

**INFERRED CHANGES IN CHINOOK COVER  
HABITAT SUITABILITY IN NECHAKO RIVER  
(REACHES 5-7) DUE TO FLOW REDUCTION**

*NECHAKO FISHERIES CONSERVATION PROGRAM  
Technical Report No. RM90-7*

Prepared by:  
R.J. Beniston and D.B. Lister  
D.B. Lister & Associates Ltd.  
January 2003



---

## **FORWARD**

---

This study was undertaken on behalf of the Nechako Fisheries Conservation Program to establish, in quantitative terms, the basis for locating, sizing, and constructing habitat complexes as required under the 1987 Settlement Agreement.

The study accomplished its goal for the upper Nechako River (Cheslatta Falls to Nautley River confluence). However, in the lower river (between the Nautley River and Stuart River confluences), due to local inflows changes in river stage related to flows were not representative of changes that would be experienced with the Kemano Completion Project (KCP). Because of this flow timing and magnitude, the results of the study in the lower Nechako River have limited value in the context of the study's goals.

In January 1985, the Province of British Columbia announced that it was rejecting KCP. As a consequence, the habitat changes suggested in this report will not occur, as the current base flows in June and September will remain unchanged in perpetuity.

---

---

# CONTENTS

List of Figures .....  
List of Tables .....  
List of Appendices .....  
INTRODUCTION .....  
    Background  
    Study Objectives  
METHODS .....  
    Study Approach  
    Adjustments to Measured Approach Velocities  
    Assessment Methodology  
RESULTS .....  
    Occurrence of Cover Types  
    Occurrence of Velocity Classes at Different Flow Levels  
    Estimated Change in Cover Suitability  
DISCUSSION .....  
    Estimation of Short and long-term Approach Velocities  
    Cover Availability  
ACKNOWLEDGEMENTS .....  
REFERENCES .....  
APPENDICES

---

---

# List of Figures

Figure 1	Map of the Nechako River Study Area Between Cheslatta Falls and the Stuart River Confluence	2
----------	---	---

---

# List of Tables

Table 1	Comparison of Nechako River Flows Below Cheslatta Falls Under Short Term and Long Term Flow Regimes	3
Table 2	Comparison of Nechako River Discharges in 1989 Study Periods with Estimated Discharges That Would Prevail Under Short Term and Long Term Flow Regimes Based on a 30 Year Record of Inflow	3
Table 3	Mean Densities of Juvenile Chinook (fish/100 m <sup>2</sup> of cover) Used to Estimate Fish Abundance by Habitat Type at Cover Sites at Short Term and Long Term Flow Levels, Nechako River, 1989	5
Table 4	Number of Major Cover Sites by Cover Type During May, Nechako River, 1989	6
Table 5	Number of Cover Sites by Velocity Class in the Lower Nechako River Under Inventoried Flows in May, 1989 and Simulated Short Term Flow Conditions	7
Table 6	Frequency of Velocity Classes at Cover Sites Under Simulated Short Term and Long Term Flow Conditions in the Lower Nechako River Study Area	7
Table 7	Comparison of Measured Approach Velocity (cm/s) in May, 1989 with Simulated Short Term and Long Term Approach Velocities in the Lower River Based on 603 Sites	7
Table 8	Estimated Net Change in Juvenile Chinook Use of Major Cover Sites in the Lower Nechako River (Reaches 5-7) Based on Hypothetical Changes in Approach Velocities at Short Term and Long Term Flow Levels	8
Table 9	Distribution of Estimated Juvenile Chinook Population by Velocity Class at a Major Cover Site in the Lower River (Reaches 5-7) at Short Term and Long Term Flow Levels, Nechako River, 1989	8
Table 10	Estimated Change in Juvenile Chinook Use of Major Cover Habitats in the Lower Nechako River (Reaches 5-7) Based on Hypothetical Changes in Approach Velocities Between Short Term and Long Term Flow Levels	9
Table 11	Estimated Change in Juvenile Chinook Use of Major Cover Sites in the Lower Nechako River Reaches Based on Hypothetical Changes in Approach Velocities Between Short Term and Long Term Flow Levels	9

---

# List of Appendices

- Appendix 1 Study Terms of Reference for Estimating Change in Cover Suitability in the Lower Nechako River, Nautley River to Stuart River, Nechako Fisheries Conservation Program 1991
- Appendix 2 Description of Methods used by Hay & Company Consultants Inc. in Estimating Short Term and Long Term Velocities at Major Cover Sites in the Lower Nechako River Based on Cover Site Inventory Data Collected During May - June, 1989
- Appendix 3 Physical Characteristics of Major Cover Sites in the Lower Nechako River During May 16 - June 2, 1989
- Appendix 4 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the Lower Nechako River During May 23 - June 2, 1989
- Appendix 5 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based on Hypothetical Changes in Short Term and Long Term Approach Velocities
- Appendix 6 River Widths at Transects in the Nechako River Between Nautley River and Vanderhoof During Short Term (169.9 m<sup>3</sup>/s) and Long Term (141.6 m<sup>3</sup>/s) Flow Levels

---

# INTRODUCTION

---

## Background

Under the Nechako Settlement Agreement, Alcan Aluminum will direct an increased proportion of the Nechako River flow to enable expansion of its hydro-electric generating capacity. An identified concern is that planned reductions in flow could adversely affect rearing habitat of juvenile chinook (*Oncorhynchus tshawytscha*) due to changes in the availability and suitability of instream cover structures.

Studies conducted at Nechako River in 1989, between Cheslatta Falls and Stuart River (Figure 1), compared the amount and quality of cover habitat at flows approximating the short (pre-project) and long term (post-project) levels in the month of June (Beniston and Lister, 1990). It was considered that the change from short to long-term flow regime (Table 1) would have the greatest effect on chinook rearing in June, a month of high abundance (Russell et al. 1983) when the fast growing juveniles are shifting their distribution into faster and deeper habitat (Anon. 1987).

A basic assumption of the 1989 study design was that river discharge during the May and September habitat inventory surveys reflected the planned short and long-term flow levels for June. A review of historic discharge data indicated, however, that this assumption was only met in the upper river (Reaches 1-4) above the Nautley River confluence (Figure 1). In the lower river (Reaches 5-7), between the Nautley and Stuart rivers, 1989 study discharges were lower than the expected 30-year levels under both short and long-term flow regimes. In addition, the discharge decline between May and September surveys greatly exceeded the decline expected under average short and long-term flow conditions in June (Table 2). As a result, an assessment of the effect of flow reduction on chinook cover habitat was only produced for the upper river.

As a result of the deficiency in the 1989 study, D.B. Lister & Associates was retained by the Nechako Fisheries Conservation Program (NFCP) to assess changes in chinook cover suitability in the lower river study area by using calculations of expected velocity conditions at cover sites under short and long term flows in June. This study was conducted under terms of reference approved by the Technical Committee established to implement the NFCP (Appendix 1). This

work complements previous investigations of juvenile chinook use of cover features relative to planned flow reductions (Beniston and Lister, 1990).

## Study Objectives

The principal objective of this study was to estimate the percent change in suitability of cover sites in the lower Nechako River, Nautley River to Stuart River, under short and long term flow regimes. Specific study objectives, as stated in the Terms of Reference (Appendix 1) were as follows:

1. To estimate changes in water velocities in Nechako River, below Nautley River, between short and long term flow hydrographs. Of prominent importance are the river velocities within 5 meters of the margins.
2. Using these estimated changes in river velocities calculate the percentage change in suitability for juvenile chinook of the cover habitat previously inventoried on the lower Nechako River in 1989.

---

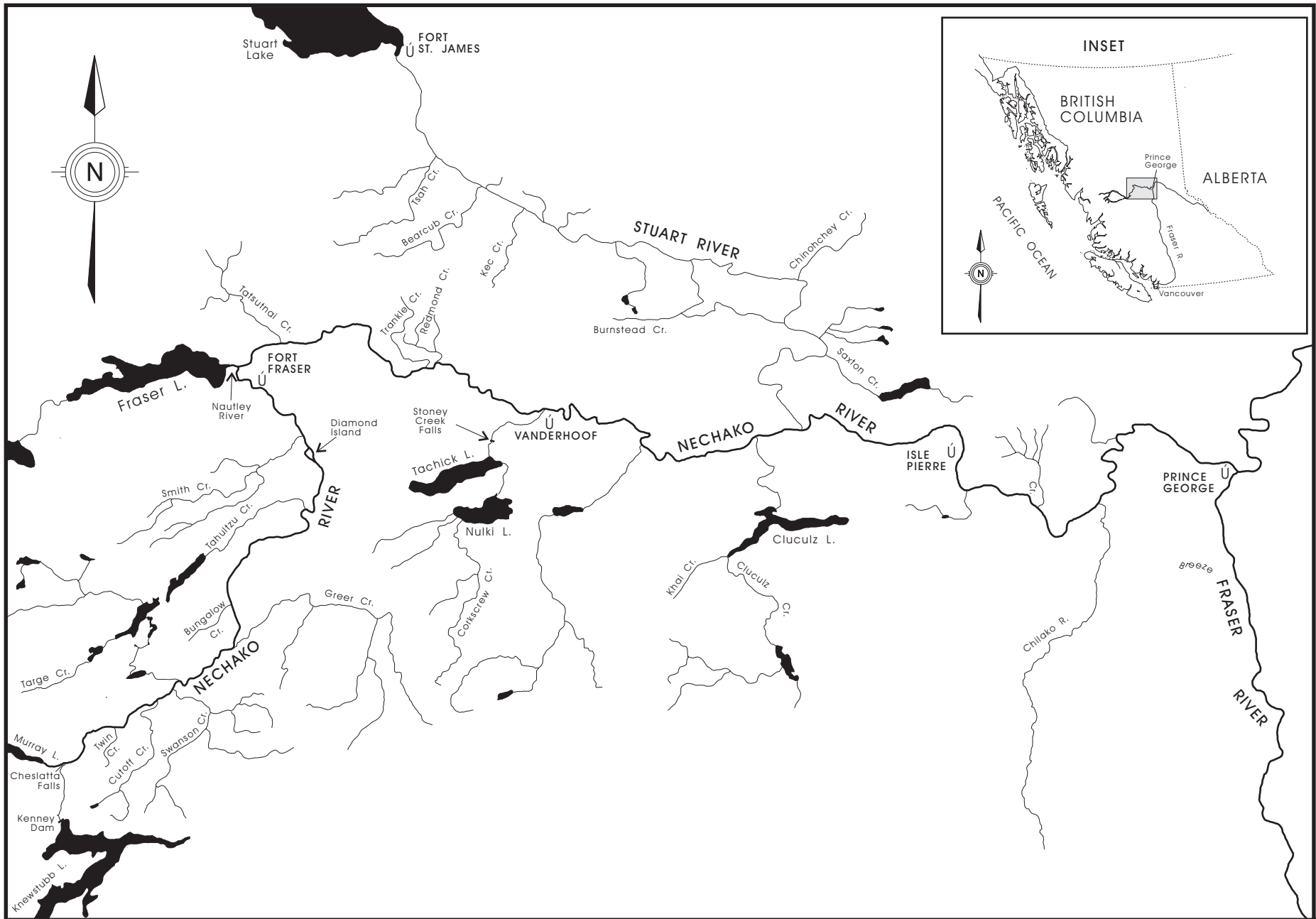
## METHODS

---

### Study Approach

Water velocity was shown to be a key variable in influencing the suitability of cover sites for rearing chinook juveniles in the Nechako River (Beniston and Lister, 1990). The NFCP proposed a program to assess the change in suitability of cover sites in the lower river by adjusting 1989 water velocity measurements at cover sites to reflect average short and long term flow conditions. Chinook populations were therefore estimated at cover sites in the lower river under short and long term flows using inferred velocity conditions and existing fish habitat density values. The change in habitat suitability was determined from the difference in estimated fish populations under short and long term flow conditions in June. The assessment provides an estimate of change in cover site rearing suitability due to the inferred effects of reductions in water velocities.





Nechako Fisheries Conservation Program

Map # RM90-7-1

FIGURE 1. Nechako River Study Area



**Table 1**  
Comparison of Nechako River Flows Below Cheslatta Falls Under Short Term and Long Term Flow Regimes<sup>a</sup>

Annual Period	Short Term Flow Regime (m <sup>3</sup> /s) <sup>b</sup>	Long Term Flow Regime (m <sup>3</sup> /s) <sup>c</sup>
April 1 - August 31	56.6 <sup>d</sup>	31.1 <sup>d</sup>
September 1 - November 30	31.1	25.5 - 28.3
December 1 - March 31	31.1	14.2
Annual Mean	41.7	24.5

a Flows are those given in Column 11 of Schedules "C" and "D" of the Settlement Agreement, as estimated below Cheslatta Falls at Hydrometric Station No. 08JA017.

b Short-term flow represents the current approved flow regime.

c Long-term flow represents the flow regime in effect following construction of the Kenney Dam Water Release Facility.

d These values do not include additional flows that may be released during July and August for cooling purposes to protect migrating adult sockeye salmon.

