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April 5, 2002

Graeme McLaren
Director, Minerals, Oil and Gas Division
Ministry of Sustainable Resource Management
1810 Blanshard Street, 1st Floor
Victoria, BC V8W 1L8

Mr. McLaren:

RE: FINAL DELIVERABLES, OVERVIEW FISH AND FISH HABITAT INVENTORY, MUSKWA WEST PTPA AND BUCKINGHORSE & POCKETKNIFE SECTION OF BESA-PROPHET PTPA

Enclosed please find one copy of the final report for the aforementioned project. The report binder contains three CD-ROM disks which comprise the digital deliverables for the project. The 1:50,000 scale project mapsheets were plotted by Spatial Mapping Ltd. of Prince George and were couriered to your office this week. I trust that they have arrived by now; if not, please inform me.

As per earlier discussion, other deliverables for this contract will be shipped to Jeff Burrows, former Fisheries Inventory Specialist for Region 7B, in Fort St. John. Those will include

- the FISS datasheets and labeled maps which he will submit to the Fisheries Data Warehouse in Victoria for update of the province-wide FISS database;
- the hard copy Photodocumentation binders;
- one set of 1:50,000 project mapsheets;
- digital copies of the final report and all other digital deliverables, on CD-ROM.

If you have any questions regarding the contract products, or have additional needs regarding this project, please contact me by any of the means listed above.

Sincerely,

Joe DeGisi

Overview Fish and Fish Habitat Inventory
Muskwa-Kechika Management Area

Muskwa West Pre-Tenure Plan Area
and
Buckinghorse & Pocketknife Portion of
Besa-Prophet Pre-Tenure Plan Area

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31 March 2002

Executive Summary

The Muskwa-Kechika Management Plan legislates pre-tenure planning as a prerequisite to the issuance, approval, permitting or authorization of oil and gas development allocation or management. Information on aquatic ecosystems is required for balanced resource planning in the Muskwa-Kechika Management Area for both mapping/zoning requirements and access management planning. This document presents results of an overview fish and fish habitat inventory for portions of Muskwa West and Besa-Prophet pre-tenure plan areas (PTPAs) in support of those requirements.

Muskwa West comprises a strip of land of width approximately 20 km and length roughly 120 km with long axis oriented north-south, bounded in the north roughly by the Tetsa River; the southern boundary lies near the Prophet River channel and the mainstem Muskwa River forms the eastern border except at the southern end. The area of interest for this project excludes the southern extremity of Muskwa West PTPA, which lies within the Upper Prophet River watershed group of the B.C. Watershed Atlas. Prior to this project overview inventory of the Upper Muskwa and Middle Muskwa watershed groups, which also overlap the Muskwa West PTPA, were conducted separately. Results of those projects were supplemented for this overview by sampling additional sites in each of those watershed groups and summarizing all sampling information from this and the previous field projects. Besa-Prophet PTPA encompasses the headwaters of the Prophet River, from the confluence of the Besa River upstream. Within the Besa-Prophet PTPA, the area of interest for this study comprises the Buckinghorse River and Pocketknife Creek headwaters. No prior sampling of fish and fish habitat has been reported for these basins within the PTPA; the present study serves as a supplement to overview fish and fish habitat inventory for the remainder of the Besa-Prophet PTPA which was completed in 1999/2000.

During the field portion of the study, 14 stream sample sites were completed within or adjacent to the Muskwa West PTPA, on August 22 and 23, 2001. Six stream sites were sampled within the Buckinghorse & Pocketknife section of the Besa-Prophet PTPA, on August 24, 2001. No lakes were sampled in either PTPA. Habitat and fish populations at all stream sites were sampled in accordance with B.C. Resource Inventory Committee standards for overview fish and fish habitat inventory. Fish capture methods which were employed included electrofishing (all sites), angling (7 sites), and pole seining (5 sites). Previous inventories of the Upper Muskwa and Middle Muskwa watershed groups sampled 25 stream sites in or near Muskwa West PTPA. Other sampling activity in the Muskwa River watershed has included surveys of lakes and channels upstream of the project area, and fish collections downstream of the PTPA. External to the Besa-Prophet PTPA, several sites have also been sampled previously in the drainages which contain the Buckinghorse and Pocketknife basins.

Seven fish species were captured in the Muskwa West PTPA by sampling during the field component of this project. These included Arctic grayling, bull trout, lake chub, longnose sucker, longnose dace, mountain whitefish, and slimy sculpin. Previous overview sampling in the PTPA and immediate surroundings also yielded only these seven species. Other fish species previously reported present in waters upstream include burbot, lake trout, rainbow trout and white sucker. In the Muskwa watershed downstream of the Tetsa River confluence, additional known species occurrences include inconnu, northern pike, finescale

dace, trout perch, spoonhead sculpin, and flathead chub. Species present upstream of the Muskwa West PTPA probably are also present occasionally in waters within the PTPA, at abundances which are difficult to detect by the methods and sampling intensities employed in overview inventory. Species known to occur nearby but downstream of the Muskwa West PTPA might also occur within the PTPA but remain unsampled for similar reasons, or their ranges may not extend to the waters within the PTPA. In the Besa-Prophet project area, 3 fish species were encountered at one or more of the Pocketknife Creek sites: Arctic grayling, bull trout, and slimy sculpin. Previous sampling downstream of the PTPA in the Minaker River drainage, to which Pocketknife Creek is tributary, yielded only Arctic grayling and slimy sculpin. Sites within the Buckinghorse River drainage yielded only Arctic grayling and slimy sculpin; prior sampling in the Buckinghorse basin downstream of the PTPA resulted in the capture of those two species as well as longnose dace. The latter species may not occur within the PTPA, or its presence may have been undetected by our sampling.

Slimy sculpin, mountain whitefish and Arctic grayling were the most ubiquitous fish species in the Muskwa West study area. Mountain whitefish were not captured in the Buckinghorse & Pocketknife portion of the Besa-Prophet PTPA, but slimy sculpin and Arctic grayling were also widely distributed in those basins. Species diversity was highest at large-channel sites on the Muskwa River mainstem and Tetsa River. In general, distribution of mountain whitefish and grayling life stages was in agreement with previous studies of habitat use by east slope Rocky Mountain fish populations in the region. Small juveniles were captured at low elevation sites: grayling in the lower reaches of tributaries, and mountain whitefish moreso in the mainstems of the largest channels. Large juveniles and adults of these two species were widely distributed in accessible channels, with grayling distributions tending to extend farthest into the headwaters of most systems. Both species may make seasonal migrations to utilize higher-elevation habitat in the summer, and overwinter in larger low-elevation channels, as has been suggested by the results of other studies.

Bull trout reproduction appears to occur in the Tetsa River and Gathto Creek watersheds, though probably upstream of the PTPA. Bull trout are also present in Kluachesi Lake; it is unknown whether the Kluachesi population is headwater-resident, or migratory as other Muskwa watershed populations are assumed to be. Sampling of Pocketknife Creek also yielded small juvenile bull trout which may indicate that spawning of the species occurs in that stream within the Besa-Prophet PTPA.

The majority of order 3 and higher order channels within both PTPAs appear to offer habitat seasonally well-suited to fish, notwithstanding low average water temperature, turbidity and seasonal variation in flow which all constrain fish production in the area. Gradients are generally moderate, habitat complexity is typically fair to good, and water chemistry apparently suited to aquatic productivity. Only two permanent impediments to fish passage were noted within the PTPA study areas. A canyon on the Chischa River appears to have blocked fish access to the waters upstream; a set of cascades on an unnamed tributary to the Tetsa River is probably a seasonal impediment but not a permanent barrier to upstream passage. Beaver impoundments are present on many channels within both PTPAs and appear to disrupt fish migrations. Fish sampling was typically unproductive in unimpounded and apparently suitable channels upstream of extensive beaver dam complexes, suggesting that dams may have obstructed seasonal movements by species such as grayling which often occupy such habitats in the summer.

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1. Introduction

1.1. Background

The Fort Nelson and Fort St. John Land and Resource Management Plans recognized the special wilderness and wildlife characteristics of the Muskwa-Kechika Management Area (M-KMA) and recommended that this area be formally designated through legislation. Enabled through the M-KMA Act, planning and management of Crown land and natural resources in the M-KMA must be conducted in accordance with the Muskwa-Kechika Management Plan, which legislates pre-tenure planning as a prerequisite to the issuance, approval, permitting or authorization of oil and gas development allocation or management. Information on aquatic ecosystems is required for balanced resource planning in the M-KMA for both mapping/zoning requirements and access management planning.

1.2. Areas of Interest

1.2.1. Muskwa West

Muskwa West Pre-Tenure Plan Area (referred to hereinafter simply as Muskwa West PTPA, this plan area was formerly referred to as Area 2) comprises a strip of land of width approximately 20 km and length roughly 120 km, with long axis oriented north-south. In the north the area is bounded roughly by the Tetsa River; the southern boundary lies near the Prophet River channel. The mainstem Muskwa River forms the eastern border of Muskwa West PTPA, except at the southern end.

Muskwa West PTPA is bisected into discrete north and south portions by the park-enclosed Tuchodi River watershed. Muskwa West PTPA includes portions of BC Watershed Atlas groups "Upper Muskwa River" (UMUS), "Middle Prophet River" (MPRO), and "Upper Prophet River" (UPRO). Overview inventory of UPRO was completed in autumn of 2000. The section of Muskwa West PTPA which overlaps that watershed atlas group, at the southernmost end of the south portion, is thus not considered to lie within the area of interest for this project.

1.2.2. Besa-Prophet

Besa-Prophet Pre-Tenure Plan Area (referred to hereinafter simply as Besa-Prophet PTPA) encompasses the headwaters of the Prophet River, from the confluence of the Besa River upstream. It includes the Besa River drainage, downstream (approximately) of the Keily Creek confluence. All of these waters lie within the Upper Prophet River Watershed Group. The Besa-Prophet PTPA also includes the headwaters of the Buckinghorse River west of approximately 123° 08' 40", which lie within the Upper Sikanni Chief Watershed Group.

Overview fish and fish habitat inventory of waters within the Besa-Prophet PTPA was completed in 2000 (Diversified Environmental Services 2000). The Buckinghorse River and Pocketknife Creek headwaters within the Besa-Prophet PTPA were excluded from that inventory study. This portion of these latter basins comprises the area of interest within the Besa-Prophet PTPA for the present project.

Map 1. Location of study areas in northeastern British Columbia (following page).

2. Methods

2.1. Sample Site Location Selection

Initial planning for this project, including summary of pre-existing fish and fish habitat information as well as sample site location selection, was completed and reported independently (De Gisi 2001). The plan was developed to the present standard for overview inventory, which applies stream order as a hierarchical physiographic framework for sample site selection, typically with a single watershed atlas group defined as the area of interest (Resource Inventory Committee 1999). The standard suggests that for each watershed group the plan should support sampling of two locations in each mainstem (5th, 6th, 7th) order-class section, one location in each 4th order section, and one 3rd, 2nd and 1st order location in each 4th order basin. The intention of pre-tenure planning, including fish and fish habitat inventory, is to maintain the functioning biophysical integrity of *enclosed and contiguous* aquatic systems. As a result, for the purposes of the project design, stream channels which form a portion of the boundary of the project area of interest were treated as if enclosed within it.

A significant proportion of the Muskwa West PTPA is composed of order 1 to 3 remnant drainages, tributary to the Muskwa River mainstem which traverses and bounds the plan area at order 6 throughout. Low-order remnant drainages are not explicitly considered by the hierarchical framework for overview inventory. However, a moderate sampling intensity within such drainages was warranted for this project, since the area of interest does not correspond to one or more discrete entire high-order drainages. Low-order streams adjacent to large mainstem channels often provide important seasonal habitat for fish.

Before 2001, documented sampling of fish and fish habitat in the project area of interest was essentially limited to an unpublished low-intensity overview inventory of MMUS conducted by Peace Sub-region Fisheries Section in 1998 (Burrows 2002). The plan for completing overview inventory in the Muskwa West PTPA (De Gisi 2001) selected 6 additional sites in the PTP section of the MMUS group to bring the coverage in that area to the present standard. Thirteen additional sites were selected in the remaining sections of the Muskwa West PTPA overlapping UMUS, and one site in the small section within MPRO.

Subsequent to the completion of the plan for overview inventory in the Muskwa West PTPA (De Gisi 2001), but prior to the implementation of the field component of the plan in the present project, the Muskwa Kechika Trust Fund independently contracted a complete overview inventory of UMUS. Site selection and field sampling activity were carried out in July 2001. To maximize the cost-effectiveness of available funds and reduce potential duplication at the overview level, six sites in UMUS were eliminated from the Muskwa West PTPA plan, comprising one field day of this project.

The available field day was used for inventory in previously unsampled portions of the Besa-Prophet PTPA. The Buckinghorse River and Pocketknife Creek comprise fourth-order basins within the Besa-Prophet PTPA. Three sample sites were chosen for each basin.

No lakes were sampled in the project because none of size sufficient to warrant survey were noted in the project area during map review.

2.2. Logistics And Access

Access to all sampling sites was accomplished by charter of a Bell 206B helicopter based in Fort Nelson. The field program was accomplished over three consecutive calendar dates, with overnight accomodation in Prophet River.

Sample sites were placed as close as possible to the pre-survey plan locations. Final location selection was made on the basis of available terrain for landing and takeoff, and adjusted by aerial observations of habitat diversity prior to landing.

Site coordinates were obtained in the field by uncorrected recreational-grade GPS (Garmin eTrex) except where forest cover prevented its use (one site). In that situation, the onboard GPS of the helicopter was used to obtain coordinates while hovering above the site.

Photographs and coordinates of notable channel features (cascades, slope failures) were obtained during transit flights between sites. Beaver dams were too numerous in much of the study area for individual photographs and recording of coordinates; general notes were recorded about their prevalence on sampled channels.

Weather was inclement during much of the field program. Low cloud ceiling provided limited opportunity for panoramic aerial photos of drainages and channels. To supplement the aerial photographs which were obtained during sampling flights, a number of images from the 1998 overview inventory of the Middle Muskwa Watershed Group (Burrows 2002) are included in this report.

2.3. Site Sampling Methods

The field crew was composed of three persons, in addition to the pilot. Typically two crew members engaged in fish sampling while the third person completed the habitat sampling and recording. The pilot occasionally assisted in some activities.

2.3.1. Fish Population Sampling

Depending on characteristics of habitat present at the site, sampling of fish populations was accomplished by one or more methods. These included angling, electrofishing, pole seining, and dip netting.

Angling techniques included roe, spinners and spoons, when water with appropriate velocity, depth and cover were present within the site. Many sites on smaller channels did not provide habitat suited to angling, and the largest channels were usually too turbid for on-site angling to be productive.

Electrofishing was conducted without stop-nets, using a Smith-Root backpack generator-powered model 15C-POW. Output voltage varied according to water chemistry, but was usually 200 to 300 V. Effort was applied in both upstream and downstream directions, from bank to bank in smaller channels. At sites on larger waters, electrofishing was conducted in side-channels and in slower current along margins of main channels. Rapid downstream electrofishing was also applied in water of moderate depth and intermediate velocity, a technique which can be effective for "ambush" capture of larger fish particularly in turbid conditions.

We pole seined channels of moderate to large size. The seine length was 5 m, depth 1.5 m, and mesh 6 mm, with a heavily-weighted lead line and stout poles of length 1.75 m. Habitat which could be sampled with this method included water of shallow to moderate

depth, and intermediate velocity. Seine hauls were usually made in a downstream direction, with one end of the seine at or very near the bank. Deeper slow water was also seined, often in side channels where bank-to-bank coverage could be obtained.

To reduce trauma from handling, captured fish were anesthetized using clove oil dissolved in ethanol, mixed with stream water to a final concentration of 100 ppm. Round weight of fish under 200 g was obtained by electronic balance; larger fish were weighed by spring scale. Photographs were taken of representative individuals of all fish species captured. Except when sacrificed for determination of sexual maturity, fish were released alive after recovery from anesthetization. Age structures were collected from all salmonids, or an appropriate subsample of all size classes when many fish of a particular species were captured at a site. Arctic grayling and mountain whitefish were aged by scales, which were mounted between microscope slides and viewed using a microfiche reader (magnification 50X) for interpretation by the author. Bull trout ages were estimated from fin rays which were sectioned and interpreted by North/South Biological Consultants[1], or from otoliths when fish were sacrificed for maturity data. Otoliths were interpreted whole under 20X stereoscopic magnification, by the author.

2.3.2. Habitat Sampling

Parameters required by the Resource Inventory Committee standard Site Card were estimated and recorded at each site (Resource Inventory Committee 1998). Upstream and downstream surface photos were taken of each site, as well as aerial photographs during helicopter approach to or exit from the site.

Rather than estimating water chemistry parameters on-site, water samples (250 ml) were collected at each location. At each field day's end, pH and specific conductance were estimated for all samples, using Hanna Instruments meters HI9023 and HI9033 respectively.

Beaver dams were extremely abundant on many channels which were overflown, and we made no attempt to map their location or characterize their height. We noted where impoundment complexes were extensive, as an effect on fish presence was often apparent at sample sites upstream.

2.3.3. Site Location Referencing

All waters within the study area lie in the Muskwa River drainage. Correspondingly, their watershed codes all begin with the digits 212. Those digits have been trimmed from most watershed code references in this document for brevity. Site coordinates in tables of the report text provide GIS-derived values which have been snapped to the stream centrelines of the BC Watershed Atlas. In the report text, numbers for sample sites are presented in [square brackets] for clarity. Sample site numbers given for the previous overview inventories in UMUS and MMUS are the original (field) site numbers assigned during those projects, and are also used on the map deliverables for this contract. The final reports for those projects were not available during the preparation of this document, and the final site numbering in the reports may differ from the field site numbering given here.

[1] 83 Scurfield Blvd.; Winnipeg, Manitoba; R3Y 1G4

3. Results

3.1. Muskwa West PTPA

During the field portion of the study, 14 stream sample sites were completed within or adjacent to the Muskwa West PTPA. Site visits were conducted on August 22 and 23, 2001. Locations are provided in Table 1 and depicted on Map 2 and Map 3 (Appendix II). Habitat data (RIC Stream Cards), fish collection data (RIC Fish Cards), and site surface and aerial photographs are presented in order of site number in Appendix III through Appendix XV and Appendix XXII.

The geographic coordinates of 25 stream sites in or near the Muskwa West PTPA, sampled during the UMUS and MMUS overview inventories conducted prior to this study, are provided in Table 4. The site locations are also depicted on Map 2 and Map 3 (Appendix II).

The following section of this document provides an overview of the results of sampling by this study and previous overviews in the area. Subsequent sections present the basin-specific results in greater detail.

3.1.1. General Summary

3.1.1.1. Site Physical and Chemical Characteristics

A summary of physical and chemical characteristics of stream sites sampled in the Muskwa West PTPA during the field portion of the study is presented in Table 2. Water temperature ranged between 4 and 11°C. Warmer temperatures were observed in the larger channels and other low-elevation sites, while the coldest temperatures occurred at the higher sites in the interior of the PTPA. With the exception of a single site east of the Muskwa River on a highly disturbed channel, pH estimates were moderately basic for all sampled channels. Conductance varied much more widely, but suggest intermediate to productive trophic status; all estimates were within the range capable of supporting fish. Mainstem rivers were turbid, as were some smaller streams. Heavy rain immediately before and during the field component of the study may have elevated the turbidity in the latter channels as well as possibly the lower Tetsa River.

Table 5 provides available physical and chemical parameters for stream sites in or near the Muskwa West PTPA which were sampled during the UMUS and MMUS overview inventories conducted prior to this study. The range of values for pH and conductance at sites in the 1998 MMUS overview inventory agrees relatively well with values for these parameters estimated at sites during the present study. The 1998 overview was conducted on several dates between September 4 and September 24, so the pattern in temperature differences among sites may be obscured by the rapid seasonal change in average water temperatures which occurs at the end of summer.

3.1.1.2. Fish Species Occurrence

Seven fish species were captured by sampling during the field component of this project. These included Arctic grayling, bull trout, lake chub, longnose sucker, longnose dace, mountain whitefish, and slimy sculpin (Table 3). Fish species diversity was highest at

mainstem sites on large channels such as the Tetsa and Muskwa rivers; all seven species encountered in the study were captured at one site on the Muskwa River (Table 3).

Slimy sculpin and mountain whitefish were the most ubiquitous fish species. Each was captured at 5 of 7 sites where fish were found present; all of these sites were located on large channels (Muskwa mainstem, Tetsa and Gathto rivers). All life stages of mountain whitefish were captured one or another of these large-channels sites, though only a single site on the Muskwa River yielded all life stages at the same site. Mountain whitefish were the only young-of-year salmonid captured during the study, indicating reproduction of the species in or near those sites. Arctic grayling were encountered as juveniles at two of the large-channel sites, and as juvenile and sub-adult stages on smaller tributary channels within the PTPA. Bull trout of the juvenile and sub-adult stages were captured only at two large-channel sites. The absence of salmonid fry from the smaller channels sampled in the interior of the PTPA suggests that those streams are used seasonally for rearing by salmonid game fish species, but possibly not for reproduction.

At 7 of the 14 sites of the present study, in or adjacent to the Muskwa West PTPA, no fish were captured. Overflight did not reveal permanent impassable barriers downstream of sampling locations on any of the streams with sites which yielded no fish. However, beaver impoundments were typically abundant on such channels. Beaver dams likely obstruct seasonal movements by fish which might otherwise lead to summer utilization of those streams as rearing habitat.

The same assemblage of seven species was also captured at various sites in or adjacent to the Muskwa West PTPA, during the MMUS and UMUS watershed group inventories which previously sampled in the area (Table 6). Nineteen of the 25 sites in those overview inventories yielded fish. Arctic grayling and slimy sculpin were the most ubiquitous fish species, with one or more life stages of the former species present at 16 sites, and the latter species at 15 sites.

The pre-existing UMUS inventory sampled just one large-channel site in or near Muskwa West PTPA, on the Gathto River upstream of the PTPA. Perhaps as a result, mountain whitefish young-of-year were not captured at any of the sites in that study which were in or near the PTPA, though whitefish juveniles and sub-adults were present in smaller tributary channels in the interior of the PTPA. The latter occurrence contrasts with the sampling for the field portion of the present study which captured mountain whitefish only at large channel sites. Another significant variation was the capture of Arctic grayling fry by the UMUS inventory at two sites in Kluachesi Creek watershed within the PTPA, suggesting that reproduction of the species occurs in that system. In contrast, Arctic grayling fry were not captured at any of the sites in the field component of the present study.

In addition to the large-channel fish species assemblage noted during the present study, mountain whitefish and bull trout juveniles were captured in tributary channel sites during the MMUS overview inventory along with Arctic grayling juveniles and sub-adults. Age data were not available for the MMUS study to confirm the differentiation between young-of-year and juvenile salmonids, but Arctic grayling which may have been young-of-year were captured in the lower reaches of the larger tributary channels such as Falk Creek and the Chischa River.

In addition to the fish sampled during the present study and the UMUS and MMUS overview inventories, other species previously reported present in waters within the Muskwa West PTPA or in waters upstream include burbot, lake trout, rainbow trout and white sucker

(surveys of Grizzly, Kluachesi, Summit and Tetsa lakes, B.C. Environment lake files, Fort St. John, B.C.; Woods 2001). Of those species, burbot are most likely to be widely distributed in the Muskwa West PTPA study area but are less-frequently captured by the methods employed, particularly in turbid water. Rainbow trout in Fern, Summit and Grizzly lakes are introduced populations. Rainbow trout are also present, at least seasonally, in the North Tetsa River downstream of Summit Lake (Zuchewich 1994) and the species presumably occurs sporadically in the Tetsa River adjacent to Muskwa West PTPA though none have been captured during inventory sampling. White sucker are not usually abundant in turbid-water systems, though if present in Kluachesi Lake the species likely occurs at low abundance in Kluachesi Creek and the Muskwa River within and adjacent to the PTPA. As their name implies, lake trout are typically lentic so the aquatic habitat offered by channels within or adjacent to the Muskwa West PTPA would be poorly suited to the species.

