate sockeye, steelhead, bull trout, and cutthroat have been observed as well. Since 2001, coho abundance has fluctuated between 0 and 94 with an average of 39 fish. Historic escapement estimates average 78 coho. Coho have been observed spawning immediately upstream of the culvert and within the culvert as well.

The Hodder Creek culvert supports the Kispiox Trail at approximately 88 km. The culvert controls access to high value spawning and rearing fish habitat in the lake and about 8.3 km of tributaries upstream of Hodder Lake. Bedrock limits the culvert outlet pool depth and the downstream gradient is 6%, which together do not allow a backwater solution. The culvert is undersized to adequately pass a 100 year high flow event and is 23 m downstream of a beaver dam that could potentially fail or be breached. Excess culvert velocity (0.95 m/s average on moderate flows), an outfall drop barrier at some flows, and low in-culvert water depth along with insufficient outlet pool depth limit fish passage. Hodder Creek culvert restoration is rated a High Priority Restoration site with a matrix score of 46. An open bottom arch or open bottom structure is recommended.

Figure 25. Hodder Creek upstream of culvert.
View shows beaver dam and lake in background

Figure 26. Hodder Creek culvert inlet. View downstream to inlet.

Figure 27. Hodder Creek culvert inlet. View upstream from inlet.

Figure 28. Hodder Creek culvert outlet. View upstream to outlet.

Figure 29. Hodder Creek culvert outlet. View downstream from outlet.

Date	05/30/06	Stream Name	**Hodder Creek**
Road Name	Kispiox Trail	Watershed Code	470-607201-10000
UTM/GPS Location	09 533796 6176388	Recorders Name	TW/KR
1:20 000 Map Sheet	103P078	Field Number	103P078-009
Site Number	100		

Culvert Characteristics	
Culvert Diameter (mm)	1000 mm
Culvert Length (m)	20 m
Culvert Slope (%)	1.0%
Culvert Material	CMP
Culvert Water Velocity	0.95 m/s
Culvert Shape	Round
Culvert Wetted Width	73
High Water Mark	44 cm
Culvert Water Depth	17 cm
Culvert Outfall Drop	10 cm
Culvert Maintenance	No
Comment	Culvert outlet pool 3 x 4 m good size

Stream Characteristics		
Pool Depth at Outfall	27	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	3.05 m	0
Bankfull Width avg	3.40 m	0
Water Depth avg	22.6 cm	0
Bankfull Depth (cm)	40	0
Stream Velocity avg	0.40 m/s	0
Stream Gradient (%)	6.0 %	N/A
Substrate	G/C/B/Bedrock	N/A
Fish Habitat Quality	High	High
Beaver Activity/Type	None observed	None observed
Barrier Evaluation:	Partial	
Barrier Type	Velocity, outfall drop, outfall pool depth at low to high water levels	
Prescription	Install open bottom structure	
Comment	Culvert overdue for rehab	

Q100 Estimate	3.87
Stream Length Above Barrier	8.3 km
% Stream Barred	96 %

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 8. Hodder Creek Culvert, Site 100

MEDIUM PRIORITY FISH PASSAGE SITES

Five sites are rated as moderate restoration priority. The ratings reflect culvert, fish presence and distribution, and habitat qualities and quantities. Most moderate priority crossings are second order low gradient streams with partial barriers.

Kline Creek Culvert
Site 39

Kline Creek is a small third order watershed approximately 11.3 km^2 in area. The watershed is characterized by significant water stored in Kline Lake, and numerous wetlands and beaver impoundments. The drainage likely increases and decreases in size as beaver impoundments re-direct drainage into or out of indistinct wetlands charging Cullon Creek, Ironside Creek, and the Elizabeth Lake watershed. Beaver activity is widespread throughout the majority of the drainage and is notable upstream of the road crossing. Known fish presence in Kline Creek is coho and cutthroat with cutthroat present in the lake.