## Adjustments to Measured Approach Velocities

Hay & Company Consultants Inc. were retained by NFCP to develop correction factors for adjusting approach velocities measured in May-June, 1989 to those which would occur under average short and long term flow levels in June (Appendix 2). Their procedure involved the use of 47 transects (water depth and velocity) established by the International Pacific Salmon Fisheries Commission on the Nechako River between the Nautley and Stuart rivers. Transects were located at 1-5 km intervals throughout that river section. At each transect, mean channel velocity was estimated for the short and long term flow. The ratio of percent mean channel velocity change to percent flow change from short to long term flow was cal-

**Table 2**  
Comparison of Nechako River Discharges in 1989 Study Periods with Estimated Discharges That Would Prevail Under Short Term and Long Term Flow Regimes Based on a 30 Year Record of Inflow

	Short Term Flow Regime		Long Term Flow Regime	
	Discharge During 1989 Study (m <sup>3</sup> /s)	30-year Discharge for June (m <sup>3</sup> /s) <sup>a</sup>	Discharge During 1989 Study (m <sup>3</sup> /s)	30-year Discharge for June (m <sup>3</sup> /s) <sup>a</sup>
Flow Release (as measured at Cheslatta Falls) <sup>b</sup>	54.3	56.6 <sup>d</sup>	35.2	31.1 <sup>d</sup>
Discharge in Upper River (at downstream end of Reach 2) <sup>c</sup>	67.5	64.5	37.8	39
Discharge in Lower River (at Vanderhoof) <sup>d</sup>	137.9	166.7	51.4	141.2

a The 30 year discharge estimates mean monthly values derived from Envirocon Ltd. estimates of Nechako Discharge near Cheslatta Falls (Reach 1) and at Reach 2 for the 1957-81 period, and Water Survey of Canada (1989) data for Cheslatta Falls (1981-88) and Vanderhoof 1957-88).

b Discharge at Cheslatta Falls as specified in Schedules "C" and "D" of the Settlement Agreement.

c Discharge index for upper river (Reaches 1-4) equal Cheslatta Falls discharge plus estimated tributary inflow to the downstream end of Reach 2. Tributary inflow was estimated with a simple liner regression model (based on 1957-81 Envirocon data) that relates mean monthly Reach 2 inflow to mean monthly inflow from all tributaries between Cheslatta Falls and Vanderhoof. Methodology is described in Appendix 9 of Beniston and Lister (1990).

d Discharge index in lower river (Reaches 5-7) is from Vanderhoof gauge (08JC001) at downstream end of Reach 6. Estimates of 30 year discharge were derived by adding the calculated average inflow between Cheslatta Falls and Vanderhoof (1957-88 data ) to flow releases at Cheslatta Falls.

culated for each transect. That ratio was used to produce an estimate of percent change in mean channel velocity at each transect, from the estimated value for the May-June, 1989 study period to that which would occur at average short and long term flow levels.

For this analysis, it has been assumed that percent changes in mean channel velocity would also apply to changes in marginal velocities, i.e. velocity at approximately 5 m from shore. It was also assumed that percent changes in velocity at each transect would apply to individual cover sites in proximity to that transect. The approach velocity at each of the 603 cover sites inventories in May-June, 1989 (Appendix 3) was therefore corrected to simulate short and long term flow conditions, using the adjustments indicated in Appendix 2. An example of the steps required to adjust approach velocities at a single cover site is shown below:

Short Term Flow Correction Factor	Long Term Flow Correction Factor	Measured Approach Velocity * (cm/s)	Calculated	
			Short Term Approach Velocity	Long Term Approach Velocity
+8.8	-2.3%	30	33	29

\* As measured during the May 23- June 2, 1989 habitat inventory in the lower river

Appendix 4 provides a summary of measured and corrected short and long term approach velocities for each cover site in the lower river.

## Assessment Methodology

The procedure for estimating change in chinook cover habitat suitability at major cover sites<sup>1</sup> in the lower river was similar to that previously described for the upper river (Beniston and Lister, 1990). One difference, however, is that the present assessment of rearing suitability is based only on hypothetical changes in water velocity at cover sites. Unlike the 1989 study, it does not include the effects of flow reduction on habitat availability, i.e. the number of cover sites and area of cover at each site. This subject is discussed in "Cover Availability".

<sup>1</sup> A major cover site is 2 m<sup>2</sup> or greater in area. Minor cover sites (< 2 m<sup>2</sup>) were also inventoried in the 1989 study.

Estimating the change in habitat suitability in the lower river involved the use of habitat specific mean fish densities as indices of habitat quality. The estimated rearing value of each cover site was determined for simulated short and long term flow levels on the basis of 4 factors: (1) habitat type; (2) area of cover; (3) velocity rating; and (4) estimated mean fish density (number/m<sup>2</sup> of cover) for the particular velocity class and habitat type. For this assessment, it was assumed that area of cover did not change between short and long term flow levels.

The net change in fish number at each cover site (an index of change in habitat suitability) equaled the difference between the estimated site population under simulated short and long-term flow conditions in June. A sample calculation of the change in chinook number at a single cover site is given below:

Habitat Type	Flow Level	Cover Area (m <sup>2</sup> )	Velocity Rating	Mean Density (fish/m <sup>2</sup> )	Estimated Site Population
Tree Windfall with Debris	short- term long- term	15.0 15.0	high low	2.96 0.28	44 4
					Net change -40

Mean chinook densities by habitat type and velocity class were used to estimate fish populations at cover sites at the 2 flow levels. The average fish density values were derived from all cover sites enumerated in the upper and lower river during June, 1989. Estimated changes in chinook habitat suitability in the lower river were developed with 2 different techniques, using unadjusted and adjusted mean fish densities by habitat group (Table 3). The first procedure employed unadjusted mean chinook densities by habitat group, calculated by dividing the total number of chinook at given site by the total cover area of the site. The second procedure involved the use of adjusted mean density values to estimate fish populations at cover sites. As shown in the previous report (Beniston and Lister, 1990), sites with cover areas greater than 15 m<sup>2</sup> frequently supported lower numbers than observed at sites with 11-15 m<sup>2</sup>. A value of 15 m<sup>2</sup> was therefore set as the maximum usable area of cover. Adjusted mean density estimates were calculated using a 15 m<sup>2</sup> limit for cover area. In applying adjusted mean chinook densities to estimate

**Table 3**  
**Mean Densities of Juvenile Chinook (fish/100 m<sup>2</sup> of cover) Used to Estimate Fish Abundance**  
**by Habitat Type at Cover Sites at Short Term and Long Term Flow Levels, Nechako River, 1989**

Habitat Group	Velocity Rating	Number of Sites	Mean Chinook Density <sup>a</sup> (fish/100m <sup>2</sup> of cover)	
			Unadjusted <sup>b</sup>	Adjusted <sup>c</sup>
Beaver Lodge and Debris Accumulation	low	27	3	6
	moderate	32	67	86
	high	17	184	221
Tree Windfall with Debris	low	9	27	28
	moderate	11	326	362
	high	8	235	296
Log Windfall with Debris/Tree Windfall without Debris	low	10	7	7
	moderate	7	290	305
	high	3	599	599
Overhanging Vegetation with and without Instream Cover	low	24	1	1
	moderate	18	25	37
	high	8	112	144
Offshore Tree or Log	low	5	9	9
	moderate	4	23	35
	high	3	27	30
Cutbank	low	2	0	0
	moderate	1	31	54
	high	5	42	58
Dock/Boat	low	10	5	6
	moderate	1	40	40
	high	1	458	687
Bank Protection	low	7	1	3
	moderate	4	4	9
	high	0	---	---
Boulder Cluster <sup>d</sup>	---	4	10	10

a Mean densities from fish enumeration survey in June, 1989.

b Individual site densities were calculated by dividing total number of chinook enumerated by total cover area. Mean densities were then calculated by specific habitat groupings.

c It was assumed that sites with more than 15 m<sup>2</sup> of cover would not support greater chinook densities than sites with 15 m<sup>2</sup> of cover. At all sites with cover area exceeding 15 m<sup>2</sup>, the total amount of usable cover was therefore assumed to be 15 m<sup>2</sup>. Site densities calculated in this manner were used to estimate mean adjusted chinook density by habitat group.

d Because of the small sample size in each velocity class, no attempt was made to calculate density by velocity class. Density data for this habitat type were therefore combined to derive a single mean density value.

fish populations at cover sites, it was also assumed that a site with cover area exceeding 15 m<sup>2</sup> would not support more fish than a site with 15 m<sup>2</sup>. The area of each site with more than 15 m<sup>2</sup> of cover was therefore set at 15 m<sup>2</sup> for purposes of estimating the site population.

The estimated changes in fish numbers derived from the mean fish density values are only considered to be indices of proportionate change in habitat suitability, based on inferred velocity conditions at short and long term flows. The numbers of fish estimated at cover sites under the 2 flow regimes are likely much lower than actual population sizes since the estimates were generated from geometric means (Sokal and Rohlf, 1981) calculated from long-transformed density data for each habitat group in June, 1989.

Estimating changes in rearing habitat in the lower river did not include point bar shears and backeddies since the inventory of those habitats was incomplete.

## RESULTS

### Occurrence of Cover Types

In the May, 1989 survey, 603 major cover features were identified in the lower river (Appendix 3). Two general cover types, beaver lodges and debris accumulations and overhanging vegetation with and without instream cover, were most common (Table 4). The amount of cover provided by cover features in the lower river totaled 17,190 m<sup>2</sup>, equivalent to 182 m<sup>2</sup> per km of river length. Cover in the lower river was 2.2 times more prevalent than in the upper river (182 m<sup>2</sup> versus 83 m<sup>2</sup> per km).

### Occurrence of Velocity Classes at Different Flow Levels

Correction factors developed by Hay & Company (Appendix 2), indicated that approach velocities in May, 1989 would need to be increased by an average of 10% (range -1% to 22.5%) to simulate short term flow conditions. Similarly, approach velocities measured in May, 1989 would

also have to be increased by an average of 2.1% (range -1.3% to 8.6%) to reflect long term flow conditions. Correction of approach velocities to the short term flow regime resulted in a decrease of low velocity sites by 8% and an increase in numbers of moderate and high velocity sites by 8-9% (Table 5).

The comparative occurrence of velocity classes under simulated short and long term flow conditions is presented in Table 6. The flow reduction would increase numbers of low velocity sites by 7% and decrease numbers of moderate and high velocity sites by 5-7%

On average, the approach velocities measured in May, 1989 and the calculated short and long term approach velocities differ only slightly (Table 7), reflecting the small degree of adjustment (Appendix 2).

### Estimated Change in Cover Suitability

This section provides an assessment of change in suitability of major cover sites relative to assumed velocity conditions under short and long term flows. Estimates of change in rearing suitability are summarized from the site-by-site assessment provided in Appendix 5.

Table 4  
Number of Major Cover Sites by Cover Type  
During May, Nechako River, 1989

Cover Type	Number of Sites	Percent Occurrence
Beaver Lodge and Debris Accumulation	204	34
Tree Windfall with Debris	65	11
Tree Windfall/Log Windfall with Debris	93	16
Overhanging Vegetation with and without Instream Cover	171	28
Offshore Tree and Log	8	1
Cutbank	5	1
Dock/Boat	33	5
Bank Protection	24	4
	603	
a Excludes point bars and backeddies		

Table 5  
Number of Cover Sties by Velocity Class  
in the Lower Nechako River Under Inventoried  
Flows in May, 1989 and Simulated Short Term  
Flow Conditions

Velocity Class <sup>a</sup>	Number of Sites		Percent Change
	Inventry Flows	Short-Term Flows	
low	300	276	-8
modeate	233	251	+8
high	70	76	+9

<sup>a</sup> low = 0-19 cm/s; moderate = 20-40 cm/s; high = > 40 cm/s

Table 6  
Frequency of Velocity Classes at Cover Sites Under  
Simulated Short Term and Long Term Flow  
Conditions in the Lower Nechako River Study Area

Velocity Class	Number of Sites		Percent Change
	Short Term Flows	Long Term Flows	
low	276	294	+7
modeate	251	238	-5
high	76	71	-7

Table 7  
Comparison of Measured Approach Velocity (cms)  
in May, 1989 with Simulated Short Term and Long  
Term Approach Velocities in the Lower River  
Based on 603 Sites

	Mean Velocity	Standard Deviation	Range
Measured	22.2	17.7	0-134
Short Term	23.9	18.5	0-155
Long Term	22.5	17.7	0-134

### ***Overall Change***

Habitat suitability of major cover sites would decline by 4-5% due to the change from short to long term flow in the lower river study area (Table 8). As shown for the upper river (Beniston and Lister, 1990), the unadjusted fish densities and actual cover area method produced a higher chinook population estimate than the adjusted density approach. For brevity, only the adjusted density method is used in presenting changes in rearing suitability by cover type and river reach.