3.1.1.3. Impediments to Fish Passage

A single set of cascades on unnamed channel 580800-30200-37400, downstream of Muskwa West PTPA, comprised the only permanent impediment to fish passage noted during the field portion of this overview inventory (Map 2). Presence of a single fish, likely an adult Arctic grayling, was detected by electrofishing at site #1 on this channel upstream of the cascades. The occurrence of fish at the site suggests that the cascades are not completely impassable, as a headwater-resident population of either Arctic grayling or bull trout does not seem likely in this basin. Impassable permanent barriers to upstream movement of fish were not noted on any of the other channels within the UMUS portion of Muskwa West PTPA which were examined by the prior inventory activity in that group (T. Euchner, personal communication). During overflight in the 1998 inventory of MMUS (Burrows 2002), cascades judged impassable to fish were documented on the Chischa River channel within the Muskwa West PTPA (Map 2). That study noted no other permanent barriers on channels within the MMUS portion of Muskwa West PTPA, though cascades on Chlotapecta Creek were noted just upstream of the PTPA boundary and beaver activity was extensive on some streams.

Table 1. Fish and fish habitat sample site locations for 2001, Muskwa West PTPA. Column headings are self-explanatory except: **Group** gives the abbreviation for the BC Watershed Atlas watershed group which contains the site. UTM coordinates are field positions snapped by GIS to the stream linework of the BC watershed atlas. Site 20 is adjacent to the PTPA.

Site	Water	Watershed Code	Group	UTM (NAD83)
1	Unnamed	580800-30200-37400	MMUS	10.430607.6498737
2	Unnamed	580800-30200-37400	MMUS	10.430973.6496097
3	Tetsa R	580800-30200	MMUS	10.455880.6501166
4	Unnamed	580800-39100-39300	MMUS	10.454418.6470092
5	Muskwa R	580800	MMUS	10.462492.6474034
6	Unnamed	580800-36500	MMUS	10.451743.6477347
7	Unnamed	580800-43000	UMUS	10.455937.6457735
8	Unnamed	580800-44100	UMUS	10.457888.6454120
9	Unnamed	580800-44400-05700-2400-5090	UMUS	10.456909.6445478
10	Gathto Ck	580800-44400	UMUS	10.459571.6445031
11	Muskwa R	580800	UMUS	10.471779.6415366
12	Muskwa R	580800	UMUS	10.472570.6442060
13	Bunch Ck	580800-04700-51100	UMUS	10.483703.6414236
20	Unnamed	580800-33000	MMUS	10.455806.6491043

Table 2. Physical characteristics of fish habitat recorded at sample site locations for 2001, Muskwa West PTPA. **Width** refers to channel width in metres; **Gradient** values are percentages; **Morphology** provides the channel form code in upper case font and dominant substrate code in lower case (see Table 12 and Table 13 for code definitions); **Temp**erature unit is degree Celsius; **Cond** refers to specific conductance, where unit is µmhos; **Turb**idity codes are given in Table 11. Site 20 is adjacent to, but not within, the PTPA.

Site	Width	Gradient	Morphology	Temp	pH	Cond	Turb	Order	Magnitude
1	12.5	1.0	CPBb	5.0	8.1	468	C	4	16
2	6.3	2.7	CPBc	4.0	8.2	487	C	3	10
3	219.0	1.3	RPCWc	9.5	8.3	354	T	5	396
4	4.2	2.5	RPGWg	8.0	8.4	477	M	2	7
5	370.0	0.0	RPc	10.0	8.4	399	T	6	1802
6	2.1	0.8	LCf	7.0	8.3	280	M	3	8
7	6.1	1.0	RPc	6.5	8.3	387	M	2	6
8	4.2	1.5	RPb	7.0	8.1	164	M	3	7
9	3.1	4.5	CPf	7.5	7.6	120	M	1	1
10	190.6	1.0	RPc	10.0	8.3	419	C	5	315
11	156.3	0.5	RPc	11.0	8.4	316	M	6	545
12	97.2	1.0	RPc	10.5	8.0	353	T	6	722
13	3.6	0.8	LCf	10.5	8.0	138	M	3	6
20	38.8	4.0	CPc	10.0	4.6	969	T	3	6

Table 3. Fish species captured at sample site locations for 2001, Muskwa West PTPA. Fish species codes are provided in Table 10; parentheses indicate suspected but unconfirmed presence. For each game-fish species, following the species code are lower case letters designating the life stages captured at the site, where f = fry, j = juvenile, s = sub-adult and a = adult. Capture **Method** codes are: AG = angling; EF = electrofishing; SN = pole seine. Site 20 is located adjacent to, but not within, the PTPA.

Site	Water	Fish Species / Life Stage Codes	Methods
1	580800-30200-37400	(GR)	AG EF
2	580800-30200-37400	NFC	EF
3	Tetsa R	BTs CCG GRj LKC LSU MWj	AG EF SN
4	580800-39100-39300	NFC	EF
5	Muskwa R	BTj CCG GRj LKC LNC LSU MWj	AG EF SN
6	580800-36500	NFC	EF
7	580800-43000	NFC	EF
8	580800-44100	GRjs	EF
9	580800-44400-05700-2400-5090	NFC	EF
10	Gathto Ck	CCG MWf	EF SN
11	Muskwa R	CCG LKC LSU MWfj	AG EF SN
12	Muskwa R	CCG LKC LSU MWfja	EF SN
13	Bunch Ck	NFC	DN EF
20	580800-33000	NFC	EF

Table 4. Fish and fish habitat sample site locations in or adjacent to the Muskwa West PTPA, with survey completed prior to the field component of this study. Column headings are self-explanatory except: **Site** gives the field site number used by the project which conducted the sampling; **Source** refers to the project which collected the data where D = Diversified Environmental Services' 2001 inventory of UMUS; B = Burrows' unpublished 1998 inventory of MMUS. UTM coordinates are snapped to the stream linework of the BC watershed atlas.

Site	Water	Watershed Code	Source	UTM (NAD83)
17	Gathto Ck	580800-44400	D	10.453751.6437414
18	Beckman Ck	580800-44400-05700	D	10.462507.6450472
20	Kluachesi Ck	580800-48300	D	10.465322.6443817
21	Unnamed	580800-48300-19500	D	10.463666.6438695
25	Unnamed	580800-55600	D	10.480016.6430666
26	Unnamed	580800-62000	D	10.476940.6420662
30	Varrick Ck	580800-54700	D	10.477555.6432017
31	Varrick Ck	580800-54700-60200	D	10.466963.6428917
32	Unnamed	580800-54700-74200	D	10.465783.6425243
33	Reimer Ck	580800-64400	D	10.469541.6419220
34	Puder Ck	580800-64700	D	10.471317.6409384
35	Wenger Ck	580800-60500-59700	D	10.477349.6412799
36	Wenger Ck	580800-60500	D	10.480464.6419763
16	Chischa R	580800-39100	B	10.445919.6490384
17	Chischa R	580800-32000	B	10.449687.6491231
18	Chlotapecta Ck	580800-33700	B	10.444816.6482405
19	Chlotapecta Ck	580800-33700	B	10.453157.6488994
20	Falk Ck	580800-32000	B	10.462034.6472112
2-1	Doan Ck	580800-30200-11300	B	10.441636.6495484
2-2	Doan Ck	580800-30200-11300	B	10.451813.6498804
2-3	Tetsa R	580800-30200	B	10.411730.6488055
2-4	Unnamed	580800-30200-63400	B	10.418708.6494062
2-5	Unnamed	580800-30200-48500	B	10.423508.6501193
2-6	Tetsa R	580800-30200	B	10.449105.6500190
M1	Muskwa R	580800	B	10.458867.6498651

Table 5. Physical characteristics of fish habitat recorded at sample site locations in or adjacent to the Muskwa West PTPA, with survey completed prior to the field component of this study. Site numbers correspond to those in Table 4. **Width** refers to channel width in metres; **Gradient** values are percentages; **Morph**ology provides the channel form code in upper case font and dominant substrate code in lower case (see Table 12 and Table 13 for code definitions); **Temp**erature unit is degree Celsius; **Cond** refers to specific conductance, where unit is µmhos; **Turb**idity codes are given in Table 11.

Site	Width	Gradient	Morph	Temp	pH	Cond	Turb	Order	Magnitude
17	91.7	1.5	RPc	-	-	-	-	5	300
18	14.2	1.0	RPc	-	-	-	-	3	53
20	27.4	0.8	RPc	-	-	-	-	4	86
21	13.1	1.5	RPc	-	-	-	-	3	7
25	12.3	1.3	RPc	-	-	-	-	3	17
26	2.5	1.0	RPf	-	-	-	-	2	2
30	22.8	1.5	RPc	-	-	-	-	4	31
31	7.5	4.0	RPc	-	-	-	-	2	3
32	3.5	1.3	RPc	-	-	-	-	2	5
33	10.2	1.3	RPg	-	-	-	-	3	9
34	8.0	1.0	RPc	-	-	-	-	3	5
35	2.8	1.0	RPc	-	-	-	-	3	5
36	9.2	0.8	RPc	-	-	-	-	3	10
16	54.0	0.6	RPc	7.0	8.60	450	C	4	150
17	121.8	1.5	RPc	7.9	8.64	457	C	4	156
18	57.6	0.5	RPc	6.2	8.50	700	C	4	117
19	69.7	0.5	RPc	9.4	8.54	689	C	4	134
20	17.8	0.3	RPg	9.8	8.50	603	C	4	45
2-1	7.7	0.8	RPf	4.9	-	563	C	2	3
2-2	17.5	0.4	RPf	7.0	8.56	546	L	4	35
2-3	47.5	1.1	RPc	5.3	8.52	263	C	2	5
2-4	44.8	0.3	RPg	4.0	8.64	541	C	3	34
2-5	31.0	1.0	RPg	7.0	8.54	650	C	4	48
2-6	104.7	0.9	RPc	10.1	8.52	459	L	5	343
M1	103.0	0.3	RPc	8.9	8.40	487	M	6	2236

Table 6. Fish species captured at sample site locations in or adjacent to Muskwa West PTPA, with survey completed prior to the field component of this study. Site numbers correspond to those in Table 4. Fish species codes are provided in Table 10. For each game-fish species for which age data were available, following the species code are lower case letters designating the life stages captured at the site: f = fry, j = juvenile, s = sub-adult and a = adult. Capture method codes: AG = angling; EF = electrofishing; SN = pole seine.

Site	Water	Watershed Code	Species
17	Gathto Ck	580800-44400	BTj CCG GRj MWj
18	Beckman Ck	580800-44400-05700	CCG GRj MWj
20	Kluachesi Ck	580800-48300	CCG GRfj MWj
21	Unnamed	580800-48300-19500	GRfj
25	Unnamed	580800-55600	CCG GRj MWj
26	Unnamed	580800-62000	CCG GRj MWj
30	Varrick Ck	580800-54700	CCG GRj LSU
31	Unnamed	580800-54700-60200	CCG LNC MWj
32	Unnamed	580800-54700-74200	GRj MWjs
33	Reimer Ck	580800-64400	GRj MWj CCG
34	Puder Ck	580800-64700	GRj MWj
35	Wenger Ck	580800-60500-59700	CCG
36	Wenger Ck	580800-60500	CCG GRj LKC LNC
16	Chischa R	580800-39100	NFC
17	Chischa R	580800-32000	CCG GR MW
18	Chlotapecta Ck	580800-33700	NFC
19	Chlotapecta Ck	580800-33700	CCG GR
20	Falk Ck	580800-32000	BT CCG GR LSU MW
2-1	Doan Ck	580800-30200-11300	NFC
2-2	Doan Ck	580800-30200-11300	NFC
2-3	Tetsa R	580800-30200	BT
2-4	Unnamed	580800-30200-63400	NFC
2-5	Unnamed	580800-30200-48500	NFC
2-6	Tetsa R	580800-30200	BT CCG GR
M1	Muskwa R	580800	CCG GR LSU

3.1.2. Muskwa River 580800

The Muskwa River enters the Muskwa West PTPA just downstream of the channel's exit from the foothills of the Rocky Mountains. The river is typically very glacially turbid in this section. Moderate topographical relief east of the mountains does not provide the river with the gradient and resultant energy needed to continue to transport the sediment which it carries from the mountain reaches. As a consequence, as the direction of flow changes through a wide arc from roughly eastward, to north-northwestward, the river deposits the

transported sediment. The deposition causes the channel to meander tortuously and form numerous large side channels and oxbow lakes in its floodplain (Photo 1). As the river assumes a north-northwestward course forming the eastern boundary of the Muskwa West PTPA, its channel gradually becomes more confined downstream, though still meandering moderately (Photo 2). In many places, meanders carry the flow against high eroding banks (Photo 3), so that during periods of higher discharge the turbidity downstream becomes more dominated by darker fines. At the north end of the Muskwa West PTPA, the Muskwa River channel is moderately incised (Photo 4) and the tributary streams from both east and west have downcut significant canyons to the floor of the Muskwa valley.

Three additional sixth-order mainstem sites were sampled on the Muskwa River during the field component of the present study. Site #11 was located in the tortuously meandering portion of the river which traverses the southern end of the south portion of Muskwa West PTPA. Slimy sculpin, lake chub and mountain whitefish fry and juveniles were captured at the site, indicating reproduction of the latter species in this portion of the river. Roughly midway between the mouths of Varrick Creek and Kluachesi Creek in the moderately meandering section of the Muskwa mainstem, site #12 yielded the same assemblage of species, with the addition of the adult life stage of mountain whitefish. Site #5 was located just north of the mouth of Falk Creek, near the south end of the northern portion of the PTPA; all seven species encountered during the project were captured at this site. Juvenile Arctic grayling, bull trout and mountain whitefish were the salmonid life stages present.

Adjacent to the Muskwa West PTPA, prior to this project a single Muskwa River mainstem site [M1] had received overview fish and fish habitat sampling during the 1998 MMUS overview. The site was located just upstream of the Tetsa River confluence; slimy sculpin, longnose sucker, and juvenile Arctic grayling were captured.

Fish species which are known present in the Muskwa watershed downstream of the Tetsa River confluence include Arctic grayling, bull trout, burbot, inconnu, mountain whitefish, northern pike, trout perch, slimy sculpin, spoonhead sculpin, finescale dace, lake chub, longnose dace, flathead chub, white sucker, and longnose sucker (UBC Fish Museum 1997).[2]

3.1.3. Bunch Creek 580800-04700-51100

The headwaters of Bunch Creek, in the Middle Prophet River watershed group, lie within Muskwa West PTPA. Bunch Creek flows north and then east to join the Prophet River mainstem. No previous sampling attention has been reported for the Bunch Creek basin. One site [13] was sampled on the third-order portion of the channel within the PTPA. The topographical relief in the area is minimal, and the area appears as poorly drained muskeg. The channel was extensively beaver-impounded in the vicinity of the site; no fish were captured.

[2] FISS mapsheet 94J/11 reports coarsescale sucker present in the lower Muskwa River but according to the *Field Key to the Fishes of British Columbia* (McPhail and Carveth 1999) the species is not believed to occur in the Lower Liard drainage. Either mis-identification of white sucker, or mis-coding of another species, is probable.

Photo 1. Muskwa River valley (upstream), near Puder Creek mouth. Roll 4, Frame 4. CD #2, Image #0404.

Photo 2. Muskwa River valley (upstream) between the mouths of Kluachesi Creek and Varrick Creek. Roll 4, Frame 9. CD #2, Image #0409.

Photo 3. Upstream view of Muskwa River valley, near mouth of Flack Creek. Roll 2 Frame 13. CD #1, Image #0213.

Photo 4. Slope failure into Muskwa River channel, opposite bank and slightly upstream of the mouth of the Chischa River. Roll 2 Frame 11. CD #1, Image #0211.

3.1.4. Tetsa River 580800-30200

The Tetsa and North Tetsa rivers originate in the easternmost ranges of the northern Rocky Mountains in the vicinity of Stone Mountain Provincial Park. The two streams drain at high gradient in a generally north-northeastern direction for approximately half of their length before turning east toward the Muskwa River valley. The lower Tetsa River flows eastward near the northern margin of the north portion of the Muskwa West PTPA. As it approaches its confluence with Muskwa River, the fifth-order Tetsa River channel forms the boundary of the PTPA. The Alaska Highway follows the Tetsa valley upstream of the Mill Creek confluence, to the west of the section of the river which borders the PTPA. The river is reputed to offer good angling for Arctic grayling and bull trout (Woods 2001).

The reach of the lower Tetsa River which borders the PTPA flows through a moderately incised but relatively broad valley. This portion of the river displays extensive lateral bars, islands, and occasional braiding due to the deposition of sediment with the reduction in gradient from the mountain reaches (Photo 5). A single stream site [3] on the Tetsa River was sampled during the current project, roughly 5 km upstream of the river's mouth. Of the seven species encountered during the study, only longnose dace were not captured at this site. Arctic grayling and mountain whitefish juveniles and a bull trout sub-adult comprised the salmonid life stages sampled.

Two sites were sampled on the Tetsa channel during the 1998 overview. Site #2-6 was located approximately 14 channel km upstream of the mouth, and yielded bull trout, Arctic grayling and slimy sculpin. West and south of the PTPA, site #2-3 yielded a bull trout juvenile and a ripe male.

Recorded previous sampling in the sixth-order Tetsa basin has yielded Arctic grayling, bull trout, lake trout, slimy sculpin and lake chub. The lake trout occur as a monoculture in Tetsa Lake, at the head of the Tetsa River, and probably only occasionally in fluvial habitat downstream. Other species present in the lower Muskwa probably also inhabit the Tetsa River, at least seasonally, and rainbow trout occur in the upper portion of the North Tetsa watershed (Zuchewich 1994).

Two fourth order tributaries, Doan Creek and unnamed 580800-30200-37400, drain northward to the Tetsa from the PTPA. The former stream was sampled during the 1998 overview of this watershed group, the latter during the field component of this study.

3.1.4.1. Unnamed 580800-30200-37400

The fourth-order basin of unnamed channel 580800-30200-37400 drains the western end of the northern section of the PTPA, and had received no reported sampling attention prior to this study. Two sample sites, fourth-order and third-order, were completed during the current project. At the lower site, on the fourth-order portion of the channel, a single fish (probably a sub-adult Arctic grayling) was detected by electrofishing, but evaded capture. No fish were caught at the upper site [2] on the third-order section of the stream. Water temperatures at the two sites were lowest encountered during the survey (4° and 5°C).

Downstream (north) of the PTPA, a set of cascades occurs on unnamed channel 580800-30200-37400; their position is approximately 1.8 km upstream of the channel mouth at the Tetsa River. Although the drop appears to constitute an impediment and possible barrier to fish passage (Photo 6), the presence of fish upstream in this basin and the lack of small juveniles suggests that the cascades are passable to larger fish at least.

3.1.4.2. Doan Creek 580800-30200-11300

The Doan Creek basin lies entirely within Muskwa West PTPA, and received two stream sample sites in the 1998 MMUS overview. Neither site yielded fish. Field notes from the survey indicate the presence of many beaver dams between site #2-2 approximately 1 km upstream of the mouth, and site #2-1 in the upper portion of the drainage. No potential barriers were noted downstream of site #2-2, though the stream is moderately entrenched as it downcuts to the Tetsa valley floor.

Associated Resource Consultants (1978) sampled "each of the main branches of Doan Creek", also in autumn. The details of sampling and exact location of their sites is unknown, but no fish were captured at either location.

3.1.5. Chischa River 580800-32000

The Chischa River, known locally as Sheep Creek, originates on the east slope of the Rocky Mountain ranges immediately south of Tetsa Lake. The channel forms part of the border of the northern portion of Muskwa West PTPA, and it emerges from the Rocky Mountain foothills to traverse the PTPA at order 4. The stream is entrenched throughout the PTPA and receives a large number of steep low-order tributaries; a canyon containing a series of cascades (Photo 7) is centred roughly 13.5 channel km upstream of the mouth. Downstream of the canyon to its mouth at the Muskwa River, the channel remains entrenched but has eroded a broad valley bottom with islands, extensive bars, and occasional braiding due to deposition of sediment from the high-energy mountain reaches upstream.

Two fourth-order sites were sampled on this stream during the 1998 MMUS overview. Site #17 approximately 10 channel km upstream of the mouth yielded Arctic grayling, mountain whitefish and slimy sculpin. The small size of the Arctic grayling and mountain whitefish suggests fry or yearling life-stages, and indicates that reproduction of either or both species may occur in the lower Chischa River within the PTPA.

One site [16] above the canyon within the PTPA yielded no fish. The previously-mentioned cascades may have blocked fish access to this watershed upstream of the canyon.

3.1.6. Unnamed 580800-33000

A single site [20] on this third-order tributary to the right (east) bank of the Muskwa River was sampled to supplement coverage in this portion of the Middle Muskwa Watershed Group, though the stream does not lie within the Muskwa West PTPA. The site was located 200 m upstream of the mouth of the stream; no fish were captured. The stream valley and channel drain the steep escarpment east of the Muskwa River mainstem, and appear to experience debris flows and other high-energy disturbances. During the sampling visit, the water was turbid and very acidic; the substrate was coated with iron flocculate. It appears doubtful that any of the right-bank tributaries to the Muskwa River, north of Falk Creek, offer habitat of good quality for fish.

3.1.7. Chlotapecta Creek 580800-33700

Chlotapecta Creek, known locally as 4 Mile Creek, drains a sizeable basin in the Rocky Mountain foothills west of Muskwa West PTPA and traverses the PTPA in a northeastern direction to join the Muskwa River at the eastern margin of the PTPA. The channel is very entrenched in the reaches within the PTPA, though the stream has eroded a

relatively broad valley bottom with extensive depositional bars in the reach (length ~5 km) just upstream of the mouth (Photo 8).

Site #19 in 1998, on the fourth-order mainstem channel approximately 1.5 channel km upstream of the Muskwa confluence, yielded slimy sculpin and an adult and very small juvenile Arctic grayling (probably young-of-year) indicating possible reproduction by the latter species in this section of the creek. During overflight of the Chlotapecta Creek channel during 1998, no barriers were noted within Muskwa West PTPA[3], but a cascade was located roughly 0.5 channel km southwest (upstream) of the western margin of the PTPA. Site #18 of the same project, approximately 3 channel km upstream of the cascade, yielded no fish suggesting that the cascade may have prevented access to the upper portion of this watershed.

3.1.8. Unnamed 580800-36500

Third-order unnamed channel 580800-36500 flows north, east, and then north to join the Muskwa River upstream of the mouth of Flack Creek. Site #6 of the present study was located near the western margin of the PTPA. No fish were captured. Many beaver dams were present on the channel of unnamed 580800-36500, downstream of the site.

3.1.9. Falk Creek 580800-39100

Falk Creek originates in the Rocky Mountain foothills west of Muskwa West PTPA and traverses the southern end of the north portion of the PTPA, at order 4. Site #20 of the 1998 MMUS overview comprised the only recorded sampling activity in the basin prior to the present study. The site was located roughly 2.5 channel km upstream of the mouth of the creek, at the mainstem Muskwa River. Sub-adult bull trout, sub-adult and yearling or young-of-year Arctic grayling, sub-adult mountain whitefish, slimy sculpin and longnose sucker were captured on that occasion. The presence of small juvenile Arctic grayling indicates that reproduction of the species may occur in this reach of Falk Creek.

3.1.9.1. Unnamed 580800-39100-39300

One site [4] on an unnamed second-order tributary to the right bank of Falk Creek was sampled for the current project. No fish were captured. There were many large beaver dams downstream of the site and upstream of the confluence with Falk Creek.