Kispiox Trail crosses Kline Creek culvert at 51 km. The culvert has historically been a fish passage problem primarily due to beaver activity with debris accumulations, dam failures, and screens on the inlet. The 500 CMP overflow culvert is crushed and dysfunctional. The 1100 main culvert is undersized for 100 year flood events, and more particularly, for beaver impoundments outbursts. The culvert is a velocity barrier for juvenile fish. Kline Creek culvert is rated medium priority with a matrix score of 42. An open bottom arch or open bottom structure is recommended.

Figure 30. Kline Creek culvert outlet. View downstream from outlet.

Figure 31. Kline Creek culvert outlet. View upstream to outlet.

Figure 32. Kline Creek culvert inlet.
View downstream of inlet.

Figure 33. Kline Creek culvert inlet.
View upstream from inlet.

Figure 34. Kline Creek culvert inlet.
View to beaver dam 29 m upstream.

Figure 35. Kline Creek culvert inlet.
View shows failure in road shoulder

Figure 36. Kline Creek
View shows erosion where Kline flowed over Kispiox Trail

Date	24/05/06	Stream Name	**Kline Creek**
Road Name	Kispiox Trail	Watershed Code	470-2901-0000
UTM/GPS Location	09 576807 6152169	Recorders Name	TW/KR
1:20 000 Map Sheet	93M051	Field Number	93M051-016
Site Number	39		
Culvert Characteristics			
Culvert Diameter (mm)	1100 mm		
Culvert Length (m)	16.5 m		
Culvert Slope (%)	0.75 %		
Culvert Material	CMP		
Culvert Water Velocity	0.52 m/s		
Culvert Shape	Round		
Culvert Wetted Width	100 cm		
High Water Mark	73 cm		
Culvert Water Depth	37 cm		
Culvert Outfall Drop	0 cm		
Culvert Maintenance	Replace with an open bottom structure		
Comment	Stream flowing into bottom of upturned culvert		
Stream Characteristics			
Pool Depth at Outfall	0		
Measure	Below Culvert Average	Above Culvert Average	
Wetted Width avg	5.25 m	3.87 m	
Bankfull Width avg	6.45 m	12.35 m	
Water Depth avg	28.3 cm	23.0 cm	
Bankfull Depth (cm)	44 cm	34 cm	
Stream Velocity avg	0.10 m/s	0.195 m/s	
Stream Gradient (%)	1.2 %	2.3 %	
Substrate	G100 silt cover	G75/silt 25	
Fish Habitat Quality	Moderate	Moderate	
Beaver Activity/Type	None observed	Yes	
Barrier Evaluation:	Velocity barrier to juveniles		
Barrier Type			
Prescription	Install open bottom structure		
Comment	Chronic passage problem		

Q100 Estimate	7.5377
Stream Length Above Barrier	16.8km
% Stream Barred	97%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	M	6	Partial	6	≥1 km	10	>70%	10	**42**

Table 9. Kline Creek Culvert Site 39

Unnamed Stream
Site 74

Site 74 culvert drains a small second order low gradient stream about 1.95 km in length that flows into the lower reach of Sweetin River, approximately 400 m downstream of the Sweetin Bridge. The stream is backwatered by Sweetin River 18.4 m downstream of the culvert. The stream provides excellent coho, chinook, and steelhead juvenile habitat upstream and downstream of the culvert. The culvert has a small outfall drop (11 cm) that could be easily backwatered 2.5 to 3 m downstream to enable easy juvenile passage into the culvert. Site 74 is rated moderate priority due to the fish values and ease of modifications enabling fish passage. Maintenance issues involve cleaning debris at the inlet.

Figure 37. Site 74 culvert outlet. View downstream from culvert.

Figure 38 Site 74 culvert outlet. View upstream of outlet.

Figure 39. Site 74 culvert inlet. View upstream from inlet.

Figure 40. Site 74 culvert inlet. View downstream to inlet.