The inferred reduction in rearing suitability is small (-5%), since relatively few cover sites would change velocity class between short and long term flows. Cover sites with moderate and high approach velocities supported 97% of estimated chinook populations (Table 9). Flow reduction would result in only 18 moderate or high velocity sites (5.5%) shifting to a lower velocity category.

### ***Change by Habitat Type***

Approximately 88% of major cover sites in the lower river study area were in 4 main habitat groups: (1) beaver lodge and debris accumulations; (2) tree windfall with debris; (3) tree windfall and long windfall with debris; and (4) overhanging vegetation with or without instream cover. Of the estimated change in suitability, 88% would occur at these habitats (Table 10).

### ***Change by River Reach***

The inferred reductions in chinook cover suitability in the lower river were greatest in Reach 7 and lowest in Reach 6 (Table 11). The greater reduction in rearing suitability in Reach 7 is attributable to higher velocity correction factors for that river section (Appendix 2).

**Table 8**  
**Estimated Net Change in Juvenile Chinook Use of Major Cover Sites in the Lower Nechako River (Reaches 5-7) Based on Hypothetical Changes in Approach Velocities at Short Term and Long Term Flow Levels**

Chinook population estimates are from 1989 data and represent indices of habitat suitability

Method <sup>a</sup>	Estimated Fish Population <sup>b</sup>		Estimated Net Change	
	Short Term	Long Term	Number	Percent
	Flow	Flow		
Unadjusted Densities	8400	8100	-300	-4
Adjusted Densities	5600	5300	-300	-5

a From adjusted and unadjusted mean fish densities in Table 3.

b Estimated total populations at cover sites, derived from geometric mean density values. Numbers are rounded to nearest hundred.

**Table 9**  
**Distribution of Estimated Juvenile Chinook Population by Velocity Class a Major Cover Site in the Lower River (Reaches 5-7) at Short Term and Long Term Flow Levels, Nechako River, 1989**

Chinook population estimates are derived from geometric mean density values.

Velocity Class	Number of Sites		Population Distribution		Percent Change <sup>b</sup>
	Short Term	Long Term	Number of Fish <sup>a</sup>		
	Flow	Flow	Short Term Flow	Long Term Flow	
Low	276	294	148	158	7
Moderate	251	238	3235	3045	-6
High	76	71	2233	2106	-6
		Total	5616	5309	

a Fish population estimates represent an index of habitat suitability and are derived from adjusted densities. Estimates to the nearest whole number do not imply accuracy to that level.

b Expressed as percent of total population change in a given velocity class.

**Table 10**  
**Estimated Change in Juvenile Chinook Use of Major Cover Habitats in the Lower Nechako River (Reaches 5-7)**  
**Based on Hypothetical Changes in Approach Velocities Between Short Term and Long Term Flow Levels**

Chinook population estimates are based on 1989 data and represent indices of habitat suitability.

Habitat Grouping	Estimated Fish Population <sup>a</sup>		Estimated Net Change	
	Short Term Flow	Long Term Flow	Number	Percent
Beaver Lodge and Debris Accumulation	1252	1172	-80	-6
Tree Windfall with Debris	1678	1616	-62	-4
Tree Windfall and Long Windfall with Debris	1459	1388	-71	-5
Overhanging Vegetation with or without Instream Cover	872	813	-59	-7
Offshore Tree or Log	16	16	0	0
Cutbank	23	23	0	0
Dock/Boat	305	271	-34	-11
Boulder Cluster	0	0	0	0
Bank Protection	11	10	-1	-9
Total <sup>b</sup>	5600	5300	-300	-5

<sup>a</sup> Population estimates are derived from adjusted densities.  
 Estimates to the nearest whole number do not imply accuracy to that level.

<sup>b</sup> Total number rounded to nearest hundred.

**Table 11**  
**Estimated Change in Juvenile Chinook Use of Major Cover Sites in the Lower Nechako River Reaches Based on**  
**Hypothetical Changes in Approach Velocities Between Short Term and Long Term Flow Levels**

Chinook population estimates are based on 1989 data and represent indices of habitat suitability.

River Reach	Estimated Fish Population		Estimated Net Change <sup>a</sup>	
	Short Term Flow	Long Term Flow	Number	Percent
5	2384	2265	-119	-5
6	1774	1764	-10	-1
7 <sup>b</sup>	1458	1280	-178	-12
Total <sup>c</sup>	5600	5300	-300	-5

<sup>a</sup> Population estimates are derived from adjusted densities.  
 Estimates to nearest whole number do not imply accuracy to that level.

<sup>b</sup> River section between Vanderhoof and Stuart River.

<sup>c</sup> Numbers rounded to nearest hundred.



---

## DISCUSSION

---

The principal objective of the present study was to estimate the change in rearing suitability of major cover sites in the lower Nechako River study area at short and long term flows. The methodology applied in this study indicated a 5% reduction in chinook cover suitability due to flow reduction. However, that methodology may have underestimated the change in chinook rearing suitability of cover sites, due to limitations in the database and inherent assumptions. The following sections include a discussion of possible biases in the assessment methodology, as well as flow related changes in the availability of chinook cover habitat.

### Estimation of Short and Long Term Approach Velocities

Correction factors developed by Hay and Company to adjust marginal velocities at cover sites were based on estimates of change in mean channel velocity by river section. A basic assumption of the methodology is that approach velocity at each cover site, generally about 5 m from the stream margin, undergoes the same percentage change as mean channel velocity in the river section in question. Examining river widths in the lower river at short and long term flow levels suggests that this assumption may not be valid. The river is 10 m wider on average at flows of 169.9 m<sup>3</sup>/s than at 141.6 m<sup>3</sup>/s, as shown from IPSFC transect data for the Nautley River to Vanderhoof section (Appendix 6). River width changes of this extent may cause greater changes in marginal velocities than those estimated from the mean velocity for the channel cross-section. A 10 m reduction in river width would likely be accompanied by a shift in the location where approach velocities would be measured, away from the cover site toward mid-channel.

Correction factors for adjusting measured approach velocities were developed from 47 depth and velocity transects previously established between the Nautley River and Stuart River. The adjustments were applied to all cover sites (603 sites in total) within 2.5 kilometers of each transect. There is no assurance that the velocity and depth conditions at transect locations necessarily reflected those at cover sites. For example, a transect at km 120.3 (IPSFC Transect No. 64) occurred at a much wider section of river than most of the 10 cover sites which it was chosen to represent. The transect was taken from a river section 150 m in

width. Of the 10 cover sites, 8 occurred where the river was narrower (68-135 m) as evidenced from 1:7500 scale aerial photographs taken at a discharge of 141.6 m<sup>3</sup>/s.

Any tendency for correction factors used in this analysis to underestimate velocity change at cover features would result in an underestimate of the change in rearing suitability in the lower river study area.

### Cover Availability

For purposes of the analysis presented here, there were two major assumptions concerning changes in the amount of chinook cover habitat (i.e. number and area of cover sites). It was assumed that (1) the amount of cover habitat identified in the May, 1989 survey equaled the amount of cover available at the average short term flow, and (2) the amount of cover habitat did not change as a result of flow reduction. With respect to assumption (1), it should be noted that the May, 1989 inventory was conducted at an average discharge of 138 m<sup>3</sup>/s in the lower river, approximately 18% below the estimated average short term flow in that section (168 m<sup>3</sup>/s). Data from the upper Nechako (Reaches 1-4) demonstrated that both the number of available cover features and habitat area tended to increase with increase in river discharge (Beniston and Lister, 1990). Use of the May, 1989 inventory to represent cover habitat in the lower Nechako study area is therefore likely to underestimate cover habitat available to juvenile chinook at the flow range of concern (143-168 m<sup>3</sup>/s). This is further supported, as shown under the "Estimation of Short and Long Term Approach" section, by the fact that river width in the lower river increases measurably between flows of 141.6 m<sup>3</sup>/s and 169.9 m<sup>3</sup>/s.

The change in habitat suitability developed for the lower river in this study (-5%) was derived from estimates of change in river velocity at cover sites. The change in rearing suitability does not, however, include the entire flow-related change in productive capacity of chinook cover habitat in the lower Nechako River. Flow reduction would also cause changes in habitat availability through reduction of cover area at individual sites and dewatering of some cover sites. Limitations in the existing database for the lower river therefore did not permit estimation of the total amount of cover habitat available or flow-related changes in the amount of that habitat.

---

## ACKNOWLEDGEMENTS

---

This study was funded as part of the Nechako Fisheries Conservation Program. The assistance of B. James of Triton Environmental Consultants Ltd. in providing background flow and transect data is acknowledged.

---

## REFERENCES

---

- ANON. 1987. Studies of juvenile chinook salmon in the Nechako River, British Columbia, 1985 and 1986. Prepared by Dept. of Fisheries and Oceans, Nechako River Project. Can MS Rep. Fish. Aquat. Sci. 1954: 152 p.*
- BENISTON, R.J., and D.B. LISTER. 1990. Preliminary inventory of habitat cover/cover opportunities, Nechako River, 1989. Prepared by D.B. Lister & Associates for Nechako Fisheries Conservation Program, Vancouver, BC. 84 p. + appendices.*
- RUSSELL, L.R., . K.R. CONLIN, O.K. JOHNSEN, and U. ORR. 1983. Chinook salmon studies in the Nechako River: 1980, 1981, 1982. Can. MS Rep. Fish. Aquat. Sci. 1728: 185 p.*
- SOKAL, R.R., and F.J. ROHLF. 1981. Biometry. 2nd ed., W.H. Freeman and Company, San Francisco. 859 p.*

## **APPENDIX 1**

**Study Terms of Reference for Estimating Change in Cover Suitability in the Lower Nechako River, Nautley River to Stuart River, Nechako Fisheries Conservation Program, 1991**



---

# **Change in Cover Habitat Suitability of Nechako River Below the Nautley Short-Term to Long-Term (Estimated)**

---

## **1.0 Objectives**

The Objectives of this program is to estimate the percent change of cover habitat quality in the Nechako River below the Nautley between the short-term and long-term flow regimes.

Specific objectives are:

- 1) to estimate changes in water velocities in the Nechako River below the Nautley between short-term and long-term flow hydrographs. Of prominent importance are the river velocities within 5 meters of the margins.
- 2) using these estimated changes in river velocities calculate the percent change in suitability for juvenile chinook of the cover habitat previously inventoried on the lower Nechako River (NFCP RM89-6).

## **2.0 Rationale**

The Remedial Measures Program of the Nechako Fisheries Conservation Program is driven by a goal to maintain chinook salmon production in the Nechako River, post KCP, with regard to habitat parameters that may change.

It has been recognized that cover habitat will be affected by flow change. Replacement cover, in the form of man-made debris complexes, is currently being pilot tested in the Nechako River. The amount of this man-made cover that will be added will be determined by the analysis of what is currently in the river and how its suitability for chinook rearing will change post KCP.

In 1989/90, a study was conducted to compare cover habitat at two different periods during the year. The first study period, May/June, was selected as a representative period of short-term flows when juvenile chinook recruitment in the river was high. The presence of high numbers of juvenile chinook make it possible to assess how the cover is utilized by the fish.

The second study period was conducted in late September. This period was chosen to simulate flows that will be seen in the river after the change in suitability for chinook rearing.

The study periods chosen did approach changes in the Nechako hydrograph that will be seen after completion of the Kenney Dam Release Facility for the Nechako River above the Nautley confluence. However, for the lower Nechako River (below the Nautley), due to the failure to factor in temporal differences in annual runoff, the comparisons of the September sample period to future long-term levels was not feasible.

The 1989/90 study inventoried a large number of natural structures in the lower Nechako River. It will be necessary to know how the suitability of this habitat for juvenile chinook will change when the flow regime changes. Due to the difficulty in reinventorying these structures at the appropriate water levels, it will be necessary to estimate how water velocities will change in this section of river when long-term flows are in place. It has been demonstrated (NFCP RM89-6) that as the velocity associated with the structures is reduced, the corresponding suitability of this habitat for juvenile chinook is also reduced. The estimated changes in water velocities will be applied to the previously inventoried cover habitat in the lower Nechako River to get a figure of percent change in cover habitat for this section of the river. This number will aid in directing the future large scale habitat complexing program.