3.1.10. Unnamed 580800-43000

Unnamed channel 580800-43000 traverses the northern end of the southern portion of PTPA. The stream originates in the Rocky Mountain foothills west of the PTPA and south of the Tuchodi River. No fish were captured at the site, despite electrofishing a large quantity of good habitat. A low to moderate amount of beaver activity was present on the channel downstream of the site; failing daylight prevented a closer examination of the probability of fish passage.

3.1.11. Unnamed 580800-44100

The entire third-order drainage of unnamed channel 580800-44100 lies within the bounds of Muskwa West PTPA. The stream's confluence with the Muskwa River occurs

[3] This conflicts with Woods (2001) which cites a personal communication (Kjos 2000) referring to a pool at the base of a set of waterfalls at the confluence of Chlotapecta Creek with the Muskwa River. Perhaps the waterfalls occur on a tributary to Chlotapecta Creek.

immediately downstream (north) of the mouth of the Gathto River. Site #8 of the present overview, roughly 9 channel km upstream of the mouth of the channel, yielded one age 2+ juvenile Arctic grayling and one age 4+ sub-adult Arctic grayling. Additional good rearing habitat for Arctic grayling on this channel, upstream of the site, was apparent from overflight.

3.1.12. Gathto Creek 580800-44400

Gathto Creek originates in the northern Rocky Mountains near Gautier Peak, between the headwaters of the Muskwa and Tuchodi Rivers. The stream flows northeast and then north across Muskwa West PTPA. It is a large fifth-order channel throughout the PTPA, and receives tributary flow from third-order Beckman Creek within the area.

Within the PTPA, one site [10] on the Gathto mainstem was sampled during the field component of this project. Slimy sculpins and mountain whitefish were the only fish species captured; the latter were present as fry, indicating reproduction of mountain whitefish in this reach.

The Gathto Creek mainstem was also sampled during the UMUS overview earlier in the summer of 2001. Site #17 was closest to the PTPA, at roughly 7.5 channel km upstream (west) of the western boundary. Slimy sculpin, and juvenile bull trout (age 3+ yr), Arctic grayling and mountain whitefish were sampled at the site.

Although bull trout fry or yearlings were not captured at site #10 of the present project or site #17 of the UMUS overview, probable redds of the species were observed in the channel upstream of the PTPA during overflight in the UMUS overview. A field visit to the same area in late winter of 2002 revealed water warmer than in nearby areas (J. Burrows, personal communication), suggestive of groundwater upwelling that may be a key factor in spawning site selection by the species.

3.1.12.1. Beckman Creek 580800-44400-05700

The headwaters of Beckman Creek lie in the Rocky Mountain foothills west of Muskwa PTPA. The stream flows through the PTPA at order 3 to join the Gathto River, roughly 6.5 channel km upstream of the latter creek's mouth. During the UMUS overview in the summer of 2001, one site [18] on Beckman Creek about 3 channel km from its mouth yielded slimy sculpin, juvenile Arctic grayling and juvenile mountain whitefish. Individuals of the salmonid species were not small enough to suggest reproduction in the stream.

3.1.12.1.1. Unnamed 580800-44400-05700-2400-5090

One site [9] on unnamed channel 580800-44400-05700-2400-5090 was sampled in the field component of this project. The first order stream is a tributary to unnamed second-order channel 580800-44400-05700-2400 in the Beckman Creek drainage. The planned sample location was located on the latter stream, but forest cover prevented helicopter access. No fish were captured at site #9; the habitat quality in the sampled channel was poor.

3.1.13. Kluachesi Creek 580800-48300

Kluachesi Creek originates in the Kluachesi Lake basin, in the Rocky Mountain foothills west of Muskwa West PTPA. It traverses the PTPA in a generally northeast

direction, at order 4. The drainage received two samples sites during the UMUS overview, and no additional sites were sampled in this watershed during the present project.

Site #20 of the UMUS overview was located on the Kluachesi Creek mainstem approximately 5.5 channel km upstream of the mouth. Sampling yielded slimy sculpin, mountain whitefish juveniles, and Arctic grayling young-of-year and juveniles. The occurrence of Arctic grayling fry suggests reproduction of the species in this area. Arctic grayling fry and juveniles were also captured at site #21 on unnamed channel 580800-48300-19500, third-order tributary to Kluachesi Creek within the PTPA. Again, Arctic grayling spawning nearby may be indicated, suggesting the overall importance of Kluachesi Creek as reproductive habitat for the species. Kluachesi Lake, at the head of Kluachesi Creek more than 10 km upstream (west) of Muskwa West PTPA, reportedly supports populations of bull trout, Arctic grayling, burbot, longnose sucker and white sucker (survey on file, Fisheries Section, Fort Saint John BC). The lake may serve as a thermal buffer for the stream, increasing its productivity for fish particularly as reproductive habitat.

3.1.14. Varrick Creek 580800-54700

Varrick Creek is the first major left bank tributary to the Muskwa River after the Muskwa completes its arc across the PTPA to a northwestern course of flow. The majority of the Varrick Creek basin lies within Muskwa West PTPA, though some headwater channels in the drainage enter from the foothills to the west. The Varrick Creek mainstem is a fourth-order channel for much of its length within the PTPA.

Site #30 on Varrick Creek roughly 1.8 channel km above its mouth yielded slimy sculpin, longnose sucker and juvenile Arctic grayling. Fish sampling at site #31 on unnamed channel 580800-54700-60200, tributary to the left bank of Varrick Creek, captured slimy sculpin, longnose dace and mountain whitefish juveniles. Site #32 on unnamed second-order tributary channel 580800-54700-74200 yielded one Arctic grayling juvenile and several mountain whitefish sub-adults.

Sites #31 and #32 were relatively near to the western boundary of the PTPA. The sampling results at these sites suggest good access by fish to much of the Varrick Creek drainage.

3.1.15. Wenger Creek 580800-60500

Wenger Creek originates within Muskwa West PTPA at the south end of the southern portion. It exits the PTPA as an order 3 channel and joins the Muskwa River mainstem outside of the PTPA.

Two sites on the Wenger Creek channel were sampled during the UMUS inventory prior to this study. Site #35, near the upstream extent of the third-order section of Wenger Creek, yielded only slimy sculpin. Slimy sculpin, lake chub, longnose dace and juvenile Arctic grayling were captured at Site #36, approximately 4 channel km upstream of the mouth of Wenger Creek but external to the PTPA area

3.1.16. Unnamed 580800-62000

Unnamed second order channel 580800-62000 is one of several small streams which originate in the Muskwa West PTPA and flow southeast to the Muskwa mainstem as it crosses the PTPA. A sample site [26] of the UMUS inventory prior to this study was located

roughly 0.2 km upstream of the mouth, and yielded slimy sculpin, juvenile Arctic grayling and juvenile mountain whitefish rearing in the stream.

3.1.17. Reimer Creek 580800-64400

Reimer Creek originates in the Rocky Mountain foothills west of the Muskwa West PTPA, and flows southeast at order 3 for much of its length within the PTPA. Site #33 of the UMUS overview inventory in summer of 2001 was located about 7 channel km upstream of the mouth. Fish captured at the site included slimy sculpin, juvenile Arctic grayling and juvenile mountain whitefish. Though the Arctic grayling were aged as yearlings, their small size at this distance from the mainstem Muskwa suggests that Reimer Creek may support reproduction of the species.

3.1.18. Puder Creek 580800-64700

Puder Creek drains the southern end of the south portion of Muskwa West PTPA. Most of its watershed lies within the PTPA, though the headwaters of the stream are external. The channel flows northeast and north to join the right bank of the Muskwa River; Puder Creek is a third-order stream through most of its length. Site #34, near the southernmost point of the PTPA and roughly 15 channel km upstream of the mouth, yielded Arctic grayling and mountain whitefish juveniles. None of these were younger than 2+ yr, so reproduction of either species in the stream is not necessarily suggested.

Photo 5. Upstream view of Tetsa River valley and channel, from the mouth.
Roll TE4 Frame 16 (Burrows 2002).

Photo 6. Cascades on unnamed channel 580800-30200-37400.
Roll 2 Frame 4. CD #1, Image #0204.

Photo 7. Cascades at upper end of lower Chischa River canyon.
Roll TE4 Frame 12 (Burrows 2002).

Photo 8. Chlotapecta Creek valley, upstream of mouth.
Roll JB3 Frame 22 (Burrows 2002).

Photo 9. Unnamed channel 580800-43000 in vicinity of site # 7.
Roll 5 Frame 22. CD #2, Image #0522.

Photo 10. Arctic grayling captured at site # 8 on unnamed channel 580800-44100.
Roll 5 Frame 18. CD #2, Image #0518.

Photo 11. Gathto Creek valley (downstream), 12 km upstream of the Muskwa confluence. Roll TE2 Frame 19 (Burrows 2002).

Photo 12. Mouth of Gathto Creek (left) at Muskwa River. Roll PR2 Frame 29 (Burrows 2002).

3.1.19. Bunch Creek 580800-04700-51100

Muskwa West PTPA overlaps the extreme southwestern portion of the Middle Prophet watershed group. Headwater tributaries to Bunch Creek drain the small zone of overlap, which is poorly drained.

Photo 13. Bunch Creek valley (downstream), toward east border of Muskwa West PTPA. Roll 4 Frame 3. CD #2, Image #0403.

3.2. Besa-Prophet Pre-Tenure Plan Area: Buckinghorse & Pocketknife

The Besa-Prophet PTPA includes the headwaters of Pocketknife Creek west of about 123° 11' 05", and those of the Buckinghorse River west of approximately 123° 08' 40". Pocketknife Creek is a tributary of the Minaker River, in the Prophet River drainage. The Buckinghorse River flows generally eastward for its entire length to its confluence with the Sikanni Chief River, which together with the Fontas River forms the Fort Nelson River at their confluence. No previous sampling attention has been reported in the Pocketknife Creek drainage; a sampling site on the Minaker River 10 air km east of the eastern border of the PTPA yielded slimy sculpin and Arctic grayling (Renewable Resource Consulting Services 1989), and the same species were captured at second site 3 km farther east (Timberland Consultants 1998). The closest pre-existing stream sample site in the Buckinghorse watershed was located on the Buckinghorse River 10 air km east of the eastern boundary of the PTPA. Arctic grayling, longnose dace and slimy sculpin were captured (LGL 1992).

Six stream sample sites were completed within the Buckinghorse & Pocketknife section of the Besa-Prophet PTPA in the present study. Site visits were conducted on August 24, 2001; locations are provided in Table 7 and depicted on Map 4. Habitat data (RIC Stream Cards), fish collection data (RIC Fish Cards), and site photographs are presented in order of site number in Appendix XVI through Appendix XXI.

Water temperatures ranged between 4 and 8°C. At the locations sampled, Pocketknife drainage streams were warmer than those in the Buckinghorse basin, though the time of day of sampling was likely a factor. Water chemistry was characterized by moderately basic pH, and low to intermediate specific conductance (Table 8).

Three fish species were encountered at one or more of the Pocketknife Creek sites: Arctic grayling, bull trout, and slimy sculpin. Arctic grayling life stages included large juveniles, sub-adults and adults; bull trout present were small juveniles. Although bull trout fry and yearlings were not captured, the presence of small (young) juveniles of the species, as well as the appearance of the habitat and the possibility of groundwater flow from the headwater ponds and wetlands, all suggest that Pocketknife Creek may support spawning by bull trout. As well, the drainage appears to offer quality habitat for Arctic grayling rearing.

Sites within the Buckinghorse River drainage yielded only Arctic grayling and slimy sculpin; Arctic grayling were sampled as juveniles, but not stages which would indicate that reproduction of the species likely occurs in this area of the watershed. Arctic grayling rearing habitat in the Buckinghorse River basin also appeared good, but seasonal migration is probably impeded by the numerous beaver dams on the channel.

Table 7. Fish and fish habitat sample site locations for 2001, Buckinghorse & Pocketknife portion of Besa-Prophet Pre-Tenure Plan Area. Column headings are self-explanatory. UTM coordinates are field positions snapped by GIS to the stream linework of the BC watershed atlas.

Site	Water	Watershed Code	UTM (NAD83)
14	Pocketknife Cr	580800-04700-54500-6250	10.488169.6366510
15	Pocketknife Cr	580800-04700-54500-6250	10.484232.6366447
16	Unnamed	580800-04700-54500-6250-8340	10.484823.6368769
17	Buckinghorse R	998700-48600	10.489135.6357771
18	Unnamed	998700-48600-92700	10.485841.6357367
19	Buckinghorse R	998700-48600	10.484652.6355826

Table 8. Physical characteristics of fish habitat recorded at sample site locations for 2001, Buckinghorse & Pocketknife portion of Besa-Prophet Pre-Tenure Plan Area. **Width** refers to channel width in metres; **Gradient** values are percentages; **Morphology** provides the channel form code in upper case font and dominant substrate code in lower case (see Table 12 and Table 13 for code definitions); **Temp**erature unit is degree Celsius; **Cond** refers to specific conductance, where unit is µmhos; **Turb**idity codes are given in Table 11.

Site	Width	Gradient	Morphology	Temp	pH	Cond	Turb	Order	Magnitude
14	24.8	1.3	RPg	6.5	7.6	265	L	4	42
15	16.3	1.5	RPCWc	8.0	7.7	256	L	3	14
16	5.6	3.5	CPBc	7.0	8.0	186	C	2	8
17	10.2	1.5	RPg	4.5	8.0	228	L	4	33
18	1.6	2.5	RPc	4.0	7.8	349	C	3	5
19	9.3	1.8	RPg	5.0	8.2	337	C	2	12

Table 9. Fish species captured at sample site locations for 2001, Buckinghorse & Pocketknife portion of Besa-Prophet Pre-Tenure Plan Area. Fish species codes are provided in Table 10. For each game-fish species, following the species code are lower case letters designating the life stages captured at the site, where f = fry, j = juvenile, s = sub-adult and a = adult. (Sub-adults are adult-sized fish which do not yet show signs of sexual maturity.) Capture **Methods** are: AG = angling; EF = electrofishing; SN = pole seine.

Site	Water	Fish Species Codes	Methods
14	Pocketknife Ck	CCG GRjsa	AG EF SN
15	Pocketknife Ck	BTj CCG GRjs	EF
16	580800-04700-54500-6250-8340	GRa	AG EF
17	Buckinghorse R	CCG GRj	AG EF
18	998700-48600-92700	NFC	EF
19	Buckinghorse R	NFC	EF

3.2.1. Pocketknife Creek 580800-04700-54500-6250

Pocketknife Creek originates in a wetland and group of shallow ponds in the Rocky Mountain foothills. The drainage of the headwater area appears anomalous, in that the wetland is perched above the Nevis Creek channel which lies about 1.5 km to the west, but outflow occurs to the east.

Three sites were sampled in the Pocketknife Creek basin during this project. Site #14 was located about 1 channel km upstream of the eastern boundary of the PTPA, on the fourth-order section of the Pocketknife Creek channel. Fish sampling yielded slimy sculpin and Arctic grayling of large juvenile and adult life stages. Site #15 was also located on the mainstem Pocketknife Creek, in the third-order section approximately 6 channel km upstream of site #14. Fish captured at site #14 included slimy sculpin, bull trout juveniles (125 mm FL and 131 mm FL, aged as 2+), and Arctic grayling juvenile and sub-adult stages.

3.2.1.1. Unnamed 580800-04700-54500-6250-8340

The basin of unnamed channel 580800-04700-54500-6250-8340 lies completely within Besa-Prophet PTPA; the stream is a second-order tributary to the left bank of Pocketknife Creek. Site #16 was located about 3.5 channel km upstream of the mouth. A single Arctic grayling adult was captured at the site.

3.2.2. Buckinghorse River 998700-48600

Buckinghorse River flows north and then east from the Rocky Mountain foothills east of Nevis Creek. The channel meanders through a relatively broad valley after turning east and achieves order of 4 before exiting the PTPA. There are a large number of beaver dams downstream of and within the Besa-Prophet PTPA on the Buckinghorse River; many dams occur on side channels but during overflight some were observed to have blocked the main channel.

The Buckinghorse basin received three sample sites during this study. Site #17 was located on the fourth order section of the mainstem Buckinghorse River, roughly 4.5 channel km upstream of the eastern boundary of the PTPA. Fish captured included slimy sculpin and juvenile Arctic grayling. Site #19 was placed on the second-order portion of Buckinghorse River, about 8 channel km upstream of site #17. No fish were captured at Site #17; the channel was dewatered about 500 m downstream of the site, and a large beaver impoundment occurred downstream of the dewatered section (Photo 17).

3.2.2.1. Unnamed 998700-48600-92700

Unnamed channel 998700-48600-92700 is a northward-flowing third-order tributary to the Buckinghorse River, which achieves order of four at the confluence of the two channels. Site 18 was located 100 m upstream of the mouth of the stream. No fish were captured; the channel offered habitat of poor quality relative to the adjacent Buckinghorse River.

Photo 14. Pocketknife Ck valley upstream (westward) from vicinity of site # 14. Roll 5 Frame 7. CD #2, Image #0507.

Photo 15. Buckinghorse R valley and channel (upstream) from the vicinity of the PTPA boundary. Roll 4 Frame 17. CD #2, Image #0417.

Photo 16. Buckinghorse R channel and valley (upstream), vicinity of site # 17. Roll 4 Frame 23. CD #2, Image #0423.

Photo 17. Upstream view SSW from vicinity of site #18, toward uppermost Buckinghorse R valley containing site #19. Note dewatering. Roll 5 Frame 3. CD#2, Image #0503.

4. Discussion

Seven fish species were captured during the field component of this project: Arctic grayling, bull trout, lake chub, longnose sucker, longnose dace, mountain whitefish, and slimy sculpin. This species assemblage was also captured at sites in or adjacent to the Muskwa West PTPA during the Upper Muskwa River watershed group inventory which was conducted earlier in the summer of 2001, and during the Middle Muskwa River watershed group inventory which sampled in September of 1998.

Stream site sampling and channel overflights suggest that most channels of order 3 or greater within and adjacent to the Muskwa West and Buckinghorse & Pocketknife study areas are capable of supporting fish at least seasonally, and a high proportion can provide habitat utilizable by salmonids. A significant fraction of order 2 channels within the PTPA may provide such habitat as well. Few permanent impediments to upstream passage appear to prevent fish from accessing suitable habitat within the portions of the PTPAs considered in the present project. A canyon on the Chischa River provides the primary exception to the previous assertion, and a set of cascades on Tetsa River tributary channel 580800-30200-37400 are likely a seasonal impediment though apparently an incomplete barrier.

In aquatic systems within the PTPAs, constraints on fish reproduction and growth include the following important factors:

- low average water temperature,
- frequent turbidity, and
- high intra-annual variation in discharge.

Seasonal variation in flow may include late summer sub-optimal flow in streams which originate in the Rocky Mountain foothills within or adjacent to the PTPA, and early summer flood-type discharge in streams which originate within the Rocky Mountain ranges west of the PTPA. Annual occurrence of the latter has attendant direct effects on fish use, and indirect effects through persistent habitat disturbance.

However, notwithstanding these and other constraints on fish production, most channels in the PTPAs which were surveyed displayed moderate gradient and fair to good complexity of habitat. And although estimated water chemistry parameters were limited to pH and conductance, both of these also were generally favorable to aquatic productivity.

During previous overview inventories of the Middle Muskwa River and Upper Muskwa River watershed groups, fish were captured at 19 of 25 sites in or adjacent to Muskwa West PTPA. Thirteen of 20 sites in the field portion of the present study yielded at least one species of fish. Although cascades and other permanent impediments are uncommon within the PTPAs, many channels display extensive impoundment by beavers, and sampling within or upstream of beaver impoundment complexes showed a clear negative correlation between primary-channel beaver dam abundance and fish presence. In streams along the east slope of the Rocky Mountains in northeastern British Columbia, salmonids often undertake seasonal migrations over relatively large distances, as is discussed in subsequent paragraphs. When numerous, beaver impoundments appear to prevent access to tributary stream habitat which would otherwise be utilized in summer and early autumn by species such as Arctic grayling.

4.1. Arctic grayling

Arctic grayling juveniles and adults were captured at a wide variety of sites in the Muskwa West PTPA areas of interest. Two sites in the Kluachesi Creek watershed which were sampled during the UMUS overview in summer 2001 yielded Arctic grayling young-of-year, suggesting that reproduction of the species may occur in those reaches. One site each on the Chischa and Chlotapecta channels within the PTPA also yielded small juvenile Arctic grayling in the 1998 overview. But in most of the locations where larger Arctic grayling occurred fry and small juveniles were not captured, implying that those areas may be used seasonally for rearing (summering) but not for reproduction. Other evidence suggests that one common life history pattern for Arctic grayling in river systems along the eastern slope of the Rocky Mountains in British Columbia may be spawning in warmer low-elevation tributaries, with summering of large juveniles and adults in upstream locations and wintering of all life stages in large mainstem channels (Diversified Environmental Services 2000). Sampling results from sites in the areas of interest for this project appear to display some elements of this general pattern. Kluachesi Lake, near the head of Kluachesi Creek, probably serves as a thermal buffer which might encourage Arctic grayling reproduction in that stream. The unnamed tributary of Kluachesi Creek, where Arctic grayling fry and yearlings also occurred, drains low foothills near the Muskwa mainstem and as a result is likely warmer than most other third-order streams within the PTPA. Larger Arctic grayling probably also utilize mainstem channels for summering, though they are more difficult to capture by sampling in those waters.

Both the Pocketknife and Buckinghorse portions of the Besa-Prophet PTPA yielded Arctic grayling juveniles and adults. Fry or small juveniles were not encountered in either basin, so spawning by the species within the PTPA is not suggested. Arctic grayling were much more abundant and widespread at the Pocketknife watershed sites than in the Buckinghorse drainage. Downstream of the PTPA, the Buckinghorse River is extensively beaver-impounded. Migration of Arctic grayling, which might overwinter and spawn at lower elevation but summer in the upper Buckinghorse watershed, may be impeded by beaver dams.

4.2. Mountain Whitefish

Mountain whitefish occurred also occurred at a variety of sample sites in the Muskwa West PTPA. The species was not encountered in the Buckinghorse or Pocketknife drainages of the Besa-Prophet PTPA. Other sampling events downstream in the Minaker and Buckinghorse watersheds also failed to collect mountain whitefish. The species' distribution may be limited to lower reaches of these systems.

In and adjacent to the Muskwa West PTPA, mountain whitefish young-of-year or small juveniles occurred at five sites on larger channels (Muskwa, Gathto and Chischa rivers) during the present and previous projects, indicating that reproduction is likely in those areas. Other sites where mountain whitefish were captured yielded only juveniles and larger individuals, suggesting that those streams may be used seasonally for rearing but not reproduction. As with Arctic grayling, a parsimonious interpretation is that mountain whitefish in the Muskwa system use lower elevation habitat for spawning and early life stage rearing, with a broad range of habitats used for summering by larger juveniles and adults, and all life stages sharing larger channels at low elevation for overwintering. But unlike Arctic grayling, very large channels such as the Muskwa and Gathto rivers were the dominant lower elevation habitats where mountain whitefish reproduction apparently occurred.

4.3. Bull Trout

Compared with Arctic grayling and mountain whitefish, bull trout have been encountered at a restricted set of locations in and adjacent to the project areas. During sampling in the present study and previous overviews, bull trout juveniles and adults were captured at all Tetsa River mainstem sites, including a ripe male far upstream of the PTPA. Bull trout juveniles were also captured in the mainstem Muskwa River near the mouth of Falk Creek and at a site located in Falk Creek near its mouth, though there was no particular indication that the latter system is used for reproduction. The species is reportedly present in Kluachesi Lake (BC Environment lake files, Fort St. John B.C.), though it is unknown whether the population there is headwater-resident or migratory. On Gathto Creek, small juveniles were captured upstream of the western boundary of the PTPA, possible redds of the species were seen during overflight of the channel upstream of the PTPA, and a late-winter visit to where redds were seen provided circumstantial evidence that bull trout might be attracted to the area for spawning due to warmer water. The lake-headed Tuchodi River watershed does not flow through the PTPA, as it is entirely enclosed within Rocky Mountains Park, but the river has long been known as an important Muskwa tributary for bull trout spawning (Woods 2001). Spawning in other tributaries to the mountain reaches of the Muskwa River, west of the PTPA, may also have been indicated by the UMUS inventory.