Date	29/05/06	Stream Name	**Unnamed**
Road Name	Kispiox Trail	Watershed Code	470-unknown
UTM/GPS Location	09 542936 6172376	Recorders Name	TW/KR
1:20 000 Map Sheet	103P069	Field Number	103P069-055
Site Number	74		
Culvert Characteristics			
Culvert Diameter (mm)	1100 mm		
Culvert Length (m)	22.2 m		
Culvert Slope (%)	2.25 %		
Culvert Material	CMP		
Culvert Water Velocity	0.60 m/s		
Culvert Shape	Round		
Culvert Wetted Width	48.5 cm		
High Water Mark	57 cm		
Culvert Water Depth	7 cm		
Culvert Outfall Drop	22 cm		
Culvert Maintenance	Clean minor debris at inlet		
Stream Characteristics			
Pool Depth at Outfall	11		
Measure	Below Culvert Average	Above Culvert Average	
Wetted Width avg	N/A m	0.65 m	
Bankfull Width avg	N/A m	3.90 m	
Water Depth avg	N/A cm	14 cm	
Bankfull Depth (cm)	N/A cm	39 cm	
Stream Velocity avg	N/A m/s	0. 266 m/s	
Stream Gradient (%)	0 %	1 %	
Substrate	S30/G30/C30/B10	S5/G75/C15/B5	
Fish Habitat Quality	High	High	
Beaver Activity/Type	None observed	None observed	
Barrier Evaluation:	Barrier at low to high flows		
Barrier Type	Velocity and outfall drop to juveniles		
Prescription	Install backwater step		
Comment	Good habitat, good cover		
Q100 Estimate	2.66		
Stream Length Above Barrier	1.9 km		
% Stream Barred	99 %		

Fish species		Habitat value		Barrier		Length of new habitat		Stream barred %		Score
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 10. Culvert Site 74

Unnamed Creek
Site 240

Site 240 culvert drains a small second order low gradient stream about 5.6 km in length that flows into Kispiox River. The stream provides excellent coho, chinook, and steelhead juvenile habitat upstream and downstream of the culvert. An unknown species of fry were observed trying to jump the 20 cm outfall drop into the culvert with no success. Site 240 is rated moderate priority due to the fish values and ease of modifications enabling fish passage. An open bottom structure or a larger diameter culvert such as a 2000 CMP embedded 20% is recommended. Maintenance issues involve cleaning debris at the inlet.

Figure 41. Site 240 culvert inlet.
View downstream to inlet

Figure 42. Site 240 culvert inlet.
View upstream from inlet.

Figure 43. Site 240 culvert outlet. View downstream to outlet.

Figure 44. Site 240 outfall drop

Figure 45. Site 240 inlet side view

Date	16/06/06	Stream Name	**Unnamed Creek**
Road Name	Poplar Park	Watershed Code	470-unknown
UTM/GPS Location	09 576807 6152169	Recorders Name	TW/JJ
1:20 000 Map Sheet	93M041	Field Number	93M041-023
Site Number	**240**		

Culvert Characteristics	
Culvert Diameter (mm)	1100 mm
Culvert Length (m)	19.0 m
Culvert Slope (%)	5 %
Culvert Material	CMP
Culvert Water Velocity	0.47 m/s
Culvert Shape	Round
Culvert Wetted Width	42 cm
High Water Mark	26 cm
Culvert Water Depth	5 cm
Culvert Outfall Drop	57 cm
Culvert Maintenance	
Comment	

Stream Characteristics		
Pool Depth at Outfall	55	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	101 m	Beaver Pond
Bankfull Width avg	155 m	
Water Depth avg	7.5 cm	
Bankfull Depth (cm)	38.5 cm	
Stream Velocity avg		
Stream Gradient (%)	4.5 %	
Substrate	S10/G40/C50	
Fish Habitat Quality	High	High
Beaver Activity/Type	None observed	Yes
Barrier Evaluation:	Barrier at low to high flows	
Barrier Type	Velocity and outfall drop	
Prescription	Replace with larger diameter culvert	
Comment	Keep in mind high fish values	