## **3.0 Work Plan**

### ***3.1 Estimating Change in Water Velocities***

Estimating changes in water velocities will be carried on in four steps.

1. Assemble hydrology to establish flows and periods of record for comparison
  2. Assemble and review previous analyses
  3. Analyze velocity profiles to establish a relationship of mean velocity to velocity at margins
  4. Predict and summarize velocity and depth changes at various reaches
-

---

### ***3.2 Estimating Change in Habitat Suitability***

From estimated water velocity values (section 3.1) changes in habitat suitability will be calculated for the lower Nechako River (below the Nautley River), as in NFCP RM89-6. Habitat cover structures and their associated velocities from the 1989 May/June sampling trip will be compared to the same structures and the estimated velocities that will be percent during the long-term flow regime.

This comparison will give changes in structures from high to medium velocity, medium to low velocity and potentially those structures that will become dewatered. The index of change in habitat suitability developed in the upper Nechako River from fish assessment work in May/June 1989 can be applied to the above velocity changes to arrive at a percent change in habitat suitability for the Nechako River below the Nautley.

## **APPENDIX 2**

**Description of Methods Used by Hay & Company Consultants Inc.  
in Estimating Short Term and Long Term Velocities at Major  
Cover Sites in the Lower Nechako River Based on Cover Site  
Inventory Data Collected During May-June, 1989**

NECHAKO RIVER - VELOCITY CHANGES

Section No.	Reach	3 Dist. Below Ches. Falls Km.	4 5 6 June Discharges			7 8 9 10 June Mean Velocities				11 Corresponding Habitat Sites Numbers	12 13 May 23 - June 2, 1989		14 15 16 17 Adjustments to May 23 - June 2, 1989 Habitat Survey			
			Short Term m <sup>3</sup> /s	Long Term m <sup>3</sup> /s	% Change	Short Term m <sup>3</sup> /s	Long Term m <sup>3</sup> /s	% Change	% Δ Vel. % Δ Q		Survey Discharge Vanderhoof m <sup>3</sup> /s	Est. Survey Discharge at Section m <sup>3</sup> /s	Short Term Flow Regime		Long Term Flow Regime	
													%Δ Q	%Δ V est. at Section	%Δ Q	%Δ V est. at Section
55	5	89.65	160.89	135.39	-15.85	0.52	0.475	-8.7	0.546	1-12	145	138.6	+16.1	+8.8	-2.3	-1.3
56	5	91.67	160.93	135.43	-15.85	0.796	0.737	-7.4	0.468	13-31	144.5	138.2	+16.4	+7.7	-2.0	-0.9
57	5	94.08	160.98	135.48	-15.84	0.948	0.884	-6.8	0.426	32-42	144	137.8	+16.8	+7.2	-1.7	-0.7
58	5	95.63	161.01	135.51	-15.84	1.44	1.41	-2.1	0.132	43-49	144	137.8	+16.8	+2.2	-1.7	-0.2
59	5	96.12	161.02	135.52	-15.84	1.17	1.17	0	0	50-54	144	137.8	+16.9	0	-1.7	0
60	5	98.41	161.06	135.56	-15.83	1.02	1.03	1.0	-0.062	55-71	144	137.9	+16.8	-1.0	-1.7	+0.1
61	5	103.22	161.16	135.66	-15.82	0.707	0.664	-6.1	0.384	72-100	143	137	+17.6	+6.8	-1.0	-0.4
62	5	106.84	161.23	135.73	-15.82	0.564	0.494	-12.4	0.785	101-118	142	136.1	+18.5	+14.5	-0.3	-0.2
63	5	107.63	161.24	135.74	-15.82	0.646	0.585	-9.4	0.597	119-125	142	136.2	+18.4	+11.0	-0.3	-0.2
64	5	107.86	161.25	135.75	-15.81	1.02	0.884	-13.3	0.843	126-135	142	134.3	+18.4	+15.5	-0.3	-0.3
65	5	112.36	161.33	135.83	-15.81	1.04	0.969	-6.8	0.432	136-163	140	134.4	+20.1	+8.7	+1.1	+0.5
66	5	113.79	161.36	135.86	-15.8	0.942	0.878	-6.8	0.43	164-182	140	134.4	+20.1	+8.6	+1.1	+0.5
67	5	115.95	161.41	135.91	-15.8	1.30	1.26	-3.1	0.195	183-203	140	134.4	+20.1	+3.9	+1.1	+0.2
68	5	117.72	161.44	135.94	-15.8	1.19	1.14	-4.2	0.266	204-211	140	134.4	+20.1	+5.4	+1.1	+0.3
69	6	119.56	161.92	136.42	-15.75	0.728	0.652	-10.4	0.663	1-9	140	134.8	+20.1	+13.3	+1.2	+0.8
70	6	121.29	162.37	136.87	-15.71	0.866	0.811	-6.4	0.404	10-21	140	135.2	+20.1	+8.1	+1.2	+0.5
71	6	122.79	162.77	137.27	-15.67	0.917	0.908	-1.0	0.063	22-42	138	133.6	+21.8	+1.4	+2.7	+0.2
72	6	127.2	163.92	138.42	-15.56	0.802	0.765	-4.6	0.297	43-64	138	134.5	+21.9	+6.5	+2.9	+0.9
73	6	129.18	164.44	138.94	-15.51	0.954	0.884	-7.3	0.473	65-73	138	134.9	+21.9	+10.4	+3.0	+1.4
74	6	130.87	164.88	139.38	-15.47	1.26	1.21	-4.0	0.257	74-79	137	134.3	+22.8	+5.9	+3.8	+1.0
75	6	135.79	166.17	140.67	-15.35	0.884	0.856	-3.2	0.206	80-86	137	135.3	+22.8	+4.7	+4.0	+0.8
76	6	137.97	166.74	141.24	-15.29	0.954	0.905	-5.1	0.336	87-91	137	135.7	+22.9	+7.7	+4.1	+1.4
77	6	139.77	167.21	141.71	-15.25	1.33	1.32	-0.8	0.049	92-101	137	136.1	+22.9	+1.1	+4.1	+0.2
78	6	141.11	167.56	142.06	-15.22	1.01	0.966	-4.4	0.286	102-110	137	136.4	+22.8	+6.5	+4.1	+1.2
79	6	142.44	167.91	142.41	-15.19	0.82	0.777	-5.2	0.345	111-118	142	141.6	+18.6	+6.4	+0.6	+0.2
80	6	143.02	168.06	142.56	-15.17	0.634	0.646	+1.9	-0.125	119-165	143	142.8	+17.7	-2.2	-0.2	0
81	6	143.76	168.25	142.75	-15.16	0.393	0.399	+1.5	-0.101	n.a.						
82*	6	144.1	168.34	142.84	-15.15	0.466	0.427	-8.4	0.552	166-174	143	143	+17.7	+9.8	-0.1	-0.1

\*Vanderhoof



1 Section No.	2 Reach	3 Dist. Below Ches. Falls Km.	4			5			10 $\frac{\% \Delta \text{Vel.}}{\% \Delta Q}$	11 Corresponding Habitat Sites Numbers	12		13				14				15				16				17			
			June Discharges			June Mean Velocities					May 23 - June 2, 1989		Adjustments to May 23 - June 2, 1989 Habitat Survey																			
			Short Term m <sup>3</sup> /s	Long Term m <sup>3</sup> /s	% Change	Short Term m <sup>3</sup> /s	Long Term m <sup>3</sup> /s	% Change			Survey Discharge Vanderhoof m <sup>3</sup> /s	Est. Survey Discharge at Section m <sup>3</sup> /s	Short Term Flow Regime		Long Term Flow Regime																	
83	6	147.35	168.88	143.38	-15.1	0.549	0.5	-8.9	0.591	1-21*	136	136.4	+23.8	+14.1	+5.1	+3.0																
84	6	152.56	169.74	144.24	-15.02	0.674	0.634	-5.9	0.395	22-50*	135	136.1	+24.7	+9.8	+6.0	+2.4																
85	6	154.58	170.07	144.57	-14.99	0.408	0.372	-8.8	0.588	51-60*	135	136.3	+24.8	+14.6	+6.1	+3.6																
86	6	155.4	170.2	144.7	-14.98	0.57	0.536	-6.0	0.398	61-73*	135	136.4	+24.8	+9.9	+6.1	+2.4																
87	6	156.59	170.4	144.9	-14.97	0.482	0.448	-7.1	0.471	74-87*	135	136.6	+24.7	+11.7	+6.1	+2.9																
88	6	159.85	170.94	145.44	-14.92	0.61	0.57	-6.6	n.a	88-94*	134	136.0	+25.7	+11.3	+6.9	+3.1																
89	6	163.94	171.61	146.11	-14.86	0.463	0.424	-8.4	n.a	95-110*	133	135.4	+26.7	+15.2	+7.9	+4.5																
90	6	165.86	171.93	146.43	-14.83	0.486	0.469	-3.5	n.a	111-124*	133	135.7	+26.7	+6.3	+7.9	+1.9																
91	7	167.47	171.21	146.71	-14.81	0.36	0.326	-9.4	0.638	125-136	133	135.9	+26.7	+17.0	+8.0	+5.1																
92	7	169.51	172.57	147.07	-14.78	0.381	0.346	-9.2	0.622	137-150	133	136.2	+26.7	+16.6	+8.0	+5.0																
93	7	171.49	172.92	147.42	-14.75	0.39	0.36	-7.7	0.522	151-166	132	135.4	+27.7	+14.5	+8.9	+4.6																
94	7	173.87	173.34	147.84	-14.71	0.975	0.866	-11.2	0.76	167-193	131	134.6	+28.8	+21.9	+9.8	+7.5																
95	7	175.55	173.64	148.14	-14.69	0.457	0.431	-5.7	0.387	194-196	131	134.9	+28.7	+11.1	+9.8	+3.8																
96	7	176.88	173.87	148.37	-14.67	0.622	0.57	-8.4	0.57	197	131	135.0	+28.8	+16.4	+9.9	+5.6																
97	7	178.6	174.18	148.68	-14.64	0.506	0.477	-5.7	0.391	198-202	131	135.3	+28.7	+11.2	+9.9	+3.9																
98	7	180.79	174.56	149.06	-14.61	1.65	1.55	-6.1	0.415	203-217	131	135.5	+28.8	+12.0	+10.0	+4.2																
99	7	182.8	174.92	149.42	-14.58	0.719	0.661	-8.1	0.553	218-224	130	134.7	+29.9	+16.5	+10.9	+6.0																
100	7	184.07	175.14	149.64	-14.56	0.61	0.546	-10.5	0.721	225-228	129	133.8	+30.9	+22.3	+11.8	+8.5																
101	7	185.54	175.4	149.9	-14.54	0.549	0.491	-10.6	0.727	229-234	129	134.0	+30.9	+22.5	+11.9	+8.6																
102	7	186.73	175.61	150.11	-14.52	0.55	0.492	-10.5	0.726	235-238	129	134.2	+30.9	+22.4	+11.9	+8.6																

\* Note : Lister report incorrectly identifies this as part of reach 7

Col. 6 : % change : Col. 5 compared to Col. 4

Col. 9 : % change : Col. 8 compared to Col. 7

Col. 10 : Col. 5 / Col.6

Col. 11 : Habitat sites (ref. Lister survey) nearest to section.