In contrast to Arctic grayling and mountain whitefish, in aquatic systems along the eastern slope of the Rocky Mountains bull trout often reproduce in higher-elevation locations particularly where conditions create higher water temperatures during the winter (Baxter 1997; Burrows et al. 2001). Larger juveniles and adults of the Tuchodi, Gathto, Kluachesi, Tetsa and other potential Muskwa tributary spawning populations upstream of the PTPA presumably migrate through the Muskwa and Tetsa river mainstems adjacent to the Muskwa West PTPA, and may reside there at other times of the year as well.

The capture of small juvenile bull trout in Pocketknife Creek within the PTPA suggests the possibility of bull trout reproduction in that reach of the stream.

4.4. Other Species

In addition to the fish sampled during the present study and the UMUS and MMUS overview inventories, other species previously reported present in waters upstream include burbot, lake trout, rainbow trout and white sucker. Of these, burbot are most likely to be widely distributed in the Muskwa West PTPA study area but are not often captured by the sampling methods employed in this study. Rainbow trout in Fern, Summit and Grizzly lakes are introduced populations; migrants presumably are present occasionally in waters downstream of these lakes, but none have been encountered during inventory sampling. White suckers likely occur at low abundance in Kluachesi Creek and the Muskwa River within and adjacent to the PTPA. Lake trout individuals may very occasionally emigrate from Tetsa Lake, but have not been captured in the Tetsa watershed downstream of the lake.

Other fish species which are known present in the Muskwa watershed downstream of the Tetsa River confluence include inconnu, northern pike, finescale dace, trout perch, spoonhead sculpin, and flathead chub (UBC Fish Museum collection database, 1997). Failure to collect any of these species may be due to incomplete sampling, or their distributions may not have extended to the study area during the field portion of the project. Except perhaps for oxbow lakes in the Muskwa floodplain, there are few waters within the Muskwa watershed upstream of the Tetsa confluence which would be warm and clear enough for northern pike. Spoonhead sculpin, trout perch, and flathead chub are found in turbid

fluvial habitats downstream; their absence from the lower Muskwa River cannot be readily explained. Inconnu may enter the Muskwa River for spawning in the autumn (Woods 2001; Burrows 2002), but juveniles of the species have rarely been captured in British Columbia by any sampling method, and capture of adults usually requires angling or gillnetting at effort levels not applied in this project.

Prior sampling in the Buckinghorse River downstream of the Besa-Prophet PTPA yielded longnose dace, which were not encountered during this study. No previous sampling has been reported in the Pocketknife Creek watershed. Previous sampling on the Minaker River, into which Pocketknife Creek flows, yielded Arctic grayling and slimy sculpin which were both also captured in this project.

4.5. Sampling Issues

For logistic reasons two widely-used methods of sampling large channel habitats were not applied during this study: beach seining and gillnetting. We did pole seine (5 m length), but beach seining with a longer net is typically more productive for some species and larger life stages when present. Due to the remote locations and crew size, transportation of a longer seine was not practical. Multiple-mesh gillnets are also highly effective for sampling backwaters and eddies of large river channels, but require a boat for deployment and overnight soak for maximum efficacy; neither of these requirements could met.

Relative abundance of fish was low at the project sample sites, particularly in smaller channels which were most often occupied by large juvenile and adult Arctic grayling. Occasionally, more than 500 seconds of electrofishing effort through several hundred metres of channel were required before any fish were captured. Accurately inferring absence of fish from streams in the PTPAs will require greater sampling effort than is needed in watersheds where fish population densities are more typical or where fish species are year-round residents.

Fish sampling results of this study differed significantly from projects conducted earlier in the same watershed groups. Because we did not re-sample any sites, it is difficult to conclude whether differences are more strongly related to site selection, variation in seasonal timing of field work, inherent differences between the channels which were sampled, sampling techniques, random variation, or other factors, although all of these are probably important elements. In the field, sample site selection involves tradeoffs. Sites which are representative of the habitat within the reach do not necessarily display the highest diversity of fish species life stages, and vice versa. Notwithstanding any differences, the aggregate density of sampling effort which has occurred within the PTPAs since 1998 constitutes very good fish and fish habitat inventory coverage at the overview level.

4.6. Impacts to Fish Habitat and Fish Populations

Aquatic habitats within the Muskwa West PTPA and the Buckinghorse & Pocketknife portion of the Besa-Prophet PTPA have received very minor impacts from human activity. The only anthropogenic modification to habitat visible during overflights was vegetation clearing for seismic lines, which creates localized effects on riparian vegetation, stream banks and substrate at crossings.

In contrast, beavers extensively impact aquatic habitat within the PTPA. The magnitude of effects varies greatly among basins. Most fourth- and higher-order channels carry enough discharge to prevent impoundment of the main channel; Doan Creek and the

Buckinghorse River were apparent exceptions. Third and second-order streams were much more likely to be blocked in multiple locations, although some valleys were completely free of beaver impacts. Beaver impoundments may have positive effects on fish production in certain situations. However, extensive complexes of dams on many channels within the PTPAs appear to constrain the seasonal migration of fish which would otherwise utilize habitat upstream; Arctic grayling are most likely to be affected. Beavers often incorporate roadbeds and culverts to assist in impounding streams. Any future road construction in the PTPAs should be designed to avoid contributing to fish passage problems caused by beavers.

The Tetsa River is the only water in the study area which can be approached by road. Tetsa River Provincial Park provides access to the river from the Alaska Highway, on the opposite bank of the channel from Muskwa West PTPA. The roadbed generally lies within 500 m of the river channel, from several kilometres west of the park to the head of the Tetsa River at Summit Lake. The river is popular for angling due to the resulting accessibility. Access to other waters in the PTPA generally occurs by jet boat, involving travel on the Muskwa River bordering the PTPA. Angling and hunting are often pursued concurrently by parties traveling on the Muskwa River in late summer and early autumn. The Muskwa mainstem becomes more fishable at this time as turbidity declines. The larger less-turbid tributaries can also be accessed for varying distances by jetboat for angling and hunting. Impacts of angling on fish populations of the Muskwa watershed would be difficult to quantify, but use of the river is probably growing. Any road development which provided easier summer and fall access to any portion of the mainstem Muskwa River upstream of the current access point would have the potential to bring about overexploitation of salmonid populations if additional restrictions on harvest were not implemented.

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Appendix I. Code Tables

Table 10. Fish species code definitions, for species encountered within the project area.

Fish Species Code	Fish Species
BB	Burbot
BT	Bull trout
CCG	Slimy sculpin
GR	Arctic grayling
LKC	Lake chub
LNC	Longnose dace
LSU	Longnose sucker
MW	Mountain whitefish
NFC	No fish captured
RB	Rainbow trout
WSU	White sucker

Table 11. Turbidity code definitions.

Turbidity Code	Turbidity
C	Clear
L	Low
M	Moderate
T	Turbid

Table 12. Substrate code definitions.

Substrate Code	Substrate
F	Fines
G	Gravel
C	Cobble
B	Boulder
R	Bedrock

Table 13. Morphology code definitions.

Morphology Code	Morphology
CPB	Cascade Pool Boulder LWD absent
CPCW	Cascade Pool Cobble LWD present minor function
LC	Large Channel
RPCW	Riffle Pool Cobble LWD functioning
RPGW	Riffle Pool Gravel LWD functioning
SPB	Step Pool Boulder LWD absent
SPBW	Step Pool Boulder LWD present minimal function
SPR	Step Pool Boulder-block LWD absent
RP	Riffle Pool
CP	Cascade Pool
SP	Step Pool

Appendix II. Project Maps

Map 2. Muskwa West Pre-Tenure Plan Area, North Section. (following page)

Map 3. Muskwa West Pre-Tenure Plan Area, South Section. (second following page)

Map 4. Besa-Prophet Pre-Tenure Plan Area, Buckinghorse & Pocketknife Section. (third following page)

Appendix III. Site Card, Fish Card and Site Photographs for Sample Site # 1 Unnamed Channel 580800-30200-37400

FDIS Site Card

Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000 **Site: 1**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000
Site #: 1 Contractor site reference: Field site # A
Field UTM (Z.E.N): 10.430596.6498706 Method: GPU Site length: 125 Method: RFL
GIS UTM (Z.E.N): 10.430607.6498737 Access: H
Date: 2001/08/22 Time: 09:30 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	17.0	11.0	8.0	14.0				12.5
Wetted Width (m):	MS	7.0	11.0	8.0	8.0				8.5
Pool Depth (m):	MS	0.45	0.15	0.30					0.30

	Gradient %	Mtd	Avg
Method I:	1.0	C	1.00
Method II:		C	

No Vis.Ch.: No Intermittent: No
Wb Depth: .5 .4 .6 Avg: 0.50 Method: MS Stage: Medium Dewatered: No Tributaries: No

COVER

Total cover amount: T

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	D	T	S	S	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 0%
Instream vegetation: Moss
LWD amount: F LWD distribution: E

	Left Bank	Right Bank
Bank shape:	S	V
Bank texture:	F	B
Riparian vegetation:	S	M
Vegetation stage:	SHR	MF

WATER

Temperature: 5 Method: T3 Conductance: 468 Method: S4
pH: 8.1 Method: P1 Turbidity: C Method: GE
Flood Signs: None noted. Method: GE

MORPHOLOGY

Bed Material Dominant: B Subdom: C
D95 (cm): 25.0 D (cm): 20.00 Morph: CPB
Pattern: SI
Islands: O
Coupling: DC
Confinement: OC
FSZ? No

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000 **Site: 1**

FEATURES

Type	Hgt	Method	Lg	Method	Photo	AirPhoto	UTM (Z/E/N)	Method
C		GE		RFL	R: 2 F: 3 L:	#:	10.431012.6500596	GPU

Comments: Also Roll # 2 Frame # 4. Set of cascades, approximately 2.5 channel km downstream of site # 1 (field site # A).

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Absent.
Spawning Habitat	Poor to fair; large substrate, lots of fines, some gravels though.
Rearing Habitat	Moderate to good; limited by amount of cover, lots of slow water.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 1 F: 1	STD	U	Upstream end of site # 1 (field site # A).
R: 1 F: 2	STD	U	Island in site # 1 (field site # A).
R: 1 F: 3	STD	D	Downstream end of site # 1 (field site # A).
R: 1 F: 4	STD	NS	Aerial view of site # 1 (field site # A).

COMMENTS

Section	Comments
COVER	LWD very few.
MORPHOLOGY	Islands very occasional.
COVER	Moss instream, but other instream vegetation was very rare.
COVER	Alpine willow spruce terrestrial vegetation.

FDIS Fish Collection Card

Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000 Reach # .0 Site 1

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 Date: 2001/08/22 To: 2001/08/22

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 Crew: JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
1			10.430596.6498706 GPU	SN 1				
1			10.430596.6498706 GPU	AG 1				
1			10.430596.6498706 GPU	EF 1				

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
1	AG 1	1	2001/08/22	10:40	2001/08/22	10:50	10 min angling effort, spinning gear.
1	EF 1	1	2001/08/22	09:30	2001/08/22	10:10	2063 seconds at 200V, settings I5.
1	SN 1	1	2001/08/22	10:00	2001/08/22	10:30	1/8 in mesh for pole seine, length 5m.

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
1	SN 1	1	FL	5.0	1.5	IN	BT	NA

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
1	EF 1	1	O	2063	125.0	8.0	200	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
1	AG 1	1	NFC			0			
1	EF 1	1	NFC			0			One fish turned up by EF but not captured.
1	SN 1	1	NFC			0			

Photo 18. Upstream view of Site #1, unnamed channel 580800-30200-37400, from mid-site. Roll 1 Frame 2. CD #1, Image #0102.

Photo 19. Aerial view of Site # 1, unnamed channel 580800-30200-37400. Roll 1 Frame 4. CD #1, Image #0104.

Appendix IV. Site Card, Fish Card and Site Photographs for Sample Site # 2 Unnamed Channel 580800-30200-37400

FDIS Site Card

Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000 **Site: 2**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000
Site #: 2 Contractor site reference: Field site # B
Field UTM (Z.E.N): 10.430973.6496098 Method: GPU Site length: 134 Method: RFL
GIS UTM (Z.E.N): 10.430973.6496097 Access: H
Date: 2001/08/22 Time: 10:45 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	8.0	5.0	5.0	5.0	6.0	7.0	8.0	6.3
Wetted Width (m):	MS	8.0	4.0	3.0	2.0	3.0	5.0	7.0	4.6
Pool Depth (m):	MS	0.10	0.10	0.20	0.40				0.20

	Gradient %		Mtd	Avg
Method I:	2.0	5.0	C	2.67
Method II:	1.0		C	

No Vis.Ch.: No Intermittent: No
Wb Depth: .3 .6 Avg: 0.45 Method: MS Stage: Medium Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	S	T	T	D	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation:
LWD amount: F LWD distribution: E

	Left Bank	Right Bank
Bank shape:	V	S
Bank texture:	F	C
Riparian vegetation:	S	S
Vegetation stage:	SHR	SHR

WATER

Temperature: 4 Method: T3 Conductance: 487 Method: S4
pH: 8.2 Method: P1 Turbidity: C Method: GE
Flood Signs: yes, 0.1m Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: B
D95 (cm): 0.20 D (cm): 0.25 Morph: CPB

Pattern: SI
Islands: O
Coupling: DC
Confinement: FC

FSZ? No

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	Yes	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000 **Site: 2**

HABITAT QUALITY

Habitat type	Comments
Other	not a great fish stream
OverWinter Habitat	absent
Spawning Habitat	**poor**, substrate too large
Rearing Habitat	fair, but very few slack-water areas

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 1 F: 5	STD	U	Upstream end of site # 2 (field site # B).
R: 1 F: 6	STD	U	Steepest area in site # 2 (field site # B).
R: 1 F: 7	STD	D	Downstream end of site # 2 (field site # B).
R: 2 F: 1	STD	NS	Aerial view of site # 2 (field site # B).
R: 2 F: 2	STD	NS	Aerial view of site # 2 (field site # B).

COMMENTS

Section	Comments
MORPHOLOGY	islands rare
COVER	**alpine willow** for riparian vegetation; moss instream rare; LWD rare

FDIS Fish Collection Card

Watershed Code: 580800-30200-37400-0000-0000-000-000-000-000-000-000 Reach # .0 Site 2

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/22 **To:** 2001/08/22

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
2			10.430973.6496098 GPU	EF 1				

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
2	EF 1	1	2001/08/22	10:45	2001/08/22	11:30	827 sec, 300V, I-5

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
2	EF 1	1	O	827	134.0	5.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
2	EF 1	1	NFC			0			No fish observed.

Photo 20. Upstream view from upper end of Site #2, unnamed channel 580800-30200-37400. Roll 1 Frame 5. CD#1, Image 0105.

Photo 21. Aerial view of Site #2, unnamed channel 580800-30200-37400. Roll 2 Frame 2. CD#1, Image 0202.

Appendix V. Site Card, Fish Card and Site Photographs for Sample Site # 3 Tetsa River 580800-30200

FDIS Site Card

Watershed Code: 580800-30200-00000-0000-0000-000-000-000-000-000-000 **Site: 3**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: TETSA RIVER Local Name:
Watershed Code: 580800-30200-00000-0000-0000-000-000-000-000-000-000
Site #: 3 Contractor site reference: Field site # C
Field UTM (Z.E.N): 10.455878.6501171 Method: GPU Site length: 400 Method: O
GIS UTM (Z.E.N): 10.455880.6501166 Access: H
Date: 2001/08/22 Time: 12:15 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	377.0	134.0	207.0	158.0				219.0
Wetted Width (m):	MS	55.0	27.0	41.0	36.0				39.8
Pool Depth (m):	MS	2.00	1.50	1.40	2.00				1.72

Wb Depth: 1.7 1.9 2.0 Avg: 1.87 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	1.5	1.1	AL	1.30
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	T	D	T	S	T	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: None
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	V	Bank shape:	V
Bank texture:	F	Bank texture:	F, G, C
Riparian vegetation:	M	Riparian vegetation:	M
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 10 Method: T3 Conductance: 354 Method: S4
pH: 8.3 Method: P2 Turbidity: T Method: GE
Flood Signs: No flood signs Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: G
D95 (cm): 63.0 D (cm): 55.00 Morph: RPC

Pattern: IM
Islands: F FSZ? No
Coupling: PC
Confinement: FC

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	Yes	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	Yes	Yes	No	No	No	No	Yes	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-30200-00000-0000-0000-000-000-000-000-000-000 **Site: 3**

HABITAT QUALITY

Habitat type	Comments
Cover	**Moderate;** boulders and occasional deep pools.
OverWinter Habitat	Moderate; infrequent deep pools.
Spawning Habitat	Moderate; several areas of spawning gravel in margins, behind boulders and in side-channels.
Rearing Habitat	Moderate; abundant off-channel at current stage but few slack-water areas.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 1 F: 10	STD	D	View of river left, main channels, site # 3 (field site # C).
R: 1 F: 11	STD	D	View of river right, side channel, site # 3 (field site # C).
R: 1 F: 8	STD	U	View of river left, main channels, site # 3 (field site # C).
R: 1 F: 9	STD	U	View of river right, side channel, site # 3 (field site # C).
R: 2 F: 6	STD	NS	Aerial view of site # 3 (field site # C).
R: 2 F: 7	STD	NS	Aerial view of site # 3 (field site # C).
R: 2 F: 8	STD	D	Aerial downstream view of Tetsa River channel, just downstream of site # 3 (field site # C).
R: 2 F: 9	STD	D	Aerial downstream view of Tetsa River channel, just downstream of site # 3 (field site # C).

COMMENTS

Section	Comments
CHANNEL	Very fine textured material confining river.
MORPHOLOGY	Site on large bar near many side channels; approximately 5 channel threads.
COVER	Mixed spruce, poplar riparian forest.
WATER	Very turbid (glacial gray), visibility ~5cm.

FDIS Fish Collection Card

Watershed Code: 580800-30200-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 3

Gazetted Name: TETSA RIVER
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/22 **To:** 2001/08/22

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
3			10.455878.6501171 GPU	AG 1	10	354	T	
3			10.455878.6501171 GPU	SN 1	10	354	T	
3			10.455878.6501171 GPU	EF 1	10	354	T	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
3	AG 1	1	2001/08/22	12:30	2001/08/22	12:40	10 min. angling with spinners
3	EF 1	1	2001/08/22	12:15	2001/08/22	13:15	1775 sec, 300V, I-5
3	SN 1	1	2001/08/22	13:20	2001/08/22	13:25	
3	SN 1	2	2001/08/22	13:25	2001/08/22	13:30	

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
3	SN 1	1	FL	5.0	1.5	IN	BT	NA

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
3	EF 1	1	O	1775	320.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
3	AG 1	1	NFC	NS		0				
3	EF 1	1	LKC	NS		1	74	74	R	
3	EF 1	1	GR	NS		6	77	128	R	
3	EF 1	1	CCG	NS		3	46	59	R	
3	EF 1	1	MW	NS		4	85	131	R	
3	EF 1	1	BT	NS		1	396	396	R	
3	SN 1	1	LKC	NS		1	76	76	R	
3	SN 1	2	LSU	NS		1	166	275	R	

FDIS Fish Collection Card

Watershed Code: 580800-30200-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 3

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age			Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
3	EF 1	1	BT	396	720.0	M	IM	OT	1						27 branchiostegal rays
3	EF 1	1	MW	125	15.4	U	IM	SC	2	2					
3	SN 1	1	LSU	275		U	IM								
3	EF 1	1	MW	131	20.2	U	U	SC	3	2		FR 3			
3	EF 1	1	MW	131	19.2	U	U	SC	4	2		FR 4			
3	EF 1	1	MW	85	5.8	U	U	SC	5	1		FR 5			
3	EF 1	1	GR	108	11.9	U	U	SC	6	1					
3	EF 1	1	GR	110	10.1	U	U	SC	7	1					
3	EF 1	1	GR	81	4.5	U	U	SC	8	1					
3	EF 1	1	GR	128	19.8	U	U	SC	9	2					
3	EF 1	1	GR	77	3.9	U	U	SC	10	1					
3	EF 1	1	GR	77	3.5	U	U	SC	11	1					
3	EF 1	1	LSU	166	59.0	U	U								
3	EF 1	1	CCG	59		U	U								
3	EF 1	1	CCG	51		U	U								
3	EF 1	1	CCG	46		U	U								
3	SN 1	1	LKC	76	5.4	U	U								
3	EF 1	1	LKC	74	4.5	U	U								

Photo 22. Downstream view of Site #3, Tetsa River 580800-30200, from mid-site.
Roll 1 Frame 10. CD#1, Image 0110.

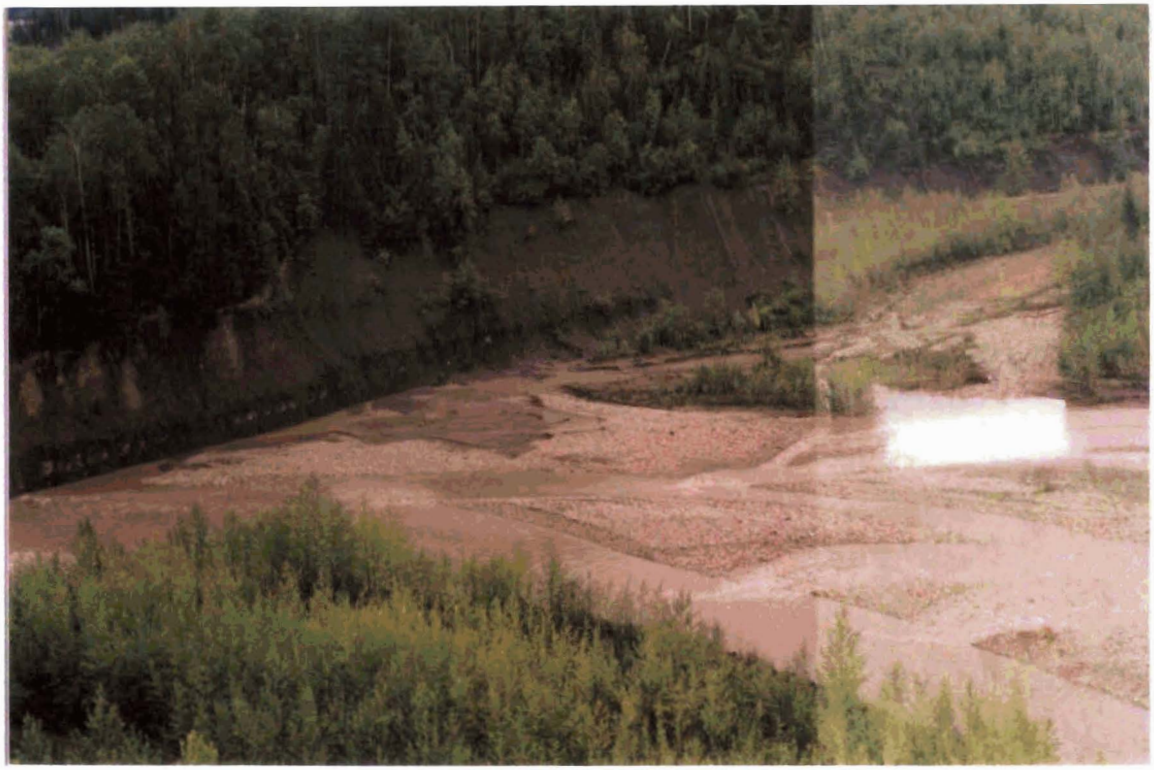

Photo 23. Aerial view of Site #3, Tetsa River 580800-30200.
Roll 2 Frame 6. CD#1, Image 0206.