Q100 Estimate	1.576
Stream Length Above Barrier	14.5 km
% Stream Barred	87%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 11. Unnamed Creek Culvert Site 240

Unnamed Creek
Site 239

Site 239 culvert drains a small second order low gradient stream about 5.6 km in length that flows into Kispiox River. Site 239 is located on a spur road off Poplar Park Road on the same stream as Site 240 and approximately 1.1 km upstream. The stream provides excellent coho, chinook, and steelhead juvenile habitat upstream and downstream of the culvert. Unknown species of fry — ~ 25 mm in length — were observed downstream of the culvert. Upstream of the crossing, high quality rearing habitat is available; however, no fry were observed. The culvert is undersized, is a outfall barrier, and has an odd combination of fill material over it that consists of logs, small wood debris, and gravel. The crossing needs to be replaced with a larger culvert placed with proper installation practices, keeping in mind the high fish values. Site 240 is rated moderate priority due to the fish values and ease of modifications enabling fish passage. Maintenance issues involve cleaning debris at the inlet.

Figure 46. Site 239 culvert inlet.
View downstream to inlet.

Figure 47. Site 239 culvert inlet.
View upstream from inlet.

Figure 48. Site 239 culvert outlet.
View downstream from outlet.

Figure 49. Site 239 culvert outlet.
View upstream to outlet.

Figure 50. Site 239 culvert.
View upstream through culvert.

Date	16/06/06	Stream Name	**Unnamed Creek**
Road Name	Poplar Park Road spur	Watershed Code	470-Unknown
UTM/GPS Location	09 574248 6150273	Recorders Name	TW/JJ
1:20 000 Map Sheet	93M041	Field Number	93M041-035
Site Number	239		

Culvert Characteristics	
Culvert Diameter (mm)	800 mm
Culvert Length (m)	5.0 m
Culvert Slope (%)	1.0 %
Culvert Material	CMP
Culvert Water Velocity	0.33 m/s
Culvert Shape	Round
Culvert Wetted Width	44 cm
High Water Mark	24 cm
Culvert Water Depth	6 cm
Culvert Outfall Drop	20 cm
Culvert Maintenance	Remove and reset longer culvert
Comment	Culvert needs to be repositioned

Stream Characteristics		
Pool Depth at Outfall	30	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	1.2 m	1.3 m
Bankfull Width avg	2.8 m	2.20 m
Water Depth avg	7.1 cm	12.6 cm
Bankfull Depth (cm)	9 cm	15 cm
Stream Velocity avg	0.06 m/s	0.028 m/s
Stream Gradient (%)	3 %	1.0 %
Substrate	S40/G60	Unknown
Fish Habitat Quality	High	High
Beaver Activity/Type	None observed	None observed
Barrier Evaluation:	Barrier at low to high flows	
Barrier Type	Velocity and outfall drop	
Prescription	Remove and install embedded larger pipe	
Comment	Good habitat	

Q100 Estimate	0.675
Stream Length Above Barrier	13.3 km
% Stream Barred	74%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	10	Partial	6	≥1 km	10	>70%	10	**46**

Table 12: Culvert Site 239

Flatfish Creek
Site 390

Flatfish Creek culvert is located approximately 180 m upstream from Kispiox River and drains a small second order low gradient stream. The system is centered on Flatfish Lake, which is known to have cutthroat present. The extent of fish species and presence in the Flatfish system is unknown; however, unidentified fry were observed both upstream and downstream of the culvert. The stream potentially provides habitat for coho, chinook, and steelhead juvenile. The culvert has log corduroy above the culvert supporting the road bed. Flatfish Creek culvert poses a velocity and outfall drop barrier to juvenile fish. Deactivation is recommended for this site. Site 390 is rated moderate priority due to the fish values and ease of modifications enabling fish passage.