Col. 14 : % change in Discharge : Col. 4 compared to Col. 13

Col. 15 : % change in Velocity : Col. 14 x Col. 10

Col. 16 : % change in Discharge : Col. 5 compared to Col. 13

Col. 17 : % change in Velocity : Col. 16 x Col. 10

## **APPENDIX 3**

### **Physical Characteristics of Major Cover Sites in the Lower Nechako River During May 16 - June 2, 1989**



Appendix 3  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
5	1	right	main	debris scat.	mod.	32	130	5.00	5.00
	2	right	main	log wind. w deb.	low	10	90	7.00	7.00
	3	right	main	instream veg.	low	12	90	7.50	7.50
	4	right	main	log wind. w deb.	low	15	90	3.00	3.00
	5	right	main	tree wind. w deb.	mod.	30	50	16.40	15.00
	6	right	main	instream veg.	mod.	24	60	10.00	10.00
	7	right	main	instream veg.	mod.	23	150	8.00	8.00
	8	right	main	debris scat.	mod.	30	130	21.00	15.00
	9	right	main	instream veg.	mod.	37	150	26.50	15.00
	10	right	main	instream veg.	mod.	39	110	10.00	10.00
	11	right	main	debris accum.	mod.	31	70	27.00	15.00
	12	right	main	beaver lodge	low	11	150	35.50	15.00
	13	left	main	log wind. w deb.	mod.	35	150	4.00	4.00
	14	left	main	instream veg.	mod.	20	160	12.00	12.00
	16	left	main	log wind. w deb.	low	19	160	6.40	6.40
	17	left	main	tree wind. w deb.	mod.	36	135	41.00	15.00
	18	left	main	log wind. w deb.	mod.	17	180	15.00	15.00
	20	right	main	beaver lodge	low	16	110	22.00	15.00
	21	right	main	instream veg	low	10	50	15.00	15.00
	22	right	main	debris accum.	low	10	30	5.50	5.50
	24	mid	main	offshore tree/log	high	75	.	6.00	6.00
	26	right	main	beaver lodge	mod.	24	90	10.00	10.00
	27	right	main	offshore tree/log	low	7	.	7.00	7.00
	28	left	main	beaver lodge	mod.	22	130	36.00	15.00
	29	left	main	overhang veg.	low	15	35	8.00	8.00
	30	left	main	log wind. w deb.	mod.	32	35	11.50	11.50
	32	left	main	debris accum.	low	4	230	354.00	15.00
	33	right	main	tree windfall	high	84	100	10.00	10.00
	34	right	main	tree wind. w deb.	high	43	30	4.50	4.50
	35	right	main	beaver lodge	mod.	23	120	6.00	6.00
	36	left	main	tree wind. w deb.	mod.	24	80	24.00	15.00
	37	left	main	beaver lodge	low	2	190	56.00	15.00
	38	left	main	debris accum.	mod.	22	90	4.00	4.00
	39	left	main	tree wind. w deb.	mod.	24	20	6.70	6.70
	40	right	main	tree wind. w deb.	mod.	25	65	4.50	4.50
	41	left	main	beaver lodge	low	19	60	4.00	4.00
	42	right	main	tree windfall	mod.	27	50	7.00	7.00
	43	right	side	tree windfall	low	1	100	43.00	15.00
	44	right	main	tree wind. w deb.	mod.	24	60	17.00	15.00
	45	left	main	beaver lodge	mod.	30	70	16.50	15.00
	46	left	main	beaver lodge	mod.	30	100	18.00	15.00
	47	right	main	tree windfall	low	1	35	6.00	6.00
	48	right	side	instream veg.	low	0	50	4.00	4.00
	49	right	side	beaver lodge	low	0	130	25.00	15.00
	50	right	main	beaver lodge	low	15	110	26.00	15.00
	51	right	main	overhang veg.	mod.	20	60	6.00	6.00

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth <sup>g</sup> (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	52	right	main	beaver lodge	high	50	75	7.70	7.70
	53	right	main	debris accum.	low	14	80	4.50	4.50
	54	right	main	beaver lodge	low	10	108	30.00	15.00
	55	left	main	instream veg.	mod.	21	60	4.30	4.30
	56	left	main	beaver lodge	low	10	170	28.00	15.00
	57	right	main	beaver lodge	low	0	40	2.50	2.50
	59	left	main	overhang veg.	high	45	130	4.00	4.00
	60	right	main	debris scat.	mod.	25	140	2.50	2.50
	61	right	main	instream veg.	mod.	32	120	2.00	2.00
	62	right	main	tree windfall	mod.	34	130	2.00	2.00
	63	right	main	debris accum.	mod.	20	70	5.00	5.00
	64	left	main	beaver lodge	mod.	35	180	12.00	12.00
	65	left	main	debris accum.	low	19	160	7.30	7.30
	66	left	main	instream veg.	mod.	30	130	18.00	15.00
	67	left	main	instream veg.	low	17	130	7.00	7.00
	68	left	main	beaver lodge	low	18	190	20.00	15.00
	69	left	main	instream veg.	mod.	20	120	11.00	11.00
	70	left	main	instream veg.	mod.	20	130	3.50	3.50
	71	left	main	instream veg.	mod.	27	140	9.00	9.00
	72	right	main	tree windfall	mod.	20	50	13.00	13.00
	73	right	main	instream veg.	mod.	25	140	7.00	7.00
	74	right	main	debris accum.	mod.	20	170	3.00	3.00
	75	right	main	instream veg.	low	12	.	5.50	5.50
	76	right	main	beaver lodge	low	15	180	21.50	15.00
	77	left	main	log wind. w deb.	mod.	30	120	1.80	1.80
	78	mid	main	beaver lodge	low	15	150	20.00	15.00
	79	right	side	tree wind. w deb.	low	6	80	6.50	6.50
	80	right	side	overhang veg.	mod.	23	100	11.00	11.00
	81	right	side	beaver lodge	mod.	23	100	4.50	4.50
	82	left	main	beaver lodge	mod.	20	160	3.00	3.00
	83	left	main	log wind. w deb.	mod.	20	110	15.00	15.00
	85	left	main	beaver lodge	low	15	100	21.00	15.00
	86	left	main	tree wind. w deb.	mod.	22	170	73.50	15.00
	88	right	main	beaver lodge	low	11	130	20.00	15.00
	89	right	main	overhang veg.	mod.	30	90	73.00	15.00
	90	left	main	log wind. w deb.	low	3	110	41.00	15.00
	92	left	main	debris accum.	low	15	40	15.00	15.00
	93	left	main	tree windfall	mod.	25	90	10.00	10.00
	94	left	main	beaver lodge	mod.	20	180	35.00	15.00
	95	left	main	log wind. w deb.	mod.	27	120	7.30	7.30
	96	right	main	tree windfall	mod.	30	85	20.00	15.00
	97	left	main	beaver lodge	mod.	23	130	29.00	15.00
	99	right	main	log wind. w deb.	mod.	20	55	2.80	2.80
	100	right	main	log wind. w deb.	low	17	50	5.00	5.00
	101	right	main	tree wind. w deb.	mod.	20	120	8.00	8.00
	102	left	main	beaver lodge	low	5	120	10.20	10.20

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth <sup>g</sup> (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	103	left	main	debris accum.	mod.	27	100	9.00	9.00
	104	right	main	instream veg.	low	2	80	4.00	4.00
	105	right	main	beaver lodge	mod.	40	120	47.00	15.00
	106	right	main	tree windfall	low	2	90	9.00	9.00
	107	left	main	beaver lodge	mod.	21	120	5.40	5.40
	108	right	main	tree windfall	low	15	90	5.00	5.00
	109	right	main	instream veg.	mod.	32	130	6.80	6.80
	110	right	main	overhang veg.	mod.	27	140	3.50	3.50
	111	right	main	beaver lodge	mod.	30	250	28.00	15.00
	112	right	main	instream veg.	low	1	90	4.50	4.50
	113	right	main	log wind. w deb.	low	0	80	7.00	7.00
	114	right	main	tree wind. w deb.	low	2	45	10.50	10.50
	115	right	main	beaver lodge	mod.	20	130	28.00	15.00
	116	right	main	log wind. w deb.	low	10	140	5.00	5.00
	117	right	main	tree windfall	low	14	140	5.00	5.00
	118	right	main	instream veg.	low	7	90	9.00	9.00
	119	right	main	beaver lodge	low	2	200	31.50	15.00
	120	left	main	instream veg.	low	16	110	12.00	12.00
	121	left	main	debris accum.	low	1	30	6.00	6.00
	122	left	main	log wind. w deb.	mod.	30	30	8.20	8.20
	123	right	main	tree wind. w deb.	high	49	130	13.50	13.50
	124	mid	main	beaver lodge	mod.	35	.	17.50	15.00
	125	left	main	log wind. w deb.	high	50	65	9.00	9.00
	126	right	side	tree wind. w deb.	high	134	40	25.00	15.00
	127	right	main	tree windfall	mod.	25	50	11.00	11.00
	128	right	main	tree windfall	low	18	35	4.00	4.00
	129	left	main	tree wind. w deb.	low	17	100	7.50	7.50
	130	right	main	beaver lodge	low	10	170	17.00	15.00
	131	left	main	tree wind. w deb.	low	2	50	5.00	5.00
	132	right	main	beaver lodge	low	1	250	12.80	12.80
	133	right	main	beaver lodge	mod.	20	250	25.00	15.00
	134	right	main	instream veg.	low	15	80	7.00	7.00
	135	right	main	log wind. w deb.	low	12	90	2.70	2.70
	136	right	main	beaver lodge	mod.	28	250	11.00	11.00
	137	right	main	beaver lodge	mod.	22	160	7.00	7.00
	138	left	main	debris accum.	mod.	20	50	14.00	14.00
	139	left	main	log wind. w deb.	low	11	130	5.00	5.00
	140	right	main	log wind. w deb.	mod.	20	110	5.00	5.00
	141	right	main	tree wind. w deb.	mod.	25	110	18.40	15.00
	142	right	main	beaver lodge	mod.	23	140	19.00	15.00
	143	right	main	instream veg.	mod.	22	140	7.50	7.50
	144	right	main	overhang veg.	mod.	27	150	14.00	14.00
	145	right	main	beaver lodge	mod.	25	150	15.00	15.00
	146	left	main	beaver lodge	mod.	22	160	20.50	15.00
	147	left	main	debris accum.	low	2	.	33.00	15.00
	148	right	main	dock/boat	mod.	40	.	4.50	4.50

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	150	left	main	tree windfall	high	65	100	9.50	9.50
	152	left	main	debris accum.	low	3	50	140.00	15.00
	153	left	main	beaver lodge	low	17	180	15.00	15.00
	154	right	main	debris accum.	low	3	20	14.00	14.00
	155	right	main	debris accum.	low	0	.	36.00	15.00
	156	right	main	tree wind. w deb.	mod.	22	30	51.00	15.00
	157	right	main	tree wind. w deb.	mod.	23	40	3.00	3.00
	158	right	main	tree wind. w deb.	low	12	30	33.00	15.00
	159	left	main	log wind. w deb.	high	49	50	21.30	15.00
	160	left	main	instream veg.	low	4	60	11.50	11.50
	161	left	main	log wind. w deb.	low	10	50	8.40	8.40
	162	right	main	instream veg.	low	17	90	8.00	8.00
	163	right	main	beaver lodge	low	10	120	26.00	15.00
	164	right	main	debris accum.	high	46	75	53.00	15.00
	165	left	main	tree wind. w deb.	high	43	45	10.00	10.00
	166	left	main	tree wind. w deb.	high	73	30	9.50	9.50
	167	left	main	instream veg.	high	74	50	12.50	12.50
	168	left	main	beaver lodge	low	16	40	2.90	2.90
	169	left	main	debris accum.	mod.	25	60	24.00	15.00
	170	right	main	tree wind. w deb.	mod.	23	40	4.00	4.00
	171	left	main	debris accum.	mod.	32	.	37.00	15.00
	172	left	main	cutbank	high	62	120	16.00	15.00
	173	left	main	debris scat.	high	60	90	8.00	8.00
	174	right	main	tree wind. w deb.	low	17	50	4.80	4.80
	175	right	main	tree wind. w deb.	low	14	80	5.00	5.00
	176	right	main	tree wind. w deb.	high	44	120	19.00	15.00
	177	right	main	instream veg.	low	18	90	27.50	15.00
	178	right	main	debris accum.	mod.	36	70	5.00	5.00
	179	right	main	tree wind. w deb.	mod.	20	100	30.50	15.00
	180	right	main	instream veg.	mod.	29	90	18.00	15.00
	181	right	main	instream veg.	low	14	80	17.00	15.00
	182	mid	main	debris accum.	mod.	32	.	2.40	2.40
	183	right	main	debris accum.	low	10	40	20.50	15.00
	184	mid	main	offshore tree/log	low	16	.	5.00	5.00
	185	right	main	debris accum.	mod.	20	35	30.00	15.00
	186	left	main	beaver lodge	low	18	100	26.00	15.00
	187	left	main	beaver lodge	high	46	160	22.00	15.00
	188	left	main	tree wind. w deb.	low	15	140	11.50	11.50
	189	mid	main	debris accum.	mod.	30	.	7.00	7.00
	190	left	main	tree wind. w deb.	mod.	33	150	20.00	15.00
	191	right	main	instream veg.	low	15	60	73.00	15.00
	192	left	main	beaver lodge	mod.	38	70	21.00	15.00
	193	left	side	instream veg.	low	0	40	11.00	11.00
	194	right	main	instream veg.	mod.	23	20	3.50	3.50
	195	right	main	tree wind. w deb.	mod.	30	40	12.50	12.50
	196	right	main	tree wind. w deb.	mod.	32	20	6.70	6.70