Appendix VI. Site Card, Fish Card and Site Photographs for Sample Site # 4 Unnamed Channel 580800-39100-39300

FDIS Site Card

Watershed Code: 580800-39100-39300-0000-0000-000-000-000-000-000-000 **Site: 4**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-39100-39300-0000-0000-000-000-000-000-000-000
Site #: 4 Contractor site reference: Field site # D
Field UTM (Z.E.N): 10.454415.6470092 Method: GPU Site length: 144 Method: RFL
GIS UTM (Z.E.N): 10.454418.6470092 Access: H
Date: 2001/08/22 Time: 18:20 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	2.6	3.4	4.8	5.1	4.9	4.2		4.2
Wetted Width (m):	MS	2.5	3.1	4.1	4.6	4.9	4.2		3.9
Pool Depth (m):	MS	0.60	0.40	0.60					0.53

Wb Depth: .4 .4 .3 Avg: 0.37 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	2.0	3.0	AL	2.50
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: Yes

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	S	T	T	D	T	S	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation:
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	S
Bank texture:	F	Bank texture:	F
Riparian vegetation:	W	Riparian vegetation:	W
Vegetation stage:	SHR	Vegetation stage:	SHR

WATER

Temperature: 8 Method: T3 Conductance: 477 Method: S4
pH: 8.4 Method: P2 Turbidity: M Method: GE
Flood Signs: Yes, 0.3 m. Method: GE

MORPHOLOGY

Bed Material Dominant: G Subdom: C
D95 (cm): 38.0 D (cm): 6.00 Morph: RPG

Pattern: IR
Islands: N FSZ? No
Coupling: PC
Confinement: OC

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	Yes	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-39100-39300-0000-0000-000-000-000-000-000-000 **Site: 4**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Fair; a few deep pools.
Spawning Habitat	Good; abundant gravels.
Rearing Habitat	Fair; abundant cover.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 1 F: 24	STD	U	View of site # 4 (field site # D), upstream of breached beaver dam.
R: 1 F: 25	STD	U	View of site # 4 (field site # D), looking at breached beaver dam.
R: 2 F: 20	STD	NS	Aerial view of site # 4 (field site # D).
R: 2 F: 21	STD	NS	Aerial view of site # 4 (field site # D).

COMMENTS

Section	Comments
SITE CARD	Site located upstream of large beaver dam complex, with some dams >2m in height.
WATER	Visibility ~30cm.

FDIS Fish Collection Card

Watershed Code: 580800-39100-39300-0000-0000-000-000-000-000-000-000 Reach # .0 Site 4

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/22 **To:** 2001/08/22

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
4			10.454415.6470092 GPU	EF 1	8	477	M	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
4	EF 1	1	2001/08/22	18:22	2001/08/22	18:40	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
4	EF 1	1	O	653	144.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
4	EF 1	1	NFC			0			

Photo 24. Upstream view in Site #4 on unnamed channel 580800-39100-39300, from breached beaver dam. Roll 1 Frame 24. CD#1, Image 0124.

Photo 25. Aerial view of Site #4 on unnamed channel 580800-39100-39300. Roll 2 Frame 20. CD#1, Image 0220.

Appendix VII. Site Card, Fish Card and Site Photographs for Sample Site # 5 Muskwa River 580800

FDIS Site Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Site: 5**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: MUSKWA RIVER Local Name:
Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Site #: 5 Contractor site reference: Field site # E
Field UTM (Z.E.N): 10.462460.6474041 Method: GPU Site length: 435 Method: RFL
GIS UTM (Z.E.N): 10.462492.6474034 Access: H
Date: 2001/08/22 Time: 13:20 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	385.0	313.0	456.0	326.0				370.0
Wetted Width (m):	MS	145.0	108.0	150.0	159.0				140.5
Pool Depth (m):	MS	2.00	1.10						1.55

Wb Depth: 1.7 1.9 1.9 Avg: 1.83 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	0.0	0.0	AL	0.00
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	T	D	N	S	T	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: None
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	V
Bank texture:	F, G	Bank texture:	F, G
Riparian vegetation:	M	Riparian vegetation:	M
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 10 Method: T3 Conductance: 399 Method: S4
pH: 8.4 Method: P2 Turbidity: T Method: GE
Flood Signs: Yes, 2.5 m. Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: G
D95 (cm): 43.0 D (cm): Morph: RPG

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	No	Yes	No	No	No	No

Pattern: IR
Islands: F FSZ? No
Coupling: PC
Confinement: OC

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	Yes	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Site: 5**

HABITAT QUALITY

Habitat type	Comments
Cover	Moderate, mainly boulders in main channel threads..
OverWinter Habitat	Moderate, few deep pools.
Spawning Habitat	Moderate, some small pockets of gravels downstream of boulders and in side channels.
Rearing Habitat	Good, clearwater side channels.

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	1	F:	15	STD	U	Upstream view of site # 5 (field site # E).
R:	1	F:	16	STD	D	Downstream view of site # 5 (field site # E).
R:	1	F:	17	STD	D	Downstream view of site # 5 (field site # E).
R:	2	F:	15	STD	NS	Aerial view of site # 5 (field site # E).
R:	2	F:	16	STD	NS	Aerial view of site # 5 (field site # E).
R:	2	F:	17	STD	NS	Aerial upstream view of Muskwa upstream of site # 5 (field site # E).

COMMENTS

Section	Comments
WATER	~14 cm visibility.

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 5

Gazetted Name: MUSKWA RIVER
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 Date: 2001/08/22 To: 2001/08/22

Local name:
Lake/Stream: S
Project ID: 3921
Agency: C206 Crew: JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone,East,North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
5			10.462460.6474041 GPU	SN 1	10	399	T	
5			10.462460.6474041 GPU	AG 1	10	399	T	
5			10.462460.6474041 GPU	EF 1	10	399	T	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
5	AG 1	1	2001/08/22	14:15	2001/08/22	14:35	Angling with roe, and hardware (spoon).
5	EF 1	1	2001/08/22	13:20	2001/08/22	14:20	
5	SN 1	1	2001/08/22	14:20	2001/08/22	14:25	
5	SN 1	2	2001/08/22	14:30	2001/08/22	14:35	

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
5	SN 1	1	FL	5.0	1.5	IN	BT	NA
5	SN 1	2	FL	5.0	1.5	IN	BT	NA

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
5	EF 1	1	O	882	250.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
5	EF 1	1	CCG	NS		28	44	88	R	
5	EF 1	1	LKC	NS		1	107	107	R	
5	EF 1	1	LNC	NS		1	68	68	R	
5	EF 1	1	LSU	NS		6	68	109	R	
5	EF 1	1	MW	NS		13	33	104	R	
5	EF 1	1	GR	NS		4	78	164	R	
5	EF 1	1	BT	NS		1	247	247	R	
5	SN 1	1	LSU	NS		1	186	186	R	
5	SN 1	2	NFC			0				

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 5

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#	Age	Genetic Vch#	Genetic Str/Smpl#	Roll #	Frame#	Comment
5	EF 1	1	BT	247	141.8	U	U	FR 1	5			1	18	
5	EF 1	1	GR	164	38.9	U	U	SC 2	2			1	21	
5	EF 1	1	GR	114	14.7	U	U	SC 3	1					
5	EF 1	1	GR	119	16.1	U	U	SC 4	1					
5	EF 1	1	MW	104	10.2	U	U	SC 5	1		FR 5			
5	EF 1	1	MW	104	8.6	U	U	SC 6	1		FR 6			
5	EF 1	1	MW	94	7.0	U	U	SC 7	1		FR 7			
5	EF 1	1	MW	87	6.3	U	U	SC 8	1		FR 8			
5	EF 1	1	GR	78	4.3	U	U	SC 9	1		FR 9			
5	SN 1	1	LSU	186		U	U							
5	EF 1	1	LSU	98		U	U							
5	EF 1	1	LSU	97		U	U							
5	EF 1	1	LSU	98		U	U							
5	EF 1	1	LSU	86		U	U							
5	EF 1	1	LSU	104		U	U							
5	EF 1	1	LNC	68		U	U							
5	EF 1	1	LKC	107		U	U							
5	EF 1	1	CCG	44		U	U							
5	EF 1	1	CCG	85		U	U							
5	EF 1	1	MW	46	.9	U	U							
5	EF 1	1	MW	46	.9	U	U							
5	EF 1	1	MW	50		U	U							
5	EF 1	1	MW	44		U	U							
5	EF 1	1	MW	44		U	U							
5	EF 1	1	MW	43		U	U							
5	EF 1	1	MW	33		U	U							
5	EF 1	1	MW	47		U	U							
5	EF 1	1	MW	34		U	U							

Photo 26. Upstream view from lower end of Site #5, Muskwa River 580800.
Roll 1 Frame 16. CD#1, Image 0116.

Photo 27. Aerial view of Site #5, Muskwa River 580800.
Roll 2 Frame 16. CD#1, Image 0216.

Photo 28. Bull trout (*Salvelinus confluentus*) captured at Site #5, Muskwa River 580800. Roll 1 Frame 19. CD#1, Image 0119.

Photo 29. Arctic grayling (*Thymallus arcticus*) captured at Site #5, Muskwa River 580800. Roll 1 Frame 21. CD#1, Image 0121.

Appendix VIII. Site Card, Fish Card and Site Photographs for Sample Site # 6 Unnamed Channel 580800-36500

FDIS Site Card

Watershed Code: 580800-36500-00000-0000-0000-000-000-000-000-000-000 **Site: 6**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-36500-00000-0000-0000-000-000-000-000-000-000
Site #: 6 Contractor site reference: Field site # F
Field UTM (Z.E.N): 10.451741.6477348 Method: GPU Site length: 130 Method: RFL
GIS UTM (Z.E.N): 10.451743.6477347 Access: H
Date: 2001/08/22 Time: 17:20 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	2.4	2.9	1.8	1.4	2.3	1.7		2.1
Wetted Width (m):	MS	2.4	2.9	1.9	1.4	2.3	1.7		2.1
Pool Depth (m):	MS	0.30	0.40	0.40	0.30				0.35

Wb Depth: .3 .4 .3 Avg: 0.33 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	0.5	1.0	AL	0.75
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	N	N	S	T	D	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: Vascular
LWD amount: N LWD distribution: NA

	Left Bank	Right Bank
Bank shape:	S	S
Bank texture:	F	F
Riparian vegetation:	W	W
Vegetation stage:	SHR	SHR

WATER

Temperature: 7 Method: T3 Conductance: 280 Method: S4
pH: 8.3 Method: P2 Turbidity: M Method: GE
Flood Signs: Method: GE

MORPHOLOGY

Bed Material Dominant: F Subdom: G
D95 (cm): 5.00 D (cm): 4.00 Morph: LC
Pattern: IM
Islands: N FSZ? No
Coupling: DC
Confinement: UN

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	Yes	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	Yes	No	No	No	No

Bars NONE: Yes SIDE: No DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-36500-00000-0000-0000-000-000-000-000-000-000 **Site: 6**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Good, water depth and proximity to ponds.
Spawning Habitat	Moderate, several pockets of small gravels.
Rearing Habitat	Good, abundant cover.

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	1	F:	22	STD	U	View of site # 6 (field site # F).
R:	1	F:	23	STD	D	View of site # 6 (field site # F).
R:	2	F:	18	STD	NS	Aerial view of site # 6 (field site # F).
R:	2	F:	19	STD	NS	Aerial view of site # 6 (field site # F).

COMMENTS

Section	Comments
WATER	Visibility ~23 cm.

FDIS Fish Collection Card

Watershed Code: 580800-36500-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 6

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/22 **To:** 2001/08/22
Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
6			10.451741.6477348 GPU	EF 1	7	280	M	Site F.

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
6	EF 1	1	2001/08/22	17:20	2001/08/22	17:35	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
6	EF 1	1	O	801	130.0	2.0	200	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lnth (Min/Max)	Activity	Comment
6	EF 1	1	NFC			0			

Photo 30. Upstream view from middle of Site # 6, unnamed channel 580800-36500.
Roll 1 Frame 22. CD#1, Image 0122.

Photo 31. Aerial view of Site # 6, unnamed channel 580800-36500.
Roll 2 Frame 18. CD#1, Image 0218.

Appendix IX. Site Card, Fish Card and Site Photographs for Sample Site # 7 Unnamed Channel 580800-43000

FDIS Site Card

Watershed Code: 580800-43000-00000-0000-0000-000-000-000-000-000-000 **Site: 7**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-43000-00000-0000-0000-000-000-000-000-000-000
Site #: 7 Contractor site reference: Field site # G
Field UTM (Z.E.N): 10.455940.6457735 Method: GPU Site length: 200 Method: RFL
GIS UTM (Z.E.N): 10.455937.6457735 Access: H
Date: 2001/08/24 Time: 19:14 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	5.2	6.3	7.2	6.3	5.6			6.1
Wetted Width (m):	MS	5.2	6.3	6.6	6.3	5.6			6.0
Pool Depth (m):	MS	0.40	0.40	0.70	1.10				0.65

Wb Depth: .3 .3 .4 Avg: 0.33 Method: MS Stage: Medium

	Gradient %	Mtd	Avg
Method I:	1.0	C	1.00
Method II:	1.0	AL	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	T	T	S	D	S	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 0%
Instream vegetation:
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	U	Bank shape:	V
Bank texture:	F	Bank texture:	F
Riparian vegetation:	S	Riparian vegetation:	S
Vegetation stage:	SHR	Vegetation stage:	SHR

WATER

Temperature: 7 Method: T3 Conductance: 387 Method: S4
pH: 8.3 Method: P2 Turbidity: M Method: GE
Flood Signs: Yes, 0.3 m. Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: G
D95 (cm): 20.0 D (cm): 8.00 Morph: RP

Pattern: SI
Islands: N
Coupling: DC
Confinement: UN
FSZ? No

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-43000-00000-0000-0000-000-000-000-000-000-000 **Site: 7**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Present; residual pool of depth 1.1 m.
Spawning Habitat	Fair; suitable substrate is present though not abundant as there are lots of fines.
Rearing Habitat	Good; lots of good pools with moderate cover.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 5 F: 21	STD	NS	Aerial view of site # 7 (field site # G).
R: 5 F: 22	STD	NS	Aerial view of site # 7 (field site # G).
R: 7 F: 15	STD	U	View at mid-site # 7 (field site # G).
R: 7 F: 16	STD	D	View at mid-site # 7 (field site # G).

WILDLIFE

Group	Observations
MAM	Shrew, by electrofisher.

COMMENTS

Section	Comments
SITE CARD	**Beaver dams** on channel several km downstream of site.
MORPHOLOGY	Substrates appear stable: a layer of moss, algae and organics cover all.
COVER	LWD quantity and distribution inadvertently no recorded.

FDIS Fish Collection Card

Watershed Code: 580800-43000-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 7

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/24 **To:** 2001/08/24

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
7			10.455940.6457735 GPU	EF 1	7	387	M	Site G

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
7	EF 1	1	2001/08/24	19:15	2001/08/24	19:45	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
7	EF 1	1	O	1056	300.0	6.0	200	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
7	EF 1	1	NFC			0			Shocked many good pools, saw no fish.

Photo 32. Downstream view from middle of Site #7, unnamed channel 580800-43000. Roll 7 Frame 16. CD#2, Image 0716.

Photo 33. Aerial view of Site #7, unnamed channel 580800-43000. Roll 5 Frame 21. CD#2, Image 0521.

Appendix X. Site Card, Fish Card and Site Photographs for Sample Site # 8 Unnamed Channel 580800-44100

FDIS Site Card

Watershed Code: 580800-44100-00000-0000-0000-000-000-000-000-000-000 **Site: 8**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-44100-00000-0000-0000-000-000-000-000-000-000
Site #: 8 Contractor site reference: Field site # H
Field UTM (Z.E.N): 10.457841.6454105 Method: GPU Site length: 150 Method: RFL
GIS UTM (Z.E.N): 10.457888.6454120 Access: H
Date: 2001/08/24 Time: 18:14 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	4.8	4.3	5.0	5.0	3.6	2.5		4.2
Wetted Width (m):	MS	4.8	4.3	5.0	5.0	3.6	2.5		4.2
Pool Depth (m):	MS	0.35	0.30	0.25					0.30

Wb Depth: .6 .4 .4 Avg: 0.47 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	2.0	1.0	C	1.50
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	T	S	D	S	S	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 0%
Instream vegetation: Moss
LWD amount: N LWD distribution: NA

Left Bank		Right Bank	
Bank shape:	U	Bank shape:	U
Bank texture:	F	Bank texture:	F
Riparian vegetation:	S	Riparian vegetation:	S
Vegetation stage:	SHR	Vegetation stage:	SHR

WATER

Temperature: 7 Method: T3 Conductance: 164 Method: S4
pH: 8.1 Method: P2 Turbidity: M Method: GE
Flood Signs: 0.1 m, debris. Method: GE

MORPHOLOGY

Bed Material Dominant: B Subdom: G
D95 (cm): 30.0 D (cm): 5.00 Morph: RP
Pattern: SI
Islands: N FSZ? No
Coupling: PC
Confinement: OC

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-44100-00000-0000-0000-000-000-000-000-000-000 **Site: 8**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Fair; only a few deep pools ~70cm in depth.
Spawning Habitat	Poor to none; only small substrate is shale.
Rearing Habitat	Good; deep pools and good cover.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 5 F: 16	STD	X	Crew in site # 8 (field site # H).
R: 5 F: 17	STD	X	Crew in site # 8 (field site # H).
R: 5 F: 19	STD	NS	Aerial view of site # 8 (field site # H).
R: 5 F: 20	STD	NS	Aerial view of site # 8 (field site # H).
R: 7 F: 11	STD	U	View of poor fish habitat at downstream end of site # 8 (field site # H).
R: 7 F: 12	STD	D	View of poor fish habitat at downstream end of site # 8 (field site # H).
R: 7 F: 13	STD	U	View of good fish habitat in site # 8 (field site # H).
R: 7 F: 14	STD	D	View of good habitat in site # 8 (field site # H); start of poorer cascade-pool habitat visible.

WILDLIFE

Group	Observations
MAM	Major game trail running up valley alongside channel.

COMMENTS

Section	Comments
SITE CARD	From the air, it appeared that habitat was also good upstream of the confluence above the site.
SITE CARD	Site is in two reaches; downstream end is poor CP habitat; upstream end is good RP habitat; habitat data is from upstream RP reach where fish were captured.

FDIS Fish Collection Card

Watershed Code: 580800-44100-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 8

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/24 **To:** 2001/08/24

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
8			10.457841.6454105 GPU	EF 1	7	164	M	Site H

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
8	EF 1	1	2001/08/24	18:20	2001/08/24	18:45	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
8	EF 1	1	O	799	250.0	4.0	300	J	6	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
8	EF 1	1	GR	NS		2	157	257	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#		/Age	Vch#	Genetic Str/Smpl#	Roll #	Frame#	Comment
8	EF 1	1	GR	257	169.0	F	MT	SC	1	4			5	18	
8	EF 1	1	GR	157		U	U	SC	2	2					

Photo 34. Downstream view from middle of Site #8, unnamed channel 580800-44100.
Roll 7 Frame 14. CD#2, Image 0714.

Photo 35. Aerial view of Site #8, unnamed channel 580800-44100
Roll 5 Frame 20. CD#2, Image 0520.

Appendix XI. Site Card, Fish Card and Site Photographs for Sample Site # 9 Unnamed Channel 580800-44400-05700-2400-5090

FDIS Site Card

Watershed Code: 580800-44400-05700-2400-5090-000-000-000-000-000-000 **Site: 9**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-44400-05700-2400-5090-000-000-000-000-000-000
Site #: 9 Contractor site reference: Field site # I
Field UTM (Z.E.N): 10.456876.6445416 Method: GPU Site length: 140 Method: RFL
GIS UTM (Z.E.N): 10.456909.6445478 Access: H
Date: 2001/08/23 Time: 20:15 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	3.6	4.2	1.9	2.4	3.6	2.9		3.1
Wetted Width (m):	MS	3.6	4.2	1.9	2.3	3.6	2.9		3.1
Pool Depth (m):	MS	0.75	0.50	0.60	0.80	0.70			0.67

Wb Depth: .2 .3 .3 Avg: 0.27 Method: MS Stage: Medium

	Gradient %	Mtd	Avg
Method I:	4.5	AL	4.50
Method II:			

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: A

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	S	T	T	S	D	S	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 21-40%
Instream vegetation: Moss, Vascular
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	S
Bank texture:	F	Bank texture:	F
Riparian vegetation:	C	Riparian vegetation:	C
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 8 Method: T3 Conductance: 120 Method: S4
pH: 7.6 Method: P2 Turbidity: M Method: GE
Flood Signs: Yes, 0.3 m. Method: GE

MORPHOLOGY

Bed Material Dominant: F Subdom: G
D95 (cm): 29.0 D (cm): 6.00 Morph: CP

Pattern: IR
Islands: N FSZ? No
Coupling: DC
Confinement: UN

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	Yes	No	No	No	Yes	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: Yes SIDE: No DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-44400-05700-2400-5090-000-000-000-000-000-000 **Site: 9**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Good; abundant deep pools.
Spawning Habitat	Poor; lack of suitable-size gravels.
Rearing Habitat	Good; deep pools and abundant cover.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 18	STD	U	View of site # 9 (field site # i).
R: 3 F: 19	STD	D	View of site # 9 (field site # i).

WILDLIFE

Group	Observations
MAM	Old beaver dams.

COMMENTS

Section	Comments
COVER	Riparian forest consists of mature spruce with willow and sedge at water's edge.
CHANNEL	Many small woody debris jams create steps and cascades.

FDIS Fish Collection Card

Watershed Code: 580800-44400-05700-2400-5090-000-000-000-000-000-000 Reach # .0 Site 9

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 Date: 2001/08/23 To: 2001/08/23

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 Crew: JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
9			10.456876.6445416 GPU	EF 1	8	120	M	Site I.

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
9	EF 1	1	2001/08/23	20:15	2001/08/23	20:30	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
9	EF 1	1	O	595	140.0	2.5	300	I	5	S-R	15C-POW

FISH SUMMARY

	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
9	EF 1	1	NFC			0			

Photo 36. Upstream view from middle of site # 9, unnamed channel 580800-44400-05700-2400-5090. Roll 3 Frame 18. CD#1, Image 0318.

Photo 37. Downstream view from lower end of site # 9, unnamed channel 580800-44400-05700-2400-5090. Roll 3 Frame19. CD#1, Image 0319.

Appendix XII. Site Card, Fish Card and Site Photographs for Sample Site # 10 Gathto Creek 580800-44400

FDIS Site Card

Watershed Code: 580800-44400-00000-0000-0000-000-000-000-000-000-000 **Site: 10**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: GATHTO CREEK Local Name:
Watershed Code: 580800-44400-00000-0000-0000-000-000-000-000-000-000
Site #: 10 Contractor site reference: Field site # K
Field UTM (Z.E.N): 10.459536.6445012 Method: GPU Site length: 600 Method: RFL
GIS UTM (Z.E.N): 10.459571.6445031 Access: H
Date: 2001/08/23 Time: 16:20 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	130.0	160.0	168.0	255.0	240.0			190.6
Wetted Width (m):	RFL	35.0	48.0	37.0	44.0	52.0			43.2
Pool Depth (m):	GE	3.00							3.00

	Gradient %	Mtd	Avg
Method I:	1.0	GE	1.00
Method II:		C	

No Vis.Ch.: No Intermittent: No
Wb Depth: 2.5 Avg: 2.50 Method: GE Stage: Medium Dewatered: No Tributaries: Yes

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	N	D	N	S	N	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 0%
Instream vegetation: None
LWD amount: F LWD distribution: C

	Left Bank	Right Bank
Bank shape:	V	V
Bank texture:	R	F
Riparian vegetation:	C	M
Vegetation stage:	MF	MF

WATER

Temperature: 10 Method: T3 Conductance: 419 Method: S4
pH: 8.3 Method: P2 Turbidity: C Method: GE
Flood Signs: yes, 0.5 m. Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: B
D95 (cm): 40.0 D (cm): 60.00 Morph: LC

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	Yes	No

Pattern: SI
Islands: I FSZ? No
Coupling: PC
Confinement: FC

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-44400-00000-0000-0000-000-000-000-000-000-000 **Site: 10**

HABITAT QUALITY

Habitat type	Comments
Spawning Habitat	Fair; some suitable substrate but mostly too large.
Rearing Habitat	Fair to poor; minimal amount of cover except boulders.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 4 F: 12	STD	NS	Aerial view of site # 10 (field site # K).
R: 4 F: 13	STD	D	View of site, from top of site # 10 (field site # K).
R: 4 F: 14	STD	U	View of site, from lower end of site # 10 (field site # K).
R: 4 F: 15	STD	NS	Aerial view of site # 10 (field site # K).