Figure 51. Site 390 culvert inlet. View downstream to inlet.

Figure 52. Site 390 culvert inlet. View upstream from inlet.

Figure 53. Site 390 culvert outlet. View downstream from outlet.

Figure 54. Site 390 culvert outlet. View upstream to outlet.

Figure 55. Site 390 Corduroy and road bed.

Date	15/08/06	Stream Name	**Flatfish Creek**
Road Name	Unknown	Watershed Code	470-5564-0000
UTM/GPS Location	09 539105 6170639	Recorders Name	TW/JM
1:20 000 Map Sheet	103P069	Field Number	103P069-035
Site Number	390		

Culvert Characteristics	
Culvert Diameter (mm)	1000 mm
Culvert Length (m)	18.5 m
Culvert Slope (%)	3.0 %
Culvert Material	CMP
Culvert Water Velocity	0.63 m/s
Culvert Shape	Round
Culvert Wetted Width	31 cm
High Water Mark	25 cm
Culvert Water Depth	5 cm
Culvert Outfall Drop	30 cm
Culvert Maintenance	Remove
Comment	Deactivate road

Stream Characteristics		
Pool Depth at Outfall	0	
Measure	Below Culvert Average	Above Culvert Average
Wetted Width avg	0.88 m	1.6 m
Bankfull Width avg	1.8 m	2.15 m
Water Depth avg	30 cm	15 cm
Bankfull Depth (cm)	28 cm	15 cm
Stream Velocity avg	0.13 m/s	0.08 m/s
Stream Gradient (%)	3.8 %	Unknown %
Substrate	S5/G80/C10/B5	S5/G80/C10/B5
Fish Habitat Quality	Moderate	Moderate
Beaver Activity/Type	None observed	None observed
Barrier Evaluation:	Barrier at low to high flows	
Barrier Type	Velocity and outfall drop	
Prescription	Deactivate	
Comment	Fry observed	

Q100 Estimate	0.9537
Stream Length Above Barrier	2.1 km
% Stream Barred	88%

Fish species		**Habitat value**		**Barrier**		**Length of new habitat**		**Stream barred %**		**Score**
Multiple and Significant	10	H	6	Partial	6	≥1 km	10	>70%	10	**42**

Table 13. Flatfish Creek Culvert Site 390

LOW PRIORITY FISH PASSAGE SITES

Sites rated low restoration priority reflect fish species, habitat value, severity of barrier, amount of new habitat gained, percent of stream barred, and limiting to upstream barriers. The majority of the nineteen low priority crossing sites are located on first and second order streams that have low habitat values. Table 14 summarizes these sites.