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	197	left	side	overhang veg.	high	94	40	24.00	15.00
	198	right	side	overhang veg.	mod.	22	20	112.00	15.00
	199	left	side	instream veg.	high	65	30	43.00	15.00
	200	left	side	beaver lodge	mod.	20	80	15.00	15.00
	201	right	side	instream veg.	low	2	45	68.00	15.00
	202	right	main	beaver lodge	low	10	160	31.00	15.00
	203	right	main	tree wind. w deb.	high	73	250	41.00	15.00
	204	right	side	instream veg.	high	46	50	7.00	7.00
	206	right	main	debris accum.	mod.	25	250	26.00	15.00
	207	left	main	log wind. w deb.	low	5	280	21.00	15.00
	208	left	main	beaver lodge	high	47	90	34.00	15.00
	209	right	main	log wind. w deb.	mod.	35	40	8.00	8.00
	210	left	main	instream veg.	high	92	160	7.00	7.00
	211	left	main	cutbank	high	92	250	8.00	8.00
6	1	right	main	log wind. w deb.	low	3	30	6.20	6.20
	2	right	main	log wind. w deb.	low	5	70	58.40	15.00
	3	right	main	debris accum.	low	12	25	36.00	15.00
	4	right	main	log wind. w deb.	low	5	40	5.58	5.58
	5	right	main	debris accum.	low	15	35	34.00	15.00
	6	left	main	instream veg.	mod.	27	130	14.00	14.00
	7	right	main	beaver lodge	low	14	140	19.00	15.00
	8	left	main	instream veg.	mod.	27	120	130.00	15.00
	9	left	main	instream veg.	high	41	130	16.00	15.00
	10	right	main	overhang veg.	low	17	80	36.00	15.00
	11	right	main	instream veg.	low	17	60	5.50	5.50
	12	left	main	debris accum.	low	2	38	3.50	3.50
	13	right	main	instream veg.	mod.	20	150	12.50	12.50
	15	right	main	debris accum.	mod.	29	160	19.00	15.00
	16	right	main	instream veg.	low	13	90	9.00	9.00
	18	right	main	instream veg.	low	2	60	4.00	4.00
	20	right	main	overhang veg.	mod.	32	70	61.00	15.00
	21	right	main	tree wind. w deb.	high	48	80	10.00	10.00
	22	left	main	dock/boat	low	18	110	8.00	8.00
	23	right	main	instream veg.	low	17	60	4.60	4.60
	24	right	main	instream veg.	low	16	70	53.00	15.00
	25	mid	main	offshore tree/log	mod.	36	.	9.50	9.50
	26	right	main	instream veg.	high	44	140	156.00	15.00
	27	right	main	instream veg.	mod.	23	150	72.00	15.00
	28	right	main	instream veg.	mod.	33	160	25.00	15.00
	29	right	main	instream veg.	mod.	23	150	15.00	15.00
	30	right	main	log wind. w deb.	mod.	32	110	5.20	5.20
	31	right	main	debris scat.	low	1	20	9.00	9.00
	32	right	main	log wind. w deb.	mod.	26	90	9.50	9.50
	33	right	main	instream veg.	low	10	80	4.50	4.50
	34	right	main	beaver lodge	mod.	37	110	10.00	10.00



Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	35	left	main	beaver lodge	low	8	160	20.00	15.00
	36	left	main	instream veg.	mod.	27	120	14.50	14.50
	37	left	main	instream veg.	mod.	37	120	80.00	15.00
	38	right	main	log windfall	mod.	25	90	25.00	15.00
	39	right	main	beaver lodge	mod.	20	120	15.00	15.00
	40	right	main	instream veg.	low	18	80	46.00	15.00
	41	right	main	log wind. w deb.	high	44	70	15.00	15.00
	42	right	main	instream veg.	low	15	60	8.00	8.00
	43	right	main	overhang veg.	mod.	24	80	7.50	7.50
	44	right	main	instream veg.	mod.	27	90	31.50	15.00
	45	right	main	instream veg.	mod.	29	110	24.50	15.00
	46	right	main	debris accum.	mod.	33	130	3.00	3.00
	47	right	main	instream veg.	mod.	40	250	9.00	9.00
	48	right	main	beaver lodge	mod.	29	160	12.00	12.00
	49	right	main	instream veg.	high	43	150	38.00	15.00
	50	right	main	instream veg.	high	43	180	14.00	14.00
	51	right	main	instream veg.	mod.	35	160	67.00	15.00
	52	right	main	instream veg.	mod.	35	160	30.00	15.00
	53	right	main	instream veg.	mod.	37	140	540.00	15.00
	54	right	main	log wind. w deb.	high	85	110	16.50	15.00
	55	right	main	log wind. w deb.	low	16	80	7.50	7.50
	56	right	main	instream veg.	mod.	20	90	4.50	4.50
	58	right	main	instream veg.	mod.	20	80	12.00	12.00
	59	right	main	overhang veg.	mod.	31	85	11.00	11.00
	60	right	main	beaver lodge	mod.	29	100	3.50	3.50
	61	right	main	instream veg.	mod.	25	100	16.50	15.00
	62	right	main	instream veg.	mod.	23	75	35.00	15.00
	63	right	main	instream veg.	mod.	26	120	15.00	15.00
	64	right	main	log wind. w deb.	low	15	90	15.00	15.00
	65	right	main	instream veg.	mod.	23	110	6.00	6.00
	66	left	main	debris accum.	low	3	80	3.00	3.00
	67	right	main	instream veg.	mod.	21	140	6.00	6.00
	68	right	main	log wind. w deb.	low	8	90	10.00	10.00
	69	right	main	beaver lodge	mod.	35	150	31.60	15.00
	70	right	main	log windfall	high	48	100	23.00	15.00
	71	right	main	overhang veg.	high	43	130	6.00	6.00
	72	left	main	tree wind. w deb.	mod.	30	60	12.00	12.00
	73	right	main	beaver lodge	low	0	110	20.00	15.00
	74	right	main	debris accum.	low	9	90	2.50	2.50
	75	right	main	beaver lodge	mod.	34	150	18.00	15.00
	76	left	main	beaver lodge	mod.	20	60	24.50	15.00
	78	left	main	dock/boat	low	7	.	3.50	3.50
	79	left	main	debris accum.	mod.	20	45	7.00	7.00
	80	left	main	log wind. w deb.	mod.	22	60	10.00	10.00
	81	left	main	dock/boat	low	0	.	16.00	15.00
	82	left	main	offshore tree/log	mod.	25	.	5.80	5.80

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	83	left	main	debris accum.	mod.	23	30	3.50	3.50
	84	right	main	beaver lodge	high	48	140	13.00	13.00
	85	right	main	beaver lodge	low	5	30	9.00	9.00
	86	right	main	instream veg.	low	5	45	4.00	4.00
	87	left	main	dock/boat	mod.	29	.	16.80	15.00
	88	right	main	beaver lodge	low	17	60	6.00	6.00
	89	left	main	debris accum.	mod.	32	60	4.20	4.20
	90	mid	main	offshore tree/log	mod.	25	.	4.00	4.00
	91	right	main	beaver lodge	mod.	34	40	4.50	4.50
	92	right	main	beaver lodge	low	16	60	4.00	4.00
	93	right	main	tree wind. w deb.	high	48	55	3.50	3.50
	94	right	main	tree wind. w deb.	high	54	30	19.20	15.00
	95	right	main	tree wind. w deb.	mod.	25	30	6.50	6.50
	96	right	main	tree wind. w deb.	mod.	20	40	5.50	5.50
	97	right	main	beaver lodge	high	84	110	23.00	15.00
	98	right	main	instream veg.	mod.	32	60	7.00	7.00
	99	right	main	tree wind. w deb.	high	58	50	11.50	11.50
	100	right	main	tree wind. w deb.	high	54	80	54.00	15.00
	101	right	side	overhang veg.	high	59	20	60.00	15.00
	102	left	main	overhang veg.	high	60	80	121.00	15.00
	103	left	main	beaver lodge	high	76	100	23.50	15.00
	104	mid	side	beaver lodge	mod.	24	.	60.00	15.00
	105	right	side	overhang veg.	high	88	30	36.00	15.00
	106	mid	side	beaver lodge	low	0	.	36.00	15.00
	107	left	side	overhang veg.	low	3	50	40.00	15.00
	108	left	side	overhang veg.	low	0	50	171.00	15.00
	109	left	side	overhang veg.	low	0	120	160.00	15.00
	110	left	side	debris accum.	high	55	60	33.00	15.00
	111	left	main	overhang veg.	low	16	40	50.00	15.00
	112	left	side	beaver lodge	low	8	80	4.00	4.00
	113	right	side	beaver lodge	low	3	130	8.00	8.00
	114	left	main	beaver lodge	low	14	120	2.50	2.50
	115	right	side	beaver lodge	low	0	100	17.00	15.00
	116	right	main	beaver lodge	mod.	20	125	18.00	15.00
	117	mid	side	beaver lodge	mod.	37	.	63.00	15.00
	118	right	side	instream veg.	high	54	40	37.30	15.00
	119	mid	main	offshore tree/log	mod.	20	.	4.40	4.40
	120	right	main	beaver lodge	low	12	130	8.00	8.00
	121	right	main	dock/boat	low	10	.	7.20	7.20
	122	right	main	concrete	mod.	20	250	65.00	15.00
	123	right	main	concrete	high	80	160	45.00	15.00
	124	right	main	car	low	4	180	78.00	15.00
	125	right	main	car	mod.	25	170	8.00	8.00
	126	right	main	car	mod.	25	170	23.00	15.00
	127	left	side	beaver lodge	mod.	38	45	23.00	15.00
	128	left	side	overhang veg.	high	55	60	36.00	15.00

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	129	right	side	overhang veg.	mod.	20	30	90.00	15.00
	130	right	side	debris accum.	high	45	130	8.00	8.00
	131	left	side	beaver lodge	mod.	25	105	5.00	5.00
	132	right	side	overhang veg.	high	90	50	32.00	15.00
	133	left	side	beaver lodge	high	74	90	11.50	11.50
	134	left	side	beaver lodge	mod.	20	75	6.00	6.00
	135	left	side	instream veg.	mod.	23	30	84.00	15.00
	136	right	side	overhang veg.	low	6	40	53.00	15.00
	137	left	side	instream veg.	high	54	110	29.00	15.00
	138	right	side	overhang veg.	high	80	70	60.00	15.00
	139	right	side	overhang veg.	high	80	60	210.00	15.00
	140	right	side	beaver lodge	high	65	70	30.00	15.00
	141	left	side	instream veg.	mod.	33	65	3.50	3.50
	142	right	side	instream veg.	high	59	50	57.00	15.00
	143	left	side	overhang veg.	high	84	.	45.00	15.00
	144	left	side	overhang veg.	high	59	90	80.00	15.00
	145	left	side	instream veg.	low	17	35	4.00	4.00
	146	right	side	overhang veg.	mod.	27	.	30.00	15.00
	147	left	side	overhang veg.	high	71	60	42.00	15.00
	148	left	side	overhang veg.	high	42	90	12.00	12.00
	149	left	side	instream veg.	high	50	20	13.20	13.20
	150	left	side	overhang veg.	mod.	39	25	16.00	15.00
	151	left	side	instream veg.	low	3	50	23.50	15.00
	152	left	side	cutbank	high	54	30	26.00	15.00
	153	left	side	overhang veg.	low	4	.	27.00	15.00
	154	left	side	overhang veg.	mod.	30	30	45.00	15.00
	155	left	side	beaver lodge	mod.	30	40	10.00	10.00
	156	left	side	overhang veg.	mod.	30	55	23.00	15.00
	157	left	side	instream veg.	mod.	21	40	74.00	15.00
	158	left	side	beaver lodge	mod.	20	55	4.00	4.00
	159	mid	side	beaver lodge	high	51	.	72.00	15.00
	160	right	side	beaver lodge	mod.	27	60	55.00	15.00
	161	right	side	beaver lodge	mod.	27	.	27.00	15.00
	162	mid	side	beaver lodge	mod.	20	.	24.00	15.00
	163	left	side	concrete	high	41	90	3.00	3.00
	164	left	side	beaver lodge	high	57	150	7.00	7.00
	165	left	side	concrete	high	57	115	18.00	15.00
	166	left	main	debris accum.	low	10	35	5.00	5.00
	167	left	main	dock/boat	low	2	.	14.00	14.00
	168	left	main	dock/boat	low	5	.	17.00	15.00
	169	mid	side	dock/boat	low	10	.	10.00	10.00
	170	right	main	dock/boat	mod.	32	.	27.00	15.00
	171	right	main	dock/boat	mod.	31	.	29.00	15.00
	172	right	main	dock/boat	mod.	25	.	24.00	15.00
	173	right	main	dock/boat	mod.	23	.	30.00	15.00
	174	right	main	dock/boat	low	17	.	15.00	15.00