COMMENTS

Section	Comments
CHANNEL	Site had main channel (mostly fast water), and one shallow (<30cm depth) side channel of width 10m.
SITE CARD	Left bank mostly cliff; main channel pool depths not safe to obtain, guessed to be greater than 2m.

FDIS Fish Collection Card

Watershed Code: 580800-44400-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 10

Gazetted Name: GATHTO CREEK
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 Date: 2001/08/23 To: 2001/08/23

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 Crew: JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone East North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
10			10.459536.6445012 GPU	AG 1	10	419	C	
10			10.459536.6445012 GPU	SN 1	10	419	C	
10			10.459536.6445012 GPU	EF 1	10	419	C	Site K

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
10	AG 1	1	2001/08/23	16:30	2001/08/23	16:40	Angling with spoon.
10	EF 1	1	2001/08/23	16:20	2001/08/23	16:40	
10	SN 1	1	2001/08/23	16:45	2001/08/23	16:55	

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
10	SN 1	FL	5.0	1.5	IN	BT	NA	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
10	EF 1	1	O	790	220.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lath (Min/Max)		Activity	Comment
10	EF 1	1	CCG	NS		8	36	84	R	
10	SN 1	1	MW	F		2	43	49	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#/Age	Vch#	Genetic Str/Smpl#	Roll #	Frame#	Comment
10	SN 1	1	MW	43		U	U						
10	SN 1	1	MW	49		U	U						
10	SN 1	1	CCG	83		U	U						
10	SN 1	1	CCG	84		U	U						
10	SN 1	1	CCG	82		U	U						
10	SN 1	1	CCG	71		U	U						
10	SN 1	1	CCG	61		U	U						

FDIS Fish Collection Card

Watershed Code: 580800-44400-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 10

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age	Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
10	SN 1	1	CCG	52		U	U						
10	SN 1	1	CCG	47		U	U						
10	SN 1	1	CCG	36		U	U						

Photo 38. Upstream view of main channel from middle of Site #10, Gathto Creek 580800-44400. Roll 4 Frame 14. CD#2, Image 0414.

Photo 39. Aerial view of Site #10, Gathto Creek 580800-44400. Roll 4 Frame 15. CD#2, Image 0415.

Appendix XIII. Site Card, Fish Card and Site Photographs for Sample Site # 11 Muskwa River 580800

FDIS Site Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Site: 11**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: MUSKWA RIVER Local Name:
Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Site #: 11 Contractor site reference: Field site # P
Field UTM (Z.E.N): 10.471794.6415366 Method: GPU Site length: 250 Method: RFL
GIS UTM (Z.E.N): 10.471779.6415366 Access: H
Date: 2001/08/23 Time: 14:38 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	110.0	190.0	169.0					156.3
Wetted Width (m):	RFL	91.0	102.0	130.0					107.7
Pool Depth (m):	MS	0.40	0.50	0.20	0.40	0.40			0.38

Wb Depth: 2.0 1.5 1.7 Avg: 1.73 Method: MS Stage: Medium

Gradient %	Mtd	Avg
Method I: 0.5	C	0.50
Method II:	C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	S	D	T	S	T	T	N
Loc: P/S/O:	O	O	S	P	P	P	

Crown closure (%): 1-20%
Instream vegetation: None
LWD amount: A LWD distribution: C

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	U
Bank texture:	F	Bank texture:	F
Riparian vegetation:	C	Riparian vegetation:	C
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 11 Method: T3 Conductance: 316 Method: S4
pH: 8.4 Method: P2 Turbidity: M Method: GE
Flood Signs: LWD on bank Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: G
D95 (cm): 15.0 D (cm): 15.00 Morph: LC

Pattern: ME
Islands: O FSZ? No
Coupling: DC
Confinement: UN

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Site: 11**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Present.
Spawning Habitat	Moderate to good; substrate somewhat large in main channel but more gravels in secondary channels, although much of substrate is choked with fines.
Rearing Habitat	Good; large river with relatively complex habitat due to the amount of secondary chanels and off-channel habitat.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 3	STD	U	View of primary channel from mid-site # 11 (field site # P).
R: 3 F: 4	STD	D	View of primary channel from mid-site # 11 (field site # P).
R: 3 F: 5	STD	U	View of secondary channel habitat, site # 11 (field site # P).
R: 3 F: 6	STD	X	View of large secondary channel and functioning LWS, site # 11 (field site # P).
R: 4 F: 4	STD	U	Aerial upstream view of Muskwa River valley in vicinity of site # 11 (field site # P).
R: 4 F: 5	STD	NS	Aerial view of site # 11 (field site # P).
R: 4 F: 6	STD	U	Aerial upstream view of Muskwa River valley in vicinity of site # 11 (field site # P).

COMMENTS

Section	Comments
CHANNEL	Site was located in an uncharacteristically wide area. Much of the river channel nearby was ~60m wetted and bankfull width.
CHANNEL	Residual pool and bankfull depths were measured in secondary channels due to size of main channel.

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 11

Gazetted Name: MUSKWA RIVER
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/23 **To:** 2001/08/23

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
11			10.471794.6415366 GPU	AG 2	11	316	M	
11			10.471794.6415366 GPU	AG 1	11	316	M	
11			10.471794.6415366 GPU	SN 1	11	316	M	
11			10.471794.6415366 GPU	EF 1	11	316	M	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
11	AG 1	1	2001/08/23	16:00	2001/08/23	16:15	
11	AG 2	1	2001/08/23	16:10	2001/08/23	16:20	
11	EF 1	1	2001/08/23	15:30	2001/08/23	16:00	
11	SN 1	1	2001/08/23	16:05	2001/08/23	16:10	

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
11	SN 1	1	FL	5.0	1.5	IN	BT	NA

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
11	EF 1	1	O	1281	350.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
11	AG 1	1	NFC			0				
11	AG 2	1	NFC			0				
11	EF 1	1	LKC	NS		1	91	91	R	
11	EF 1	1	CCG	NS		22	53	84	R	
11	EF 1	1	MW	NS		11	71	147	R	
11	SN 1	1	LSU	NS		2	246	253	R	
11	SN 1	1	LKC	F		1	37	37	R	
11	SN 1	1	CCG	NS		5	46	78	R	
11	SN 1	1	MW	NS		34	28	193	R	

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 11

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#/Age	Vch#	Genetic Str/Smpl#	Roll #	Frame#	Comment
11	EF 1	1	MW	94	7.6	U	U	SC 1 1		FR 1			
11	EF 1	1	MW	84	5.4	U	U	SC 2 1		FR 2			
11	EF 1	1	MW	100	7.9	U	U	SC 3 1		FR 3			
11	EF 1	1	MW	147	31.0	U	U	SC 4 3		FR 4			
11	EF 1	1	MW	84	5.0	U	U	SC 5 1		FR 5			
11	EF 1	1	MW	83	5.1	U	U	SC 6 1		FR 6			
11	EF 1	1	MW	83	5.3	U	U	SC 7 1		FR 7			
11	EF 1	1	MW	80	4.5	U	U	SC 8 1		FR 8			
11	EF 1	1	MW	71	3.4	U	U	SC 9 1		FR 9			
11	EF 1	1	MW	75	3.9	U	U	SC 10 1		FR 10			
11	EF 1	1	MW	75	3.7	U	U	SC 11 1		FR 11			
11	EF 1	1	LKC	91	7.8	U	U						
11	EF 1	1	CCG	77		U	U						
11	EF 1	1	CCG	53		U	U						
11	EF 1	1	CCG	84		U	U						
11	EF 1	1	CCG	74		U	U						
11	EF 1	1	CCG	55		U	U						
11	EF 1	1	CCG	75		U	U						
11	EF 1	1	CCG	69		U	U						
11	EF 1	1	CCG	59		U	U						
11	EF 1	1	CCG	68		U	U						
11	EF 1	1	CCG	75		U	U						
11	EF 1	1	CCG	60		U	U						
11	EF 1	1	CCG	71		U	U						
11	EF 1	1	CCG	63		U	U						
11	EF 1	1	CCG	64		U	U						
11	EF 1	1	CCG	62		U	U						
11	EF 1	1	CCG	60		U	U						
11	EF 1	1	CCG	65		U	U						
11	EF 1	1	CCG	55		U	U						
11	EF 1	1	CCG	56		U	U						
11	SN 1	1	LKC	37		U	U						
11	EF 1	1	CCG	54		U	U						
11	EF 1	1	CCG	56		U	U						
11	EF 1	1	CCG	69		U	U						
11	SN 1	1	MW	44		U	U			FR 12			
11	SN 1	1	MW	33		U	U			FR 13			
11	SN 1	1	MW	29		U	U			FR 14			
11	SN 1	1	MW	33		U	U			FR 15			
11	SN 1	1	MW	193	61.5	M	IM				3	8	
11	SN 1	1	LSU	246		U	U				3	7	
11	SN 1	1	LSU	253		U	U						
11	SN 1	1	MW	139		U	U						
11	SN 1	1	MW	115		U	U						
11	SN 1	1	MW	99		U	U						
11	SN 1	1	MW	110		U	U						
11	SN 1	1	MW	122		U	U						
11	SN 1	1	MW	105		U	U						
11	SN 1	1	MW	87		U	U						
11	SN 1	1	MW	80		U	U						
11	SN 1	1	MW	45		U	U						
11	SN 1	1	MW	43		U	U						
11	SN 1	1	MW	35		U	U						

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 11

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#/Age	Vch#	Genetic Str/Smpl#	Roll #	Frame#	Comment
11	SN 1	1	MW	43		U	U						
11	SN 1	1	MW	40		U	U						
11	SN 1	1	MW	30		U	U						
11	SN 1	1	MW	44		U	U						
11	SN 1	1	MW	43		U	U						
11	SN 1	1	MW	39		U	U						
11	SN 1	1	MW	46		U	U						
11	SN 1	1	MW	44		U	U						
11	SN 1	1	MW	35		U	U						
11	SN 1	1	MW	33		U	U						
11	SN 1	1	MW	34		U	U						
11	SN 1	1	MW	33		U	U						
11	SN 1	1	MW	34		U	U						
11	SN 1	1	MW	37		U	U						
11	SN 1	1	MW	28		U	U						
11	SN 1	1	MW	44		U	U						
11	SN 1	1	MW	28		U	U						
11	SN 1	1	MW	36		U	U						
11	SN 1	1	CCG	70		U	U				3	9	
11	SN 1	1	CCG	78		U	U				3	10	
11	SN 1	1	CCG	59		U	U						
11	SN 1	1	CCG	48		U	U						
11	SN 1	1	CCG	46		U	U						

Photo 40. Cross-channel view at middle of Site # 11, Muskwa River 580800.
Roll 3 Frame 6. CD#1, Image 0306.

Photo 41. Aerial view of Site # 11, Muskwa River 580800.
Roll 4 Frame 5. CD#2, Image 0405.

Appendix XIV. Site Card, Fish Card and Site Photographs for Sample Site # 12 Muskwa River 580800

FDIS Site Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Site: 12**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: MUSKWA RIVER Local Name:
Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Site #: 12 Contractor site reference: Field site # Q
Field UTM (Z.E.N): 10.472570.6442090 Method: GPU Site length: 335 Method: RFL
GIS UTM (Z.E.N): 10.472570.6442060 Access: H
Date: 2001/08/23 Time: 10:45 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	86.0	95.0	99.0	109.0	97.0			97.2
Wetted Width (m):	RFL	80.0	61.0	71.0	90.0	78.0			76.0
Pool Depth (m):	MS								0.00

Wb Depth: 1.6 1.1 1.2 Avg: 1.30 Method: MS Stage: Medium

Gradient %	Mtd	Avg
Method I: 1.0	AL	1.00
Method II:	C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	S	T	D	S	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: None
LWD amount: F LWD distribution: C

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	S
Bank texture:	F, G, C	Bank texture:	F, G, C
Riparian vegetation:	M	Riparian vegetation:	M
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 11 Method: T3 Conductance: 353 Method: S4
pH: 8.0 Method: P2 Turbidity: T Method: GE
Flood Signs: yes, 1.4 m. Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: G
D95 (cm): 34.0 D (cm): 22.00 Morph: RP

Pattern: IM
Islands: I FSZ? No
Coupling: PC
Confinement: OC

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Site: 12**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Few deep pools present in/near site.
Rearing Habitat	Moderate; lack of pools and cover elements.
Spawning Habitat	Fair to poor; some gravel present but mostly cemented with fines.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 11	STD	U	View of site # 12 (field site # Q), river left, including side channel.
R: 3 F: 12	STD	U	View of site # 12 (field site # Q), river right.
R: 3 F: 13	STD	D	View of site # 12 (field site # Q), river left, including side channel.
R: 3 F: 14	STD	D	View of site # 12 (field site # Q), river right.
R: 4 F: 7	STD	NS	Aerial view of site # 12 (field site # Q).
R: 4 F: 8	STD	NS	Aerial view of site # 12 (field site # Q).
R: 4 F: 9	STD	D	Aerial downstream view of Muskwa River channel and valley, vicinity of site # 12 (field site # Q).

COMMENTS

Section	Comments
CHANNEL	Channel is currently migrating from river left to river right.
CHANNEL	Banks at top of site river right and bottom of site river left consist of fine shale cliffs and are actively eroding into channel.

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 12

Gazetted Name: MUSKWA RIVER
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/23 **To:** 2001/08/23

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone	East	North	Mtd	Mtd/No	Temp	Cond	Turbid	Comment
12			10	472570	6442090	GPU	SN 1	11	353	T	
12			10	472570	6442090	GPU	EF 1	11	353	T	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
12	EF 1	1	2001/08/23	16:45	2001/08/23	17:00	
12	SN 1	1	2001/08/23	17:00	2001/08/23	17:15	

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
12	SN 1	1	FL	5.0	1.5	IN	BT	NA

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
12	EF 1	1	O	844	250.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
12	EF 1	1	LKC	NS		2	72	80	R	
12	EF 1	1	CCG	NS		5	40	73	R	
12	EF 1	1	LSU	NS		2	200	240	R	
12	EF 1	1	MW	NS		3	88	279	R	
12	SN 1	1	CCG	NS		1	44	44	R	
12	SN 1	1	LKC	NS		7	62	95	R	
12	SN 1	1	LSU	NS		1	157	157	R	
12	SN 1	1	MW	NS		4	39	115	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#		/Age	Vch#	Genetic Str/Smpl#	Roll #	Frame#	Comment
12	EF 1	1	MW	279	255.0	F	M	SC	1	R			3	15	
12	EF 1	1	MW	113	13.0	U	U	SC	2	3					
12	EF 1	1	MW	88	6.5	U	U	SC	3	2					

FDIS Fish Collection Card

Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 12

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age	Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
12	EF 1	1	CCG	73		U	U						
12	EF 1	1	LSU	240		U	U						
12	EF 1	1	LSU	200		U	U				3	16	
12	EF 1	1	LKC	80		U	U				3	17	
12	EF 1	1	LKC	72		U	U						
12	EF 1	1	CCG	45		U	U						
12	EF 1	1	CCG	43		U	U						
12	EF 1	1	CCG	40		U	U						
12	SN 1	1	LSU	157		U	U						
12	SN 1	1	MW	115	13.7	U	U	SC 4 2					
12	SN 1	1	MW	80	5.2	U	U						
12	SN 1	1	MW	78	5.1	U	U						
12	SN 1	1	LKC	77		U	U						
12	SN 1	1	LKC	95		U	U						
12	SN 1	1	LKC	67		U	U						
12	SN 1	1	LKC	75		U	U						
12	SN 1	1	LKC	75		U	U						
12	SN 1	1	LKC	68		U	U						
12	SN 1	1	LKC	62		U	U						
12	SN 1	1	CCG	44		U	U						
12	SN 1	1	MW	39		U	U						

Photo 42. Downstream view from upper end of Site #12, Muskwa River 580800.
Roll 3 Frame 11. CD#1, Image 0311.

Photo 43. Aerial view of Site #12, Muskwa River 580800.
Roll 4 Frame 8. CD#2, Image 0408.

Appendix XV. Site Card, Fish Card and Site Photographs for Sample Site # 13 Bunch Creek 580800-04700-51100

FDIS Site Card

Watershed Code: 580800-04700-51100-0000-0000-000-000-000-000-000-000 **Site: 13**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: BUNCH CREEK Local Name:
Watershed Code: 580800-04700-51100-0000-0000-000-000-000-000-000-000
Site #: 13 Contractor site reference: Field site # T
Field UTM (Z.E.N): 10.483689.6414223 Method: GPU Site length: 123 Method: RFL
GIS UTM (Z.E.N): 10.483703.6414236 Access: H
Date: 2001/08/23 Time: 13:45 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	2.8	3.4	4.1	3.9	2.6	4.8		3.6
Wetted Width (m):	MS	2.8	3.4	4.1	3.9	2.6	3.9		3.5
Pool Depth (m):	MS	0.40	0.50	0.60					0.50

Wb Depth: .5 .6 .5 Avg: 0.53 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	0.5	1.0	AL	0.75
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: A

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	S	T	N	T	D	S	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: Moss, Vascular
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	S
Bank texture:	F	Bank texture:	F
Riparian vegetation:	S	Riparian vegetation:	S
Vegetation stage:	SHR	Vegetation stage:	SHR

WATER

Temperature: 11 Method: T3 Conductance: 138 Method: S4
pH: 8.0 Method: P2 Turbidity: M Method: GE
Flood Signs: Yes, 0.2 m. Method: GE

MORPHOLOGY

Bed Material Dominant: F Subdom: G
D95 (cm): 13.0 D (cm): 5.00 Morph: LC
Pattern: IR
Islands: N FSZ? No
Coupling: DC
Confinement: UN

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	Yes	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-04700-51100-0000-0000-000-000-000-000-000-000 **Site: 13**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Fair, lack of deep pools but beaver ponds may be used.
Rearing Habitat	Good, abundant cover.
Spawning Habitat	Fair, gravels immediately downstream of beaver dams.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 1	STD	U	View of site # 13 (field site # T) at fresh beaver dam.
R: 3 F: 2	STD	D	View of site # 13 (field site # T) at small pond.
R: 4 F: 1	STD	NS	Aerial view of site # 13 (field site # T).
R: 4 F: 2	STD	NS	Aerial view of site # 13 (field site # T).
R: 4 F: 3	STD	NS	Aerial view of Bunch Creek valley, vicinity of site # 13 (field site # T)

WILDLIFE

Group	Observations
MAM	Beaver dams

COMMENTS

Section	Comments
CHANNEL	Conifer forest on upland away from unsaturated soil.
SITE CARD	Site located in beaver dam complex

FDIS Fish Collection Card

Watershed Code: 580800-04700-51100-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 13

Gazetted Name: BUNCH CREEK **Local name:**
Waterbody ID: **Lake/Stream:** S
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000 **Project ID:** 3921
Fish Permit #: SC2001-022 **Date:** 2001/08/23 **To:** 2001/08/23 **Agency:** C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone	East	North	Mtd	Mtd/No	Temp	Cond	Turbid	Comment
13			10	483689	6414223	GPU	DN 1	11	138	T	
13			10	483689	6414223	GPU	EF 1	11	138	T	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
13	DN 1	1	2001/08/23	13:45	2001/08/23	14:05	
13	EF 1	1	2001/08/23	13:45	2001/08/23	14:05	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
13	EF 1	1	O	781	120.0	3.0	700	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lath (Min/Max)	Activity	Comment
13	DN 1	1	NFC			0			
13	EF 1	1	NFC			0			

Photo 44. Downstream view of Site #13, Bunch Creek 580800-04700-51100.
Roll 3 Frame 2. CD#1, Image 0302.

Photo 45. Aerial view of Site #13, Bunch Creek 580800-04700-51100.
Roll 4 Frame 3. CD#2, Image 0403.

Appendix XVI. Site Card, Fish Card and Site Photographs for Sample Site # 14 Pocketknife Creek 580800-04700-54500-6250

FDIS Site Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 **Site: 14**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: POCKETKNIFE CREEK Local Name:
Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000
Site #: 14 Contractor site reference: Field site # U
Field UTM (Z.E.N): 10.488166.6366463 Method: GPU Site length: 165 Method: RFL
GIS UTM (Z.E.N): 10.488169.6366510 Access: H
Date: 2001/08/24 Time: 12:00 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	22.0	42.0	17.0	20.0	23.0			24.8
Wetted Width (m):	RFL	17.0	10.0	14.0	5.0	9.0			11.0
Pool Depth (m):	MS	0.51	0.45	0.71					0.56

Wb Depth: .4 .7 .7 Avg: 0.60 Method: MS Stage: Medium

Gradient %		Mtd	Avg
Method I:	1.5 1.0	AL	1.25
Method II:		C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: A

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	S	T	D	S	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation:
LWD amount: F LWD distribution: E

Left Bank		Right Bank	
Bank shape:	S	Bank shape:	S
Bank texture:	F, G, C	Bank texture:	F, G, C
Riparian vegetation:	C	Riparian vegetation:	C
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 7 Method: T3 Conductance: 265 Method: S4
pH: 7.6 Method: P2 Turbidity: L Method: GE
Flood Signs: Yes, 0.6 m. Method: GE

MORPHOLOGY

Bed Material Dominant: G Subdom: C
D95 (cm): 37.0 D (cm): 21.00 Morph: RP

Pattern: IR
Islands: O
Coupling: DC
Confinement: UN

FSZ? No

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	Yes	Yes	Yes	Yes	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	Yes	Yes	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 **Site: 14**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Some habitat available in deep pools and possibly in off-channel beaver ponds.
Rearing Habitat	Excellent, channel complexity and abundance of cover.
Spawning Habitat	Good, gravels abundant.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 5 F: 5	STD	NS	Aerial view of site # 14 (field site # U).
R: 5 F: 6	STD	NS	Aerial view of site # 14 (field site # U).
R: 5 F: 7	STD	U	Aerial upstream view (westward) of Pocketknife River valley from vicinity of site # 14 (field site # U).
R: 7 F: 1	STD	D	View of site # 14 (field site # U).
R: 7 F: 2	STD	U	View of site # 14 (field site # U).

COMMENTS

Section	Comments
CHANNEL	Channel quite active, avulsion at top of site.
SITE CARD	Stream has beaver influence on floodplain, few dams on main channel.