Kispiox FPCI Low Priority Restoration Sites

SITE I.D.	STREAM NAME	EAST	NORTH	CROSSING TYPE	FISH PRESENCE	COMMENTS
6	Unknown	561140	6163961	Culvert	Confirmed	Beaver dam built around inlet of culvert. No measurements taken upstream, juveniles present, fish observed in culvert. Low restoration priority.
10	Unknown	568150	6160268	Culvert	Confirmed	Juveniles present. Velocity barrier. Low restoration priority.
14	Unknown	5667184	6163943	Culvert	Inferred	Stream down side of road (upstream). Velocity barrier. Low restoration priority.
20	Unknown	565334	6163809	Culvert	Inferred	Velocity barrier. Low restoration priority.
23	Unknown	564130	6166808	Culvert	Unknown	Kispiox Hatchery coho released here. Velocity barrier. Low restoration priority. Recommend fish presence/absence survey.
43	Sweetin trib	541969	6174700	Culvert	Inferred	Channel braided on lower end. Culvert damaged at outlet resulting in destabilizing road, outlet fill is severely eroded. Holes in culvert at outlet ~1.56 m. Velocity barrier. Low restoration priority.
93	Unknown	545517	6170759	Culvert	Inferred	High gradient culvert. Velocity and outfall drop barrier. Low restoration priority.
171	Unknown	560538	6156815	Culvert	Inferred	Velocity and small outfall drop barrier to juvenile fish. Low restoration priority.
174	Unknown	561160	6155452	Culvert	Unknown	Small outfall drop, potential juvenile barrier. Stream branches upstream of culvert. Fairly small stream with moderate gradient and swampy with low fish habitat values above culvert. Velocity barrier. Low restoration priority.
180	Unknown	560965	6155095	Culvert	Inferred	Stream parallels road and goes down to ditch. Significant sediment source. Ditch is armoured. Road is likely built on top of creek. Stream flows through ditch 74.3m. No rehab prescribed for this site. Poor original road placement. Velocity barrier. Low restoration priority.
183	Unknown	561227	6154422	Culvert	NFP	Velocity barrier. Low restoration priority.
185	Unknown	561389	6154236	Culvert	NFP	Clean logs from outlet. Velocity barrier. Low restoration priority.
186	Unknown	561468	6154082	Culvert	Unknown	Velocity barrier. Low restoration priority.
187	Unknown	561495	6154075	Culvert	Unknown	Velocity barrier. Low restoration priority.
190	Unknown	561719	6153476	Culvert	Inferred	Fish habitat quality is low. Low restoration priority.
197	Unknown	561045	6153000	Culvert	NFP	Culvert is 50% embedded. Velocity barrier to juveniles. Low restoration priority.
271	Unknown	581262	6143775	Culvert	Confirmed	Culvert poses a barrier. Habitat above culvert looks good. Recommend armouring bank to prevent further erosion. Use material from the armouring to build two rock lines across the outlet of the pool to increase the outfall pool depth and provide fish access.

403	Dale Creek Culvert #1	582189	6135019	Culvert	Confirmed	3 culverts- 2 1800mm and 1 500mm overflow. 500 mm overflow damaged, looks as if the overflow is utilized judging by the erosion around inlet and outlet. Fry observed in pool below and above culvert. High gradient stream with large boulders and coble creating step pools. Pipe 1. Velocity and outfall drop barrier. Low restoration priority.
403	Dale Creek Culvert #2	582189	6135019	Culvert	Confirmed	Pipe 2. Velocity and outfall drop barrier. Low restoration priority.

Discussion

This report presents the forestry road fish passage issues in Kispiox Watershed that need to be addressed with restorative or maintenance action. Our findings indicate the need for restoration or rehabilitation on thirty stream crossings. Of these culvert crossings, four are rated as high priority, five are rated as medium, and twenty-one are low priorities. The assessment also found ninety-six stream crossing that require maintenance. The greatest part of the maintenance work is routine and cost effective.

The task of restoring fish passage and upstream habitat at stream crossings involves establishing priorities based on measurable benefits. With limited resources, a focused approach providing the greatest short and long-term benefits to our fish and fish habitat resources is required. Clifford, Skunsnat, Murder, and Hodder creeks are the highest priority culverts to rehabilitate in order to enable fish passage. The amount of potential habitat gained and probable coho and steelhead production are thought to be significant.

Support for moving forward with restoration efforts is being negotiated with the B.C. Ministry of Transportation, BC Ministry of Forests and Range, and forest licensees. Next steps include a meeting of partners and stakeholders to discuss and consider survey results and conceptual restoration plans, then to provide consensus for a work plan that outlines information gaps and assumptions in regard to:

- Restoration cost, liabilities, funding sources, and risks to investment if any,
- Fish species life histories and limiting habitat factors,
- Engineering assumptions and alternatives,
- Further site assessments needed.

Gitksan Watershed Authorities recognizes that a considerable investment will be required to modify the four high priority culverts and install open bottom structures, but restoring fish passage will provide long-term benefits to regional communities, the aboriginal, recreational, and commercial fisheries, as well as to the BC Ministry of Transportation, B.C. Ministry of Forests and Range, and the forest sector.