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
7	1	right	main	log wind. w deb.	mod.	24	40	6.00	6.00
	2	left	main	dock/boat	low	18	.	27.40	15.00
	3	left	main	beaver lodge	low	3	150	25.00	15.00
	4	left	main	dock/boat	low	5	130	11.00	11.00
	5	left	main	dock/boat	mod.	23	.	31.00	15.00
	6	left	main	debris accum.	mod.	21	90	10.00	10.00
	7	left	main	instream veg.	mod.	21	100	5.00	5.00
	8	left	main	beaver lodge	mod.	33	110	12.50	12.50
	9	left	main	debris accum.	low	10	90	4.50	4.50
	10	right	main	rip rap	low	5	300	180.00	15.00
	11	left	main	beaver lodge	low	8	140	17.00	15.00
	12	right	main	rip rap	low	15	150	1000.00	15.00
	13	right	main	beaver lodge	low	17	230	20.50	15.00
	14	right	main	instream veg.	low	19	100	9.00	9.00
	15	right	main	dock/boat	high	46	.	36.50	15.00
	17	right	main	log wind. w deb.	mod.	21	75	9.00	9.00
	18	right	main	debris accum.	low	16	80	5.00	5.00
	19	right	main	debris accum.	low	10	90	5.00	5.00
	20	right	main	beaver lodge	low	6	110	31.40	15.00
	21	right	main	log wind. w deb.	low	19	100	4.50	4.50
	22	left	main	dock/boat	low	3	.	31.40	15.00
	23	left	main	dock/boat	low	2	.	32.20	15.00
	24	left	main	dock/boat	low	15	.	18.00	15.00
	25	left	main	dock/boat	low	4	.	8.40	8.40
	26	right	main	overhang veg.	low	10	70	20.00	15.00
	27	right	main	instream veg.	low	11	90	10.00	10.00
	28	right	main	instream veg.	low	10	100	23.00	15.00
	29	right	main	log wind. w deb.	low	17	90	14.90	14.90
	30	right	main	log wind. w deb.	mod.	23	90	4.20	4.20
	31	left	main	dock/boat	low	12	.	19.00	15.00
	32	left	main	dock/boat	low	8	.	28.40	15.00
	33	left	side	log wind. w deb.	mod.	31	80	3.50	3.50
	34	right	side	instream veg.	mod.	28	95	3.50	3.50
	35	right	main	tree wind. w deb.	low	18	110	11.00	11.00
	36	right	main	tree wind. w deb.	low	16	110	4.50	4.50
	37	right	main	tree wind. w deb.	mod.	29	110	6.50	6.50
	38	right	main	tree wind. w deb.	mod.	21	140	8.50	8.50
	39	right	main	tree wind. w deb.	mod.	25	150	11.00	11.00
	40	right	main	instream veg.	mod.	30	110	6.00	6.00
	41	right	main	instream veg.	mod.	31	100	10.00	10.00
	42	right	main	instream veg.	low	16	90	15.00	15.00
	43	right	main	log wind. w deb.	mod.	21	150	8.50	8.50
	44	right	main	log wind. w deb.	mod.	20	120	6.10	6.10
	45	right	main	log wind. w deb.	mod.	25	110	5.20	5.20
	46	right	main	debris accum.	mod.	31	120	14.00	14.00
	47	right	main	log wind. w deb.	low	15	110	4.20	4.20

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	48	right	main	debris accum.	low	16	120	3.00	3.00
	49	right	main	beaver lodge	low	19	120	14.50	14.50
	50	left	main	beaver lodge	low	19	130	18.00	15.00
	51	left	main	debris accum.	low	10	220	5.00	5.00
	52	right	main	debris accum.	low	11	100	9.00	9.00
	53	right	main	rip rap	low	16	70	10.00	10.00
	54	right	main	rip rap	low	11	140	200.00	15.00
	55	right	main	rip rap	low	3	120	200.00	15.00
	56	left	main	beaver lodge	mod.	32	135	18.00	15.00
	57	right	main	debris accum.	low	16	90	4.30	4.30
	58	right	main	debris accum.	mod.	30	70	3.00	3.00
	59	right	main	tree wind. w deb.	mod.	29	170	5.00	5.00
	60	right	main	tree wind. w deb.	mod.	27	100	9.00	9.00
	61	right	main	beaver lodge	low	9	160	10.00	10.00
	62	right	main	log wind. w deb.	mod.	26	130	3.60	3.60
	63	left	side	overhang veg.	mod.	21	100	3.00	3.00
	64	left	side	instream veg.	low	7	130	15.00	15.00
	65	left	side	instream veg.	mod.	22	190	30.00	15.00
	66	left	side	instream veg.	mod.	23	190	44.00	15.00
	67	left	side	beaver lodge	low	12	150	27.00	15.00
	68	left	main	debris accum.	low	4	70	74.00	15.00
	69	left	main	debris scat.	low	12	300	10.00	10.00
	70	left	main	debris scat.	low	5	160	19.00	15.00
	71	right	main	cutbank	low	5	200	68.00	15.00
	72	left	main	beaver lodge	low	17	140	47.00	15.00
	73	right	main	instream veg.	low	4	150	8.00	8.00
	74	right	main	instream veg.	low	5	100	7.00	7.00
	75	right	main	instream veg.	low	3	130	48.00	15.00
	76	right	main	instream veg.	low	15	190	150.00	15.00
	77	right	main	log wind. w deb.	mod.	23	190	10.40	10.40
	78	right	main	instream veg.	mod.	21	120	320.00	15.00
	79	right	main	instream veg.	low	10	80	216.00	15.00
	80	right	main	rip rap	mod.	40	300	600.00	15.00
	81	right	main	beaver lodge	mod.	24	100	18.60	15.00
	82	right	main	tree wind. w deb.	low	19	100	6.00	6.00
	83	right	main	tree wind. w deb.	mod.	21	130	6.00	6.00
	84	right	main	tree wind. w deb.	low	14	140	4.00	4.00
	85	right	main	tree wind. w deb.	low	7	50	3.50	3.50
	86	right	main	tree wind. w deb.	low	3	60	17.50	15.00
	87	right	main	tree windfall	low	11	50	9.50	9.50
	88	left	main	beaver lodge	low	14	160	23.00	15.00
	89	right	main	rip rap	mod.	20	190	40.00	15.00
	90	right	main	rip rap	low	18	250	300.00	15.00
	91	right	main	tree wind. w deb.	mod.	22	140	6.00	6.00
	92	right	main	beaver lodge	low	16	130	26.00	15.00
	93	right	main	tree wind. w deb.	mod.	24	140	10.00	10.00

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	94	right	main	tree windfall	low	7	120	5.00	5.00
	95	right	main	beaver lodge	low	16	130	3.00	3.00
	96	right	main	tree wind. w deb.	mod.	23	160	4.00	4.00
	97	right	main	instream veg.	low	19	110	14.50	14.50
	98	right	main	log wind. w deb.	mod.	30	130	12.00	12.00
	99	right	main	beaver lodge	mod.	20	160	4.00	4.00
	100	left	main	beaver lodge	mod.	38	105	12.00	12.00
	101	right	main	beaver lodge	low	2	160	28.00	15.00
	102	right	main	beaver lodge	low	8	160	14.50	14.50
	103	left	main	dock/boat	mod.	28	.	107.00	15.00
	104	left	main	dock/boat	low	4	.	9.00	9.00
	105	left	main	dock/boat	low	6	.	7.50	7.50
	106	left	main	dock/boat	low	8	.	22.00	15.00
	107	left	main	tree wind. w deb.	low	10	80	4.00	4.00
	108	right	main	debris accum.	low	17	240	6.00	6.00
	109	mid	main	offshore tree/log	mod.	25	.	15.00	15.00
	110	left	main	beaver lodge	mod.	30	240	39.50	15.00
	111	left	main	tree wind. w deb.	mod.	22	110	4.50	4.50
	112	left	main	tree windfall	mod.	32	170	7.00	7.00
	113	left	main	beaver lodge	low	0	120	10.50	10.50
	114	left	main	beaver lodge	low	5	190	17.00	15.00
	115	left	main	beaver lodge	mod.	33	250	21.00	15.00
	116	left	main	dock/boat	low	5	.	43.50	15.00
	117	left	main	tree wind. w deb.	low	5	80	7.00	7.00
	118	left	main	log wind. w deb.	low	1	95	19.80	15.00
	119	left	main	tree wind. w deb.	low	5	80	3.50	3.50
	120	left	main	instream veg.	low	8	100	7.00	7.00
	121	right	main	log wind. w deb.	low	10	90	7.50	7.50
	122	left	main	debris accum.	low	7	90	5.80	5.80
	123	left	main	tree windfall	low	8	90	7.00	7.00
	124	left	main	beaver lodge	low	11	120	17.50	15.00
	125	left	main	beaver lodge	mod.	32	140	6.50	6.50
	126	right	main	instream veg.	low	17	200	40.00	15.00
	127	right	main	instream veg.	low	5	170	81.00	15.00
	128	right	main	rip rap	low	7	300	60.00	15.00
	129	right	main	instream veg.	low	17	300	60.00	15.00
	130	right	main	instream veg.	low	17	220	28.00	15.00
	131	right	main	beaver lodge	mod.	20	300	5.00	5.00
	132	right	main	dock/boat	low	12	.	19.20	15.00
	133	right	main	log wind. w deb.	low	5	120	23.00	15.00
	134	right	main	dock/boat	mod.	22	.	9.00	9.00
	135	right	main	debris accum.	low	14	100	7.00	7.00
	136	right	main	tree windfall	mod.	20	100	5.00	5.00
	137	left	main	cutbank	low	12	130	31.00	15.00
	138	left	main	instream veg.	low	0	120	20.50	15.00
	139	left	main	instream veg.	low	12	150	34.00	15.00

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	140	left	main	beaver lodge	low	9	100	9.00	9.00
	141	left	main	instream veg.	low	4	190	16.50	15.00
	142	left	main	instream veg.	low	12	160	37.00	15.00
	143	left	main	beaver lodge	low	15	200	15.00	15.00
	144	left	main	debris accum.	low	8	140	9.00	9.00
	145	left	main	log wind. w deb.	low	18	150	13.00	13.00
	146	left	main	instream veg.	mod.	25	90	124.00	15.00
	147	left	main	instream veg.	low	18	120	6.50	6.50
	148	left	main	tree wind. w deb.	low	10	100	7.50	7.50
	149	left	main	instream veg.	mod.	20	180	46.00	15.00
	150	left	main	instream veg.	low	7	100	15.00	15.00
	151	left	main	instream veg.	low	2	100	5.00	5.00
	152	right	main	rip rap	low	13	150	500.00	15.00
	153	left	main	overhang veg.	low	8	190	24.00	15.00
	154	left	main	instream veg.	low	8	200	150.00	15.00
	155	left	main	debris accum.	low	6	190	4.50	4.50
	156	left	main	instream veg.	low	15	150	65.50	15.00
	157	left	main	instream veg.	low	6	130	13.00	13.00
	158	left	main	debris scat.	low	8	170	8.50	8.50
	159	left	main	log wind. w deb.	low	7	200	7.00	7.00
	160	left	main	instream veg.	low	3	90	19.00	15.00
	161	left	main	instream veg.	low	7	205	16.00	15.00
	162	left	main	log wind. w deb.	low	8	170	4.00	4.00
	163	left	main	debris accum.	low	10	160	3.00	3.00
	164	left	main	instream veg.	low	13	150	6.00	6.00
	165	left	main	log wind. w deb.	low	11	160	8.50	8.50
	166	right	main	log wind. w deb.	low	15	120	2.50	2.50
	167	right	main	tree wind. w deb.	low	10	110	15.60	15.00
	168	right	main	log wind. w deb.	low	12	130	5.00	5.00
	169	right	main	log wind. w deb.	low	11	140	3.00	3.00
	170	left	main	log wind. w deb.	low	19	125	11.00	11.00
	171	left	main	instream veg.	mod.	23	90	14.30	14.30
	172	left	main	instream veg.	low	16	90	16.00	15.00
	173	right	main	log wind. w deb.	mod.	26	90	6.50	6.50
	174	right	main	tree wind. w deb.	mod.	29	190	18.00	15.00
	175	right	main	log wind. w deb.	low	14	150	7.00	7.00
	176	right	main	log wind. w deb.	low	12	90	5.00	5.00
	177	right	main	beaver lodge	low	18	120	18.80	15.00
	178	right	main	instream veg.	mod.	32	200	5.00	5.00
	179	right	main	instream veg.	low	17	90	17.00	15.00
	180	right	main	instream veg.	mod.	21	110	5.00	5.00
	181	right	main	debris accum.	low	19	120	3.00	3.00
	182	right	main	log wind. w deb.	mod.	25	100	5.80	5.80
	183	right	main	instream veg.	low	9	120	4.00	4.00
	184	right	main	log wind. w deb.	mod.	25	190	4.20	4.20
	185	right	main	debris accum.	low	14	130	3.00	3.00