FDIS Fish Collection Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 Reach # .0 Site 14

Gazetted Name: POCKETKNIFE CREEK
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/24 **To:** 2001/08/24

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone East North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
14			10.488166.6366463 GPU	SN 1	7	265	L	
14			10.488166.6366463 GPU	EF 1	7	265	L	
14			10.488166.6366463 GPU	AG 1	7	265	L	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
14	AG 1	1	2001/08/24	12:05	2001/08/24	12:20	15 min angling with baited spinner.
14	EF 1	1	2001/08/24	12:05	2001/08/24	12:20	
14	SN 1	1	2001/08/24	12:25	2001/08/24	12:35	

NET/TRAP SPECIFICATIONS

Site #	Mtd/No.	H/P	Net Type	Length	Depth	Mesh	Set	Habitat
14	SN 1	1	FL	5.0	1.5	IN	BT	NA

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
14	EF 1	1	O	614	165.0	3.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
14	AG 1	1	GR	A		2	236	302	R	
14	EF 1	1	CCG	NS		6	47	95	R	
14	EF 1	1	GR	A		7	181	300	R	
14	SN 1	1	GR	A		5	208	292	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smpl#		Age	Ychi#	Genetic Str/Smpl#	Roll #	Frame#	Comment
14	AG 1	1	GR	302	270.0	F	MT	SC	1	4					
14	AG 1	1	GR	236	121.0	M	MT	SC	2	4					
14	SN 1	1	GR	252	142.0	U	U	SC	3	4					
14	SN 1	1	GR	261	180.0	F	MT	SC	4	5					
14	SN 1	1	GR	292	250.0	U	U	SC	5	5			7	4	Also R #7 F #3

FDIS Fish Collection Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 14

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age			Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
14	SN 1	1	GR	208	89.0	M	IM	SC	6	3					Maturity recorded as IM/MT
14	SN 1	1	GR	221	104.0	U	U								
14	EF 1	1	GR	300	295.0	U	U	SC	7	6					
14	EF 1	1	GR	255	202.0	U	U	SC	8	4					
14	EF 1	1	GR	216	106.0	U	U	SC	9	3					
14	EF 1	1	GR	197	83.0	U	U	SC	10	3					
14	EF 1	1	GR	181	58.0	M	IM	SC	11	3					
14	EF 1	1	GR	185	68.0	U	U	SC	12	3					
14	EF 1	1	GR	194	79.0	U	U	SC	13	3					
14	EF 1	1	CCG	95		U	U							5	
14	EF 1	1	CCG	82		U	U								
14	EF 1	1	CCG	77		U	U								
14	EF 1	1	CCG	57		U	U								
14	EF 1	1	CCG	47		U	U								
14	EF 1	1	CCG	65		U	U								

Photo 46. Downstream view of Site #14, Pocketknife Creek 580800-04700-54500-6250. Roll 7 Frame 1. CD#2, Image 0701.

Photo 47. Aerial view of Site #14, Pocketknife Creek 580800-04700-54500-6250. Roll 5 Frame 5. CD#2, Image 0505.

Appendix XVII. Site Card, Fish Card and Site Photographs for Sample Site # 15 Pocketknife Creek 580800-04700-54500-6250

FDIS Site Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 **Site: 15**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: POCKETKNIFE CREEK Local Name:
Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000
Site #: 15 Contractor site reference: Field site # V
Field UTM (Z.E.N): 10.484225.6366436 Method: GPU Site length: 150 Method: RFL
GIS UTM (Z.E.N): 10.484232.6366447 Access: H
Date: 2001/08/24 Time: 15:45 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	7.5	17.0	21.0	22.0	17.0	13.0		16.3
Wetted Width (m):	MS	6.0	6.5	5.0	7.0	6.0	3.0		5.6
Pool Depth (m):	MS	0.40	0.30	0.50					0.40

	Gradient %	Mtd	Avg
Method I:	1.5	C	1.50
Method II:		C	

No Vis.Ch.: No Intermittent: No
Wb Depth: 1.0 1.2 1.0 Avg: 1.07 Method: MS Stage: Medium Dewatered: No Tributaries: No

COVER

Total cover amount: T

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	S	T	S	D	S	N
Loc: P/S/O:	P	P	P	P	P	P	

Crown closure (%): 1-20%
Instream vegetation: None
LWD amount: F LWD distribution: C

	Left Bank	Right Bank
Bank shape:	V	S
Bank texture:	F	F
Riparian vegetation:	C	C
Vegetation stage:	MF	MF

WATER

Temperature: 8 Method: T3 Conductance: 256 Method: S4
pH: 7.7 Method: P2 Turbidity: L Method: GE
Flood Signs: Yes, 0.5 m Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: G
D95 (cm): 10.0 D (cm): 30.00 Morph: RPC

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	Yes	No	No	No	No	No

Pattern: SI
Islands: O
Coupling: DC
Confinement: UN
FSZ? No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	Yes	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 **Site: 15**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Fair; pools not deep.
Rearing Habitat	Fair; cover not abundant
Spawning Habitat	Fair to good, substrate OK, some areas with suitable current velocity.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 5 F: 11	STD	D	View of site #15 (field site # V) from upper end.
R: 5 F: 12	STD	U	View of site #15 (field site # V) from lower end.
R: 5 F: 13	STD	NS	Aerial view of site #15 (field site # V).
R: 5 F: 14	STD	NS	Aerial view of site #15 (field site # V).

COMMENTS

Section	Comments
WATER	Tributary to Pocketknife Cr just above site was bringing in milky-colored water; much evidence of white precipitate on substrate of the tributary.

FDIS Fish Collection Card

Watershed Code: 580800-04700-54500-6250-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 15

Gazetted Name: POCKETKNIFE CREEK
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/24 **To:** 2001/08/24

Local name:
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone,East,North, Mtd	Mtd/No	Temp	Cond	Turbid	Comment
15			10.484225.6366436 GPU	EF 1	8	256	L	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
15	EF 1	1	2001/08/24	15:50	2001/08/24	16:10	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
15	EF 1	1	O	629	150.0	4.0	300	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lath (Min/Max)		Activity	Comment
15	EF 1	1	CCG	NS		2	44	53	R	
15	EF 1	1	GR	NS		4	197	249	R	
15	EF 1	1	BT	J		2	125	131	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age			Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
15	EF 1	1	GR	249	190.0	M	MT	SC	1	4			7	9	
15	EF 1	1	GR	212	111.0	F	MT	SC	2	3					Just beginning to mature
15	EF 1	1	GR	229	119.0	U	U	SC	3	3					
15	EF 1	1	GR	197	99.0	U	U	SC	4	3					
15	EF 1	1	BT	131	25.0	U	U	FR	5	2					
15	EF 1	1	BT	125	26.0	U	U	FR	6	2			7	10	
15	EF 1	1	CCG	53		U	U								
15	EF 1	1	CCG	44		U	U								

Photo 48. Upstream view of Site #15, Pocketknife Creek 580800-04700-54500-6250. Roll 5 Frame 12. CD#2, Image 0512.

Photo 49. Aerial view of Site #15, Pocketknife Creek 580800-04700-54500-6250. Roll 5 Frame 13. CD#2, Image 0513.

Appendix XVIII. Site Card, Fish Card and Site Photographs for Sample Site # 16 Unnamed Channel 580800-04700-54500-6250-8340

FDIS Site Card

Watershed Code: 580800-04700-54500-6250-8340-000-000-000-000-000-000 **Site: 16**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-04700-54500-6250-8340-000-000-000-000-000-000
Site #: 16 Contractor site reference: Field site # W
Field UTM (Z.E.N): 10.484789.6368768 Method: GPU Site length: 150 Method: RFL
GIS UTM (Z.E.N): 10.484823.6368769 Access: H
Date: 2001/08/24 Time: 13:50 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	5.2	4.7	4.0	6.4	7.6			5.6
Wetted Width (m):	MS	5.2	4.7	4.0	4.0	5.2			4.6
Pool Depth (m):	MS	0.50	0.40	0.20	0.40				0.38

	Gradient %		Mtd	Avg
Method I:	3.0	4.0	C	3.50
Method II:			C	

Wb Depth: .2 .2 .3 Avg: 0.23 Method: MS Stage: Medium

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	S	S	T	D	N
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: Algae
LWD amount: F LWD distribution: C

Left Bank		Right Bank	
Bank shape:	U	Bank shape:	V
Bank texture:	F	Bank texture:	G, C
Riparian vegetation:	C	Riparian vegetation:	C
Vegetation stage:	MF	Vegetation stage:	MF

WATER

Temperature: 7 Method: T3 Conductance: 186 Method: S4
pH: 8.0 Method: P2 Turbidity: C Method: GE
Flood Signs: Yes, 0.3 m. Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: B
D95 (cm): 20.0 D (cm): 15.00 Morph: CPB

Pattern: SI
Islands: O
Coupling: DC
Confinement: OC

FSZ? No

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	Yes	Yes	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 580800-04700-54500-6250-8340-000-000-000-000-000-000 **Site: 16**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Present in very small amounts.
Spawning Habitat	Poor, much of the substrate is too large though there are some gravels and sufficient depth.
Rearing Habitat	Moderate to good, good amount of cover but limited by quantity of slack water.

PHOTOS

Photo				Foc Lg	Dir	Comments
R:	5	F:	8	STD	NS	Aerial view of site # 16 (field site # W).
R:	5	F:	9	STD	NS	Aerial view of site # 16 (field site # W).
R:	7	F:	6	STD	U	Site # 16 (field site # W), at mid-site.
R:	7	F:	7	STD	D	Site # 16 (field site # W), at mid-site.

FDIS Fish Collection Card

Watershed Code: 580800-04700-54500-6250-8340-000-000-000-000-000-000 **Reach #** .0 **Site** 16

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/24 **To:** 2001/08/24

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone	East	North	Mtd	Mtd/No	Temp	Cond	Turbid	Comment
16			10	484789	6368768	GPU	AG 1	7	186	C	
16			10	484789	6368768	GPU	EF 1	7	186	C	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
16	AG 1	1	2001/08/24	14:45	2001/08/24	15:00	
16	EF 1	1	2001/08/24	14:45	2001/08/24	15:15	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
16	EF 1	1	O	741	100.0	5.0	300	I	5	S-R	15C-POW

FISH SUMMARY

	Mtd/Num	H/P	Species	Stage	Age	Total #	Lnth (Min/Max)		Activity	Comment
16	AG 1	1	NFC			0				
16	EF 1	1	GR	NS		1	270	270	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age			Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
16	EF 1	1	GR	270	200.0	F	MT	SC	1	4			7	8	Will spawn in spring 2002

Photo 50. Downstream view from middle of Site #16, unnamed channel 580800-04700-54500-6250-8340. Roll 7 Frame 7. CD#2, Image 0707.

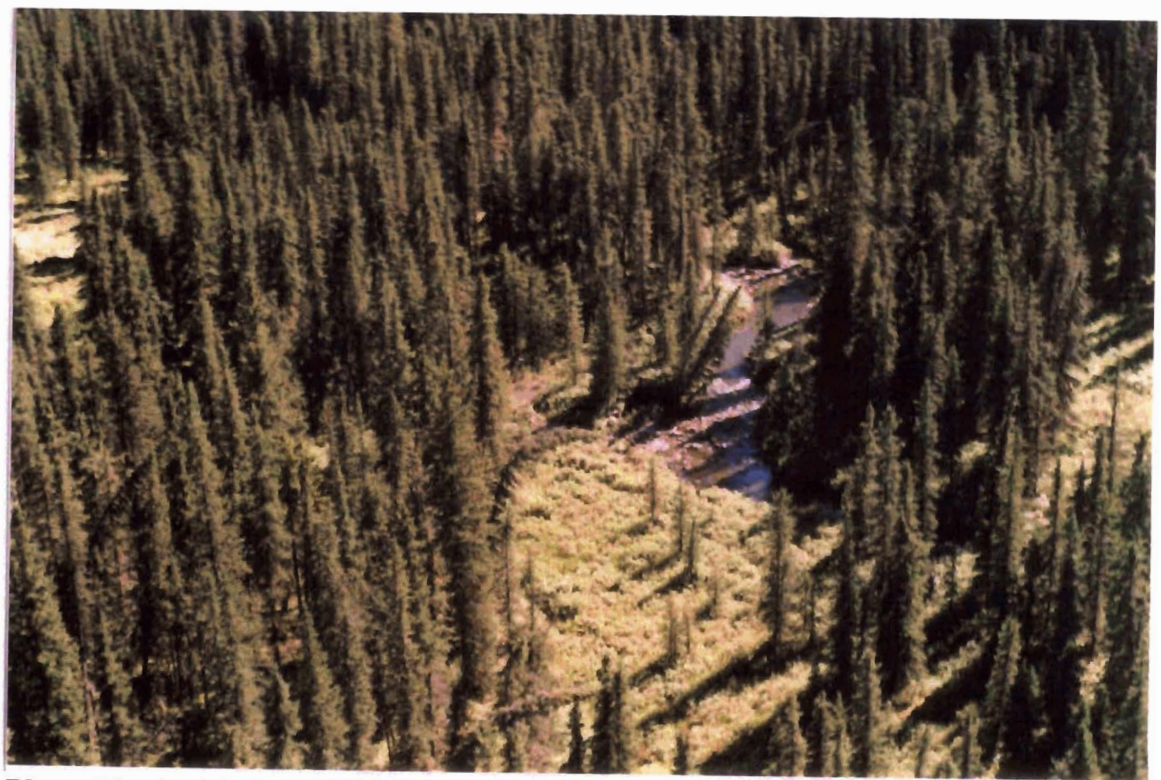

Photo 51. Aerial view of Site #16, unnamed channel 580800-04700-54500-6250-8340. Roll 5 Frame 8. CD#2, Image 0508.

Appendix XIX. Site Card, Fish Card and Site Photographs for Sample Site # 17 Buckinghorse River 998700-48600

FDIS Site Card

Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000 **Site: 17**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: BUCKINGHORSE RIVER Local Name:
Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000
Site #: 17 Contractor site reference: Field site # X
Field UTM (Z.E.N): 10.489053.6357780 Method: GPU Site length: 121 Method: RFL
GIS UTM (Z.E.N): 10.489135.6357771 Access: H
Date: 2001/08/24 Time: 08:25 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	17.0	6.3	9.4	12.2	6.1			10.2
Wetted Width (m):	MS	12.0	4.6	8.1	11.3	4.8			8.2
Pool Depth (m):	MS	0.90	1.10	0.60	0.70	1.20	0.60		0.85

Wb Depth: .3 .4 .2 Avg: 0.30 Method: MS Stage: Medium

	Gradient %	Mtd	Avg
Method I:	1.5	AL	1.50
Method II:		C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: A

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	N	S	D	S	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: Moss
LWD amount: F LWD distribution: E

	Left Bank	Right Bank
Bank shape:	S	S
Bank texture:	F	F
Riparian vegetation:	S	S
Vegetation stage:	SHR	SHR

WATER

Temperature: 5 Method: T3 Conductance: 228 Method: S4
pH: 8.0 Method: P2 Turbidity: L Method: GE
Flood Signs: Method: GE

MORPHOLOGY

Bed Material Dominant: G Subdom: C
D95 (cm): 21.0 D (cm): 9.00 Morph: RP
Pattern: IM
Islands: N FSZ? No
Coupling: DC
Confinement: UN

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	No	Yes	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000 **Site: 17**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Moderate.
Rearing Habitat	Good, abundance of cover.
Spawning Habitat	Good, abundance of gravels.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 20	STD	D	Downstream view of site # 17 (field site # X).
R: 3 F: 21	STD	U	Upstream view of site # 17 (field site # X).
R: 4 F: 20	STD	NS	Aerial upstream view of site # 17 (field site # X).
R: 4 F: 21	STD	NS	Aerial upstream view of site # 17 (field site # X).
R: 4 F: 22	STD	NS	Aerial upstream view of Buckinghorse River channel and valley from vicinity of site # 17 (field site # X).
R: 4 F: 23	STD	NS	Aerial upstream view of Buckinghorse River channel and valley from vicinity of site # 17 (field site # X).

COMMENTS

Section	Comments
SITE CARD	Site located within reach with many beaver dams. No dams in site however.
COVER	Riparian vegetation includes several spruce along banks.

FDIS Fish Collection Card

Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 17

Gazetted Name: BUCKINGHORSE RIVER
Waterbody ID:
Project WS Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 Date: 2001/08/24 To: 2001/08/24

Local name:
Lake/Stream: S
Project ID: 3921
Agency: C206 Crew: JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone	East	North	Mtd	Mtd/No	Temp	Cond	Turbid	Comment
17			10	489053	6357780	GPU	AG 2	5	228	L	
17			10	489053	6357780	GPU	AG 1	5	228	L	
17			10	489053	6357780	GPU	EF 1	5	228	L	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
17	AG 1	1	2001/08/24	08:50	2001/08/24	09:05	Dry fly - #12 Tom Thumb.
17	AG 2	1	2001/08/24	08:30	2001/08/24	08:35	Spinner.
17	EF 1	1	2001/08/24	08:25	2001/08/24	08:45	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
17	EF 1	1	O	921	121.0	4.0	400	I	7	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)		Activity	Comment
17	EF 1	1	CCG	NS		3	36	74	R	
17	EF 1	1	GR	NS		3	125	128	R	

INDIVIDUAL FISH DATA

Site#	Mtd/No	H/P	Species	Length	Weight	Sex	Mat	Age Str/Smolt#/Age			Vch#	Genetic Str/Smolt#	Roll #	Frame#	Comment
17	EF 1	1	GR	126	17.8	U	U	SC	1	2					
17	EF 1	1	GR	125	20.4	U	U	SC	2	2					
17	EF 1	1	GR	128	17.0	U	U	SC	3	2					
17	EF 1	1	CCG	74		U	U								
17	EF 1	1	CCG	36		U	U								
17	EF 1	1	CCG	49		U	U								

Photo 52. Upstream view from middle of Site #17, Buckinghorse River 998700-48600. Roll 3 Frame 21. CD#1, Image #0321.

Photo 53. Aerial view of Site #17, Buckinghorse River 998700-48600. Roll 4 Frame 21. CD#2, Image #0421.

Appendix XX. Site Card, Fish Card and Site Photographs for Sample Site # 18 Unnamed Channel 998700-48600-92700

FDIS Site Card

Watershed Code: 998700-48600-92700-0000-0000-000-000-000-000-000-000 **Site: 18**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 998700-48600-92700-0000-0000-000-000-000-000-000-000
Site #: 18 Contractor site reference: Field site # Y
Field UTM (Z.E.N): 10.485840.6357367 Method: GPU Site length: 109 Method: RFL
GIS UTM (Z.E.N): 10.485841.6357367 Access: H
Date: 2001/08/24 Time: 09:50 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	1.4	1.8	2.0	2.2	1.0	0.9		1.5
Wetted Width (m):	MS	1.4	1.8	1.9	2.2	1.0	0.9		1.5
Pool Depth (m):	MS	0.30	0.70	0.40	0.50				0.48

Wb Depth: .3 .4 .3 Avg: 0.33 Method: MS Stage: Medium

	Gradient %		Mtd	Avg
Method I:	3.0	2.0	C	2.50
Method II:			C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: M

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	N	T	D	S	D	S
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 0%
Instream vegetation:
LWD amount: N LWD distribution: NA

Left Bank		Right Bank	
Bank shape:	V	Bank shape:	U
Bank texture:	F	Bank texture:	F
Riparian vegetation:	C	Riparian vegetation:	S
Vegetation stage:	PS	Vegetation stage:	SHR

WATER

Temperature: 4 Method: T3 Conductance: 349 Method: S4
pH: 7.8 Method: P2 Turbidity: C Method: GE
Flood Signs: No Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: B
D95 (cm): 20.0 D (cm): 5.00 Morph: RP

Pattern: SI
Islands: N FSZ? No
Coupling: DC
Confinement: UN

DISTURBANCE INDICATORS	O1	B1	B2	B3	D1	D2	D3
	No	No	No	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	No	No	No	No	No	No	No	No	No	No

Bars NONE: Yes SIDE: No DIAG: No MID: No SPAN: No BR: No

FDIS Site Card

Watershed Code: 998700-48600-92700-0000-0000-000-000-000-000-000-000 **Site: 18**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	Present but not abundant; Buckinghorse is just downstream.
Spawning Habitat	None to poor, substrate is too large with lots of fines.
Rearing Habitat	Good, lots of cover and pools.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 22	STD	U	Site # 18 (field site # Y) at mid-site.
R: 3 F: 23	STD	D	Site # 18 (field site # Y) at mid-site.
R: 4 F: 24	STD	NS	Site # 18 (field site # Y) from air.
R: 4 F: 25	STD	NS	Site # 18 (field site # Y) from air.
R: 5 F: 3	STD	U	Upstream aerial view SSW from vicinity of site # 18 (field site # Y), looking to uppermost Buckinghorse River valley containing site #19 (field site # Z).
R: 5 F: 4	STD	U	Upstream aerial view SSW from vicinity of site # 18 (field site # Y), looking to uppermost Buckinghorse River valley containing site #19 (field site # Z).

WILDLIFE

Group	Observations
MAM	Water rodent (shrew?)

COMMENTS

Section	Comments
COVER	Open sedge/willow meadow with some stunted spruce.
WATER	Iron flocculate on substrate.
CHANNEL	Relatively deep channel with lots of drops over old BD debris and tussocks; these would limit upstream fish passage.

FDIS Fish Collection Card

Watershed Code: 998700-48600-92700-0000-0000-000-000-000-000-000-000 **Reach #** .0 **Site** 18

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/24 **To:** 2001/08/24

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone,East,North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
18			10.485840.6357367 GPU	EF 1	4	349	C	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
18	EF 1	1	2001/08/24	10:00	2001/08/24	10:26	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
18	EF 1	1	O	424	100.0	1.5	700	I	7	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
18	EF 1	1	NFC			0			

Photo 54. Downstream view of Site # 18, unnamed channel 998700-48600-92700. Roll 3 Frame 23. CD#1, Image #0323.

Photo 55. Aerial view of Site # 18, unnamed channel 998700-48600-92700. Roll 4 Frame 25. CD#2, Image 0425.

Appendix XXI. Site Card, Fish Card and Site Photographs for Sample Site # 19 Buckinghorse River 998700-48600

FDIS Site Card

Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000 **Site: 19**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: BUCKINGHORSE RIVER Local Name:
Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000
Site #: 19 Contractor site reference: Field site # Z
Field UTM (Z.E.N): 10.484654.6355824 Method: GPU Site length: 123 Method: RFL
GIS UTM (Z.E.N): 10.484652.6355826 Access: H
Date: 2001/08/24 Time: 10:50 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	MS	2.5	11.0	12.0	14.0	7.0			9.3
Wetted Width (m):	MS	2.5	6.0	3.5	4.0	6.0			4.4
Pool Depth (m):	MS	0.20	0.30						0.25

	Gradient %		Mtd	Avg
Method I:	1.5	2.0	AL	1.75
Method II:			C	

No Vis.Ch.: No Intermittent: No
Wb Depth: .5 1.6 Avg: 1.05 Method: MS Stage: Medium Dewatered: No Tributaries: No

COVER

Total cover amount: T

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	N	N	D	T	N	S	T
Loc: P/S/O:	P	P	P	P	P	P	P

Crown closure (%): 1-20%
Instream vegetation: Algae, Moss
LWD amount: F LWD distribution: C

Left Bank		Right Bank	
Bank shape:	V	Bank shape:	S
Bank texture:	G, C, B	Bank texture:	G, C, B
Riparian vegetation:	S	Riparian vegetation:	S
Vegetation stage:	SHR	Vegetation stage:	SHR

WATER

Temperature: 5 Method: T3 Conductance: 337 Method: S4
pH: 8.2 Method: P2 Turbidity: C Method: GE
Flood Signs: 1.5m, debris Method: GE

MORPHOLOGY

Bed Material Dominant: G Subdom: C
D95 (cm): 36.0 D (cm): 24.00 Morph: RP

Pattern: SI
Islands: I FSZ? No
Coupling: DC
Confinement: OC

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	Yes	Yes	No	No	Yes	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No

Bars NONE: No SIDE: Yes DIAG: Yes MID: Yes SPAN: No BR: No

FDIS Site Card

Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000 **Site: 19**

HABITAT QUALITY

Habitat type	Comments
Rearing Habitat	Moderate; limited cover and refuge.
OverWinter Habitat	None.
Spawning Habitat	Gravels present but likely scoured during freshet.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 3 F: 24	STD	U	Site # 19 (field site # Z), note aggradation and multiple channels.
R: 3 F: 25	STD	D	Site # 19 (field site # Z).
R: 5 F: 1	STD	NS	Aerial of site # 19 (field site # Z).
R: 5 F: 2	STD	NS	Aerial of site # 19 (field site # Z).