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Appendix 1 Photographs and Data Tables

Photographs and Data Tables submitted under separate cover.

Appendix 2 Financial Statement of Expenditures

Financial Statement submitted under separate cover.

Appendix 3 Kispiox Culverts Conceptual Restoration Plan

Conceptual Restoration Plan submitted under separate cover.

Fisheries and Oceans
Pêches et Océans

Pacific Region
Sandra Devcic, P.Eng.
Habitat and Enhancement
Fisheries and Oceans Canada
#228 – 417 2nd Avenue West
Prince Rupert, B.C. V8J 1G8

May 4, 2007

Mr. Ken Rabnett
Gitksan Watershed Authority
c/o PO Box 229
Hazelton, B.C. V0J 1Y0

Subject:

Letter of Support to Correct Long Standing Fish Passage Problems in the Kispiox Valley

Dear Ken;

Thank you for taking the time to show Lana Miller, Don Hjorth and myself the fish passage concerns identified in "Fish Passage Assessment of Kispiox Forestry Road Stream Crossings (review draft), by Ken Rabnett and Tim Wilson", specifically the Murder Creek, Skunsnat Creek, and Clifford Creek sites. The Department of Fisheries and Oceans supports your efforts to find partners to correct the problems. We agree that there are definitely fish passage concerns at these locations and would like to see the old culverts removed as soon as possible, preferably in the 2007 fish window. The following is a brief summary of our suggestions based on the site visit on May 4th, 2007.

- Murder Creek

  The height of fill above the existing culvert and the width of the channel both upstream and downstream of the structure, suggest that the preferred option would be to replace the wood stave culvert with a 12m concrete box beam bridge on precast spread footings, possibly with the additional support of piles depending on the geotechnical assessment. In the interest of public safety, we would prefer to see the structure be at least 12 m to allow for a livestock underpass, which may mean that precast abutment walls need to be used.

- Skunsnat Creek

  Bedrock is visible at the outlet of the culvert, on both banks, and is likely to be available for a foundation of an open bottom arch culvert on cast-in-place

footings. If investigation determines that the creek bottom is bedrock, a pool and weir fishway will be required through the structure. The road geometry and fill depth restrict the available options at this site.

- Clifford Creek

  The preferred option at Clifford Creek would be to replace the existing wood stave culvert with a 12m box beam bridge on spread footings, but possibly piles, due to the site conditions. The Clifford Creek site does not appear to have as much road fill as the previous sites and has quite a significant pool on the outlet end of the existing culvert. A bridge would allow this site to balance the upstream channel shape and downstream channel shape more natural shape and provide better fish passage.

The initial estimate to construct the structures listed above would possibly be $400 - 500K each. The estimate is based on a ballpark price of $4000m^2 for the supply and construction, a range based on approximate bid prices received for recent Ministry of Transportation bridge/culvert replacement tenders, and the assumption that the replacement structure can be constructed using current material values and construction costs.

However, we feel that the range provided above is high and could be significantly reduced because the sites are located on a low volume, gravel road, so costs such as paving, detours and significant traffic control may not be necessary. At this point, the estimates do not include the design and geotechnical investigation, and please note that these numbers have not been confirmed with material suppliers, therefore, should only be used in conceptual discussions with an engineer.

Please feel free to call me if you have any questions regarding the above explanation. I can be reached at (250) 638-6941.

Sincerely,

_____

Sandra Devcic, P.Eng.
Resource Restoration Engineering Technician
North Coast Area

Reviewed By: Don Hjorth, P.Eng, RRU Engineer

cc: Lana Miller, RRU Biologist
Daryl Nolan, MOT
Nini Long, P.Eng., MOT
Bruce Shepherd, North Coast Area Chief, DFO

Appendix 4 Maps

Two 1:50,000 maps in pockets.