Appendix 3 (continued)  
Physical Characteristics of Major Cover Sites in the Lower  
Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	186	right	main	debris accum.	low	5	110	3.50	3.50
	187	right	main	debris accum.	low	8	150	4.50	4.50
	188	right	main	beaver lodge	low	10	70	12.30	12.30
	189	right	main	log wind. w deb.	low	15	120	6.50	6.50
	190	right	main	beaver lodge	low	7	140	11.00	11.00
	191	right	main	log wind. w deb.	low	12	140	5.00	5.00
	192	left	main	beaver lodge	low	10	200	18.00	15.00
	193	right	main	rip rap	high	51	100	26.00	15.00
	194	left	side	instream veg.	low	16	40	40.00	15.00
	195	left	side	log wind. w deb.	low	7	150	5.50	5.50
	196	right	main	beaver lodge	low	10	150	17.00	15.00
	197	left	main	dock/boat	high	45	.	57.00	15.00
	198	right	main	beaver lodge	low	5	170	16.00	15.00
	199	right	main	log wind. w deb.	low	6	105	5.50	5.50
	200	right	main	log wind. w deb.	low	5	60	4.30	4.30
	201	right	main	log wind. w deb.	low	7	75	15.30	15.00
	202	left	main	beaver lodge	low	13	100	9.50	9.50
	203	left	main	bin wall	low	5	60	5.00	5.00
	204	right	main	tree windfall	low	17	90	2.80	2.80
	205	right	main	beaver lodge	low	4	140	9.00	9.00
	206	right	main	instream veg.	low	16	110	3.50	3.50
	207	right	side	concrete	low	14	120	4.80	4.80
	208	left	side	tree wind. w deb.	low	10	90	17.50	15.00
	209	right	side	tree wind. w deb.	high	47	140	36.00	15.00
	210	left	side	beaver lodge	low	11	110	13.00	13.00
	211	left	main	debris accum.	low	6	90	4.00	4.00
	212	left	main	instream veg.	low	8	80	11.40	11.40
	213	left	main	debris accum.	low	8	110	4.00	4.00
	214	left	main	debris accum.	low	11	170	3.90	3.90
	215	left	main	instream veg.	low	10	100	7.80	7.80
	216	left	main	beaver lodge	low	7	75	10.50	10.50
	217	left	main	beaver lodge	mod.	28	100	4.00	4.00
	218	mid	main	beaver lodge	low	16	.	19.00	15.00
	219	left	main	beaver lodge	low	11	150	14.00	14.00
	220	left	main	beaver lodge	low	10	100	4.00	4.00
	221	right	side	overhang veg.	mod.	35	55	6.00	6.00
	222	left	side	instream veg.	mod.	23	100	18.00	15.00
	223	right	main	dock/boat	low	3	.	8.00	8.00
	224	right	main	rip rap	low	14	200	37.50	15.00
	226	right	main	beaver lodge	mod.	22	130	4.00	4.00
	227	left	main	beaver lodge	low	8	110	10.00	10.00
	228	right	main	beaver lodge	low	9	140	28.00	15.00
	229	right	main	rip rap	mod.	22	230	97.50	15.00
	230	left	main	beaver lodge	low	11	100	12.00	12.00
	231	left	main	tree wind. w deb.	low	13	110	56.50	15.00
	232	right	main	tree windfall	low	15	50	40.00	15.00



Appendix 3 (continued)  
 Physical Characteristics of Major Cover Sites in the Lower  
 Nechako River During May 16 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Bank <sup>b</sup>	Channel <sup>c</sup>	Cover Type <sup>d</sup>	Velocity Rating <sup>e</sup>	Approach Velocity <sup>f</sup> (cm/s)	Depth (5m) <sup>g</sup> (cm)	Cover Area <sup>h</sup> (sq. m)	Useable Cover <sup>i</sup> (sq.m)
	233	left	main	instream veg.	low	11	110	14.00	14.00
	234	right	main	beaver lodge	low	8	160	10.00	10.00
	235	right	main	rip rap	low	15	300	300.00	15.00
	236	right	main	rip rap	mod.	31	300	450.00	15.00
	237	left	main	log wind. w deb.	low	10	120	6.80	6.80
	238	left	main	tree wind. w deb.	low	19	110	49.00	15.00

a Inventory does not include point bars and backeddies.

b right = right bank; left = left bank; mid = mid-channel.

c main = mainstem; side = side channel.

d Cover type abbreviations: debris accum. = debris accumulations or jams; log wind. w deb. = log windfall with debris; debris scat. = debris scattered; tree wind. w deb. = tree windfall with debris; overhanging veg. = overhanging vegetation; offshore tree/log = offshore tree or log; dock/boat = dock, boat or float plane; instream veg. = overhanging vegetation with instream vegetation or instream debris cover; and boulder clus. = boulder cluster.

e low = 0-19 cm/s; mod. = 20-40 cm/s; high = >40 cm/s.

f Measured upstream of the cover feature.

g Measured 5 m from shore

h Total cover area at this site.

i Useable cover area is equal to the total cover area in all cases except where the total cover area exceeds 15 m<sup>2</sup>. In these cases the useable cover was set to 15 m<sup>2</sup>.

• Denotes missing data.

## **APPENDIX 4**

### **Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the Lower Nechako River During May 23 - June 2, 1989**



Appendix 4  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>	
5	1	debris scat.	32	35.00	32.00	mod.	mod.	mod.	
	2	log wind. w deb.	10	11.00	10.00	low	low	low	
	3	instream veg.	12	13.00	12.00	low	low	low	
	4	log wind. w deb.	15	16.00	15.00	low	low	low	
	5	tree wind. w deb.	30	33.00	30.00	mod.	mod.	mod.	
	6	instream veg.	24	26.00	24.00	mod.	mod.	mod.	
	7	instream veg.	23	25.00	23.00	mod.	mod.	mod.	
	8	debris scat.	30	33.00	30.00	mod.	mod.	mod.	
	9	instream veg.	37	40.00	37.00	mod.	mod.	mod.	
	10	instream veg.	39	42.00	38.00	mod.	high	mod.	
	11	debris accum.	31	34.00	31.00	mod.	mod.	mod.	
	12	beaver lodge	11	12.00	11.00	low	low	low	
	13	log wind. w deb.	35	38.00	35.00	mod.	mod.	mod.	
	14	instream veg.	20	22.00	20.00	mod.	mod.	mod.	
	16	log wind. w deb.	19	20.00	19.00	low	mod.	low	
	17	tree wind. w deb.	36	39.00	36.00	mod.	mod.	mod.	
	18	log wind. w deb.	17	18.00	17.00	mod.	low	low	
	20	beaver lodge	16	17.00	16.00	low	low	low	
	21	instream veg.	10	11.00	10.00	low	low	low	
	22	debris accum.	10	11.00	10.00	low	low	low	
	24	offshore tree/log	75	81.00	74.00	high	high	high	
	26	beaver lodge	24	26.00	24.00	mod.	mod.	mod.	
	27	offshore tree/log	7	8.00	7.00	low	low	low	
	28	beaver lodge	22	24.00	22.00	mod.	mod.	mod.	
	29	overhang veg.	15	16.00	15.00	low	low	low	
	30	log wind. w deb.	32	34.00	32.00	mod.	mod.	mod.	
	32	debris accum.	4	4.00	4.00	low	low	low	
	33	tree windfall	84	90.00	83.00	high	high	high	
	34	tree wind. w deb.	43	46.00	43.00	high	high	high	
	35	beaver lodge	23	25.00	23.00	mod.	mod.	mod.	
	36	tree wind. w deb.	24	26.00	24.00	mod.	mod.	mod.	
	37	beaver lodge	2	2.00	2.00	low	low	low	
	38	debris accum.	22	24.00	22.00	mod.	mod.	mod.	
	39	tree wind. w deb.	24	26.00	24.00	mod.	mod.	mod.	
	40	tree wind. w deb.	25	27.00	25.00	mod.	mod.	mod.	
	41	beaver lodge	19	20.00	19.00	low	mod.	low	
	42	tree windfall	27	29.00	27.00	mod.	mod.	mod.	
	43	tree windfall	1	1.00	1.00	low	low	low	
	5	44	tree wind. w deb.	24	25.00	24.00	mod.	mod.	mod.
		45	beaver lodge	30	31.00	30.00	mod.	mod.	mod.
		46	beaver lodge	30	31.00	30.00	mod.	mod.	mod.
		47	tree windfall	1	1.00	1.00	low	low	low
		48	instream veg.	0	0.00	0.00	low	low	low
49		beaver lodge	0	0.00	0.00	low	low	low	

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	50	beaver lodge	15	15.00	15.00	low	low	low
	51	overhang veg.	20	20.00	20.00	mod.	mod.	mod.
	52	beaver lodge	50	50.00	50.00	high	high	high
	53	debris accum.	14	14.00	14.00	low	low	low
	54	beaver lodge	10	10.00	10.00	low	low	low
	55	instream veg.	21	21.00	21.00	mod.	mod.	mod.
	56	beaver lodge	10	10.00	10.00	low	low	low
	57	beaver lodge	0	0.00	0.00	low	low	low
	59	overhang veg.	45	45.00	45.00	high	high	high
	60	debris scat.	25	25.00	25.00	mod.	mod.	mod.
	61	instream veg.	32	32.00	32.00	mod.	mod.	mod.
	62	tree windfall	34	34.00	34.00	mod.	mod.	mod.
	63	debris accum.	20	20.00	20.00	mod.	mod.	mod.
	64	beaver lodge	35	35.00	35.00	mod.	mod.	mod.
	65	debris accum.	19	19.00	19.00	low	low	low
	66	instream veg.	30	30.00	30.00	mod.	mod.	mod.
	67	instream veg.	17	17.00	17.00	low	low	low
	68	beaver lodge	18	18.00	18.00	low	low	low
	69	instream veg.	20	20.00	20.00	mod.	mod.	mod.
	70	instream veg.	20	20.00	20.00	mod.	mod.	mod.
	71	instream veg.	27	27.00	27.00	mod.	mod.	mod.
	72	tree windfall	20	21.00	20.00	mod.	mod.	mod.
	73	instream veg.	25	27.00	25.00	mod.	mod.	mod.
	74	debris accum.	20	21.00	20.00	mod.	mod.	mod.
	75	instream veg.	12	13.00	12.00	low	low	low
	76	beaver lodge	15	16.00	15.00	low	low	low
	77	log wind. w deb.	30	32.00	30.00	mod.	mod.	mod.
	78	beaver lodge	15	16.00	15.00	low	low	low
	79	tree wind. w deb.	6	6.00	6.00	low	low	low
	80	overhang veg.	23	25.00	23.00	mod.	mod.	mod.
	81	beaver lodge	23	25.00	23.00	mod.	mod.	mod.
	82	beaver lodge	20	21.00	20.00	mod.	mod.	mod.
	83	log wind. w deb.	20	21.00	20.00	mod.	mod.	mod.
	85	beaver lodge	15	16.00	15.00	low	low	low
	86	tree wind. w deb.	22	23.00	22.00	mod.	mod.	mod.
	88	beaver lodge	11	12.00	11.00	low	low	low
	89	overhang veg.	30	32.00	30.00	mod.	mod.	mod.
	90	log wind. w deb.	3	3.00	3.00	low	low	low
	92	debris accum.	15	16.00	15.00	low	low	low
	93	tree windfall	25	27.00	25.00	mod.	mod.	mod.
	94	beaver lodge	20	21.00	20.00	mod.	mod.	mod.
	95	log wind. w deb.	27	29.00	27.00	mod.	mod.	mod.
	96	tree windfall	30	32.00	30.00	mod.	mod.	mod.
5	97	beaver lodge	23	25.00	23.00	mod.	mod.	mod.

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	99	log wind. w deb.	20	21.00	20.00	mod.	mod.	mod.
	100	log wind. w deb.	17	18.00	17.00	low	low	low
	101	tree wind. w deb.	20	23.00	20.00	mod.	mod.	mod.
	102	beaver lodge	5	6.00	5.00	low	low	low
	103	debris accum.	27	31.00	27.00	mod.	mod.	mod.
	104	instream veg.	2	2.00	2.00	low	low	low
	105	beaver lodge	40	46.00	40.00	mod.	high	mod.
	106	tree windfall	2	2.00	2.00	low	low	low
	107	beaver lodge	21	24.00	21.00	mod.	mod.	mod.
	108	tree windfall	15	17.00	15.00	low	low	low
	109	instream veg.	32	37.00	32.00	mod.	mod.	mod.
	110	overhang veg.	27	31.00	27.00	mod.	mod.	mod.
	111	beaver lodge	30	34.00	30.00	mod.	mod.	mod.
	112	instream veg.	1	1.00	1.00	low	low	low
	113	log wind. w deb.