COMMENTS

Section	Comments
CHANNEL	Beaver dam downstream of dewatered section, near confluence.
CHANNEL	Stream is extremely aggraded. Dewatered ~500m downstream of site. Many abandoned and flood channels.

FDIS Fish Collection Card

Watershed Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 19

Gazetted Name: BUCKINGHORSE RIVER
Waterbody ID:
Project WS Code: 998700-48600-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 Date: 2001/08/24 To: 2001/08/24

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 Crew: JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone.East.North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
19			10.484654.6355824 GPU	EF 1	5	337	C	Site Z

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
19	EF 1	1	2001/08/24	10:50	2001/08/24	11:10	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
19	EF 1	1	O	958	123.0	3.0	200	I	7	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lnth (Min/Max)	Activity	Comment
19	EF 1	1	NFC			0			

Photo 56. Downstream view from upper end of Site #19, Buckinghorse River 998700-48600. Roll 3 Frame 25. CD#1, Image 0325.

Photo 57. Aerial view of Site #19, Buckinghorse River 998700-48600. Roll 5 Frame 1. CD#2, Image 0501.

Appendix XXII. Site Card, Fish Card and Site Photographs for Sample Site # 20 Unnamed Channel 580800-33000

FDIS Site Card

Watershed Code: 580800-33000-00000-0000-0000-000-000-000-000-000-000 **Site: 20**

PROJECT

Project Name: FSJ MEM Area 2 Project Code: 3921
Project Watershed Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000

SITE

Gazetted Name: (UNNNAMED) Local Name:
Watershed Code: 580800-33000-00000-0000-0000-000-000-000-000-000-000
Site #: 20 Contractor site reference: Field site # JB
Field UTM (Z.E.N): 10.455839.6491073 Method: GPU Site length: 117 Method: RFL
GIS UTM (Z.E.N): 10.455806.6491043 Access: H
Date: 2001/08/22 Time: 14:28 Agency: C206 Crew: JD/MJ/CS Fish form? Yes

CHANNEL

	Mtd	width	width	width	width	width	width	width	Avg
Channel Width (m):	RFL	38.0	35.0	46.0	28.0	32.0	54.0		38.8
Wetted Width (m):	MS	2.1	1.9	2.3	1.8	2.0	1.7		2.0
Pool Depth (m):	MS								0.00

Wb Depth: .6 .6 6.0 Avg: 2.40 Method: MS Stage: High

	Gradient %	Mtd	Avg
Method I:	4.0	C	4.00
Method II:		C	

No Vis.Ch.: No Intermittent: No
Dewatered: No Tributaries: No

COVER

Total cover amount: T

Type:	SWD	LWD	B	C	DP	OV	IV
Amount:	T	T	S	S	N	D	N
Loc: P/S/O:	P	P	P	P		P	

Crown closure (%): 0%
Instream vegetation: None
LWD amount: F LWD distribution: C

Left Bank		Right Bank	
Bank shape:	V	Bank shape:	V
Bank texture:	G	Bank texture:	G
Riparian vegetation:	S	Riparian vegetation:	M
Vegetation stage:	SHR	Vegetation stage:	MF

WATER

Temperature: 10 Method: T3 Conductance: 969 Method: S4
pH: 4.6 Method: P2 Turbidity: T Method: GE
Flood Signs: 0.1m, debris. Method: GE

MORPHOLOGY

Bed Material Dominant: C Subdom: B
D95 (cm): 15.0 D (cm): 20.00 Morph: CP

Pattern: IR
Islands: N
Coupling: CO
Confinement: FC

FSZ? No

DISTURBANCE INDICATORS	Q1	B1	B2	B3	D1	D2	D3
	No	No	Yes	No	No	No	No

DISTURBANCE INDICATORS	C1	C2	C3	C4	C5	S1	S2	S3	S4	S5
	Yes	Yes	Yes	No	No	No	No	No	No	No

Bars NONE: No SIDE: Yes DIAG: No MID: No SPAN: Yes BR: No

FDIS Site Card

Watershed Code: 580800-33000-00000-0000-0000-000-000-000-000-000-000 **Site: 20**

HABITAT QUALITY

Habitat type	Comments
OverWinter Habitat	None.
Spawning Habitat	None to poor; substrates large and compacted.
Rearing Habitat	Poor; very little cover and no slow water.

PHOTOS

Photo	Foc Lg	Dir	Comments
R: 1 F: 12	STD	D	Downstream view of site # 20 (field site # JB).
R: 1 F: 13	STD	D	Downstream view of site # 20 (field site # JB).
R: 1 F: 14	STD	U	Upstream view of site # 20 (field site # JB).
R: 2 F: 12	STD	NS	Aerial downstream view of site # 20 (field site # JB).

COMMENTS

Section	Comments
CHANNEL	Debris torrents, high sediment movement, aggraded and active.
WATER	Much of the substrate displayed yellow-orange iron staining.

FDIS Fish Collection Card

Watershed Code: 580800-33000-00000-0000-0000-000-000-000-000-000-000 Reach # .0 Site 20

Gazetted Name: (UNNAMED)
Waterbody ID:
Project WS Code: 580800-00000-00000-0000-0000-000-000-000-000-000-000
Fish Permit #: SC2001-022 **Date:** 2001/08/22 **To:** 2001/08/22

Local name: (NONE KNOWN)
Lake/Stream: S
Project ID: 3921
Agency: C206 **Crew:** JD/MJ/CS

SITE / METHOD

Site#	NID Map	NID #	UTM Zone East North Mtd	Mtd/No	Temp	Cond	Turbid	Comment
20			10.455839.6491073 GPU	EF 1	10	969	T	

GEAR SETTINGS

Site#	Mtd/No	H/P	Date In	Time In	Date Out	Time Out	Comment
20	EF 1	1	2001/08/22	14:40	2001/08/22	14:55	

ELECTROFISHER SPECIFICATIONS

Site#	Mtd/Num	H/P	Encl	Sec	Length	Width	Voltage	Freq	Pulse	Make	Model
20	EF 1	1	O	431	117.0	2.0	200	I	5	S-R	15C-POW

FISH SUMMARY

Site#	Mtd/Num	H/P	Species	Stage	Age	Total #	Lgth (Min/Max)	Activity	Comment
20	EF 1	1	NFC			0			

Photo 58. Upstream view from lower end of Site #20, unnamed channel 580800-33000. Roll 1 Frame 12. CD#1, Image 0112.

Photo 59. Aerial view of Site #20, unnamed channel 580800-33000. Roll 2 Frame 12. CD#1, Image 0212.

Appendix XXIII. Directory of Photographs

Table 14. Project photo directory. Column headings are self-explanatory, except: **R**=roll; **F**=frame; **Dir**=photo direction; **Easting**=UTM Easting and **Northing**=UTM Northing coordinates (both in Zone 10, NAD83) of photo location.

R	F	Watershed code	Water	Site	Dir	Subject	Easting	Northing	CD	Image
1	1	580800-30200-37400	Unnamed	1	U	Upstream end of site # 1.	430607	6498737	1	0101
1	2	580800-30200-37400	Unnamed	1	U	Island in site # 1.	430607	6498737	1	0102
1	3	580800-30200-37400	Unnamed	1	D	Downstream end of site # 1.	430607	6498737	1	0103
1	4	580800-30200-37400	Unnamed	1	A	Site # 1.	430607	6498737	1	0104
1	5	580800-30200-37400	Unnamed	2	U	Upstream end of site # 2.	430973	6496097	1	0105
1	6	580800-30200-37400	Unnamed	2	U	Steepest area in site # 2.	431000	6496094	1	0106
1	7	580800-30200-37400	Unnamed	2	D	Downstream end of site # 2.	431000	6496094	1	0107
1	8	580800-30200	Tetsa R	3	U	View of river left, main channels, site # 3.	455880	6501166	1	0108
1	9	580800-30200	Tetsa R	3	U	View of river right, side channel, site # 3.	455880	6501166	1	0109
1	10	580800-30200	Tetsa R	3	D	View of river left, main channels, site # 3.	455880	6501166	1	0110
1	11	580800-30200	Tetsa R	3	D	View of river right, side channel, site # 3.	455880	6501166	1	0111
1	12	580800-33000	Unnamed	20	D	Site # 20.	455806	6491043	1	0112
1	13	580800-33000	Unnamed	20	D	Site # 20.	455806	6491043	1	0113
1	14	580800-33000	Unnamed	20	U	Site # 20.	455806	6491043	1	0114
1	15	580800	Muskwa R	5	U	Site # 5.	462492	6474034	1	0115
1	16	580800	Muskwa R	5	U	Site # 5.	462492	6474034	1	0116
1	17	580800	Muskwa R	5	D	Site # 5.	462492	6474034	1	0117
1	18	580800	Muskwa R	5	F	BT sample #1, captured at site # 5.	462492	6474034	1	0118
1	19	580800	Muskwa R	5	F	BT sample #1, captured at site # 5.	462492	6474034	1	0119
1	20	580800	Muskwa R	5	F	GR sample # 2, captured at site # 5.	462492	6474034	1	0120
1	21	580800	Muskwa R	5	F	GR sample # 2, captured at site # 5.	462492	6474034	1	0121
1	22	580800-36500	Unnamed	6	U	Site # 6.	451743	6477347	1	0122
1	23	580800-36500	Unnamed	6	D	Site # 6.	451743	6477347	1	0123
1	24	580800-39100-39300	Unnamed	4	U	Site # 4, upstream of breached beaver dam.	454418	6470092	1	0124

Table 14 continued. Project photo directory. Column headings are self-explanatory, except: **R**=roll; **F**=frame; **Dir**=photo direction; **Easting**=UTM Easting and **Northing**=UTM Northing coordinates (both in Zone 10, NAD83) of photo location.

R	F	Watershed code	Water	Site	Dir	Subject	Easting	Northing	CD	Image
1	25	580800-39100-39300	Unnamed	4	U	Site # 4, looking at breached beaver dam.	454418	6470092	1	0125
2	1	580800-30200-37400	Unnamed	2	A	Site # 2.	431000	6496094	1	0201
2	2	580800-30200-37400	Unnamed	2	A	Site # 2.	431000	6496094	1	0202
2	3	580800-30200-37400	Unnamed	NA	A	Cascades.	431012	6500596	1	0203
2	4	580800-30200-37400	Unnamed	NA	A	Cascades.	431012	6500596	1	0204
2	5	580800-30200	Tetsa R	NA	A	Downstream view of Tetsa R valley	447332	6501151	1	0205
2	6	580800-30200	Tetsa R	3	NS	Site # 3.	455880	6501166	1	0206
2	7	580800-30200	Tetsa R	3	NS	Site # 3.	455880	6501166	1	0207
2	8	580800-30200	Tetsa R	NA	A	Downstream view of Tetsa River channel, immediately downstream of site # 3.	456261	6501403	1	0208
2	9	580800-30200	Tetsa R	NA	A	Downstream view of Tetsa River channel, immediately downstream of site # 3.	456261	6501403	1	0209
2	10	580800-32000	Chischa R	NA	A	Mouth of Chischa R	456646	6494958	1	0210
2	11	580800	Muskwa R	NA	A	Slope failure on river right (opposite bank of Muskwa from mouth of Chischa R)	456781	6495201	1	0211
2	12	580800-33000	Unnamed	20	A	Site # 20.	455806	6491043	1	0212
2	13	580800	Muskwa R	NA	A	Upstream view of Muskwa R valley	456656	6482387	1	0213
2	14	580800	Muskwa R	NA	A	Upstream view of Muskwa R valley	458777	6479665	1	0214
2	15	580800	Muskwa R	5	A	Site # 5.	462492	6474034	1	0215
2	16	580800	Muskwa R	5	A	Site # 5.	462492	6474034	1	0216
2	17	580800	Muskwa R	5	A	Upstream view of Muskwa R, upstream of site #5.	462492	6474034	1	0217
2	18	580800-36500	Unnamed	6	A	Site # 6.	451743	6477347	1	0218
2	19	580800-36500	Unnamed	4	A	Upstream view of basin of unnamed 580800-36500 in vicinity of site #4	454418	6470092	1	0219
2	20	580800-39100-39300	Unnamed	4	A	Site # 4.	454418	6470092	1	0220
2	21	580800-39100-39300	Unnamed	4	A	Site # 4.	454418	6470092	1	0221
3	1	580800-04700-51100	Bunch Cr	13	U	Site # 13 at fresh beaver dam.	483703	6414236	1	0301

Table 14 continued. Project photo directory. Column headings are self-explanatory, except: **R**=roll; **F**=frame; **Dir**=photo direction; **Easting**=UTM Easting and **Northing**=UTM Northing coordinates (both in Zone 10, NAD83) of photo location.

R	F	Watershed code	Water	Site	Dir	Subject	Easting	Northing	CD	Image
3	2	580800-04700-51100	Bunch Cr	13	D	Site # 13 at small pond.	483703	6414236	1	0302
3	3	580800	Muskwa R	11	U	Primary channel from mid-site # 11.	471779	6415366	1	0303
3	4	580800	Muskwa R	11	D	Primary channel from mid-site # 11.	471779	6415366	1	0304
3	5	580800	Muskwa R	11	U	Secondary channel habitat, site # 11.	471779	6415366	1	0305
3	6	580800	Muskwa R	11	X	Large secondary channel and functioning LWD, site # 11.	471779	6415366	1	0306
3	7	580800	Muskwa R	11	F	LSU, site # 11.	471779	6415366	1	0307
3	8	580800	Muskwa R	11	F	MW sample # 16, site # 11.	471779	6415366	1	0308
3	9	580800	Muskwa R	11	F	CCG, site # 11.	471779	6415366	1	0309
3	10	580800	Muskwa R	11	F	CCG, site # 11.	471779	6415366	1	0310
3	11	580800	Muskwa R	12	U	Site # 12, river left, including side channel.	472570	6442060	1	0311
3	12	580800	Muskwa R	12	U	Site # 12, river right.	472570	6442060	1	0312
3	13	580800	Muskwa R	12	D	Site # 12, river left, including side channel.	472570	6442060	1	0313
3	14	580800	Muskwa R	12	D	Site # 12, river right.	472570	6442060	1	0314
3	15	580800	Muskwa R	12	F	MW sample # 1, site # 12.	472570	6442060	1	0315
3	16	580800	Muskwa R	12	F	LSU, site # 12.	472570	6442060	1	0316
3	17	580800	Muskwa R	12	F	LKC, site # 12.	472570	6442060	1	0317
3	18	580800-44400-05700-2400	Unnamed	9	U	Site # 9.	456909	6445478	1	0318
3	19	580800-44400-05700-2400	Unnamed	9	D	Site # 9.	456909	6445478	1	0319
3	20	998700-48600	Buckinghorse R	17	D	Site # 17.	489135	6357771	1	0320
3	21	998700-48600	Buckinghorse R	17	U	Site # 17.	489135	6357771	1	0321
3	22	998700-48600-92700	Unnamed	18	U	Site # 18 at mid-site.	485841	6357367	1	0322
3	23	998700-48600-92700	Unnamed	18	D	Site # 18 at mid-site.	485841	6357367	1	0323
3	24	998700-48600	Buckinghorse R	19	U	Site # 19, note aggradation and multiple channels.	484652	6355826	1	0324
3	25	998700-48600	Buckinghorse R	19	D	Site # 19.	484652	6355826	1	0325
4	1	580800-04700-51100	Bunch Cr	13	A	Downstream view of Bunch Creek valley, vicinity of site # 13	483703	6414236	2	0401

Table 14 continued. Project photo directory. Column headings are self-explanatory, except: **R**=roll; **F**=frame; **Dir**=photo direction; **Easting**=UTM Easting and **Northing**=UTM Northing coordinates (both in Zone 10, NAD83) of photo location.

R	F	Watershed code	Water	Site	Dir	Subject	Easting	Northing	CD	Image
4	2	580800-04700-51100	Bunch Cr	13	A	Site # 13.	483703	6414236	2	0402
4	3	580800-04700-51100	Bunch Cr	13	A	Site # 13.	483703	6414236	2	0403
4	4	580800	Muskwa R	11	A	Upstream view of Muskwa River valley in vicinity of site # 11.	471779	6415366	2	0404
4	5	580800	Muskwa R	11	A	Site # 11.	471779	6415366	2	0405
4	6	580800	Muskwa R	11	A	Upstream view of Muskwa River valley in vicinity of site # 11.	471779	6415366	2	0406
4	7	580800	Muskwa R	12	A	Site # 12.	472570	6442060	2	0407
4	8	580800	Muskwa R	12	A	Site # 12.	472570	6442060	2	0408
4	9	580800	Muskwa R	12	A	Downstream view of Muskwa River channel and valley, vicinity of site # 12.	472570	6442060	2	0409
4	10	580800-44400	Gathto Cr	NA	A	Upstream view of Gathto Cr channel and valley	463437	6450202	2	0410
4	11	580800-44400	Gathto Cr	NA	A	Upstream view of Gathto Cr channel and valley	463437	6450202	2	0411
4	12	580800-44400	Gathto Cr	10	A	Site # 10.	459571	6445031	2	0412
4	13	580800-44400	Gathto Cr	10	D	Site # 10, from upper end of site.	459571	6445031	2	0413
4	14	580800-44400	Gathto Cr	10	U	Site # 10, from lower end of site.	459571	6445031	2	0414
4	15	580800-44400	Gathto Cr	10	A	Site # 10.	459571	6445031	2	0415
4	16	998700-48600-56500	Grassy Creek	NA	A	Upstream view of Grassy Cr valley (not within area of interest).	505840	6359340	2	0416
4	17	998700-48600	Buckinghorse R	NA	A	Upstream view of Buckinghorse R channel and valley	493214	6358820	2	0417
4	18	998700-48600	Buckinghorse R	NA	A	Upstream view of Buckinghorse R channel and valley	493214	6358820	2	0418
4	19	998700-48600	Buckinghorse R	NA	A	Upstream view of Buckinghorse R channel and valley	493214	6358820	2	0419
4	20	998700-48600	Buckinghorse R	17	A	Site # 17.	489135	6357771	2	0420
4	21	998700-48600	Buckinghorse R	17	A	Site # 17.	489135	6357771	2	0421
4	22	998700-48600	Buckinghorse R	17	A	Aerial upstream view of Buckinghorse R channel and valley from vicinity of site # 17.	489135	6357771	2	0422

Table 14 continued. Project photo directory. Column headings are self-explanatory, except: **R**=roll; **F**=frame; **Dir**=photo direction; **Easting**=UTM Easting and **Northing**=UTM Northing coordinates (both in Zone 10, NAD83) of photo location.

R	F	Watershed code	Water	Site	Dir	Subject	Easting	Northing	CD	Image
4	23	998700-48600	Buckinghorse R	17	A	Aerial upstream view of Buckinghorse R channel and valley from vicinity of site #17.	489135	6357771	2	0423
4	24	998700-48600-92700	Unnamed	18	A	Site #18.	485841	6357367	2	0424
4	25	998700-48600-92700	Unnamed	18	A	Site #18.	485841	6357367	2	0425
5	1	998700-48600	Buckinghorse R	19	A	Site #19.	484652	6355826	2	0501
5	2	998700-48600	Buckinghorse R	19	A	Site #19.	484652	6355826	2	0502
5	3	998700-48600-92700	Unnamed	18	U	Upstream view SSW from vicinity of site #18, looking to uppermost Buckinghorse R valley containing site #19.	485841	6357367	2	0503
5	4	998700-48600-92700	Unnamed	18	U	Upstream view SSW from vicinity of site #18, looking to uppermost Buckinghorse R valley containing site #19.	485841	6357367	2	0504
5	5	580800-04700-54500-6250	Pocketknife Cr	14	A	Site #14.	488169	6366510	2	0505
5	6	580800-04700-54500-6250	Pocketknife Cr	14	A	Site #14.	488169	6366510	2	0506
5	7	580800-04700-54500-6250	Pocketknife Cr	14	A	Upstream view (westward) of Pocketknife Cr valley from vicinity of site #14.	488169	6366510	2	0507
5	8	580800-04700-54500-6250-8340	Unnamed	16	A	Site #16.	484823	6368769	2	0508
5	9	580800-04700-54500-6250-8340	Unnamed	16	A	Site #16.	484823	6368769	2	0509
5	10	580800-04700-54500-6250-8340	Unnamed	NA	A	Upstream view of channel 580800-04700-54500-6250-8340	485444	6368034	2	0510
5	11	580800-04700-54500-6250	Pocketknife Cr	15	D	Site #15 from upper end.	484232	6366447	2	0511
5	12	580800-04700-54500-6250	Pocketknife Cr	15	U	Site #15 from lower end.	484232	6366447	2	0512
5	13	580800-04700-54500-6250	Pocketknife Cr	15	NS	Site #15.	484232	6366447	2	0513
5	14	580800-04700-54500-6250	Pocketknife Cr	15	NS	Site #15.	484232	6366447	2	0514
5	15	580800-44400	Gathto Cr	NA	A	Upstream view of Gathto Cr channel and valley	463136	6452341	2	0515
5	16	580800-44100	Unnamed	8	X	Crew in site #8.	457888	6454120	2	0516
5	17	580800-44100	Unnamed	8	X	Crew in site #8.	457888	6454120	2	0517

Table 14 continued. Project photo directory. Column headings are self-explanatory, except: **R**=roll; **F**=frame; **Dir**=photo direction **Easting**=UTM Easting and **Northing**=UTM Northing coordinates (both in Zone 10, NAD83) of photo location.

R	F	Watershed code	Water	Site	Dir	Subject	Easting	Northing	CD	Image
5	18	580800-44100	Unnamed	8	F	GR captured at site # 8	457888	6454120	2	0518
5	19	580800-44100	Unnamed	8	A	Site # 8.	457888	6454120	2	0519
5	20	580800-44100	Unnamed	8	A	Site # 8.	457888	6454120	2	0520
5	21	580800-43000	Unnamed	7	A	Site # 7.	455937	6457735	2	0521
5	22	580800-43000	Unnamed	7	A	Site # 7.	455937	6457735	2	0522
7	1	580800-04700-54500-6250	Pocketknife Cr	14	D	Site # 14.	488169	6366510	2	0701
7	2	580800-04700-54500-6250	Pocketknife Cr	14	U	Site # 14.	488169	6366510	2	0702
7	3	580800-04700-54500-6250	Pocketknife Cr	14	F	GR sample # 5, captured at site #14.	488169	6366510	2	0703
7	4	580800-04700-54500-6250	Pocketknife Cr	14	F	GR sample # 5, captured at site #14.	488169	6366510	2	0704
7	5	580800-04700-54500-6250	Pocketknife Cr	14	F	CCG captured at site # 14.	488169	6366510	2	0705
7	6	580800-04700-54500-6250-8340	Unnamed	16	U	Site # 16, at mid-site.	484823	6368769	2	0706
7	7	580800-04700-54500-6250-8340	Unnamed	16	D	Site # 16, at mid-site.	484823	6368769	2	0707
7	8	580800-04700-54500-6250-8340	Unnamed	16	F	GR sample # 1, captured at site # 16	484823	6368769	2	0708
7	9	580800-04700-54500-6250	Pocketknife Cr	15	F	GR sample # 1, captured at site #15.	484232	6366447	2	0709
7	10	580800-04700-54500-6250	Pocketknife Cr	15	F	BT sample #5, captured at site # 15.	484232	6366447	2	0710
7	11	580800-44100	Unnamed	8	U	Poor fish habitat at downstream end of site # 8.	457888	6454120	2	0711
7	12	580800-44100	Unnamed	8	D	Poor fish habitat at downstream end of site # 8.	457888	6454120	2	0712
7	13	580800-44100	Unnamed	8	U	Good fish habitat in site # 8.	457888	6454120	2	0713
7	14	580800-44100	Unnamed	8	D	Good habitat in site # 8; start of poorer cascade-pool habitat visible.	457888	6454120	2	0714
7	15	580800-43000	Unnamed	7	U	Mid-site # 7.	455937	6457735	2	0715
7	16	580800-43000	Unnamed	7	D	Mid-site # 7.	455937	6457735	2	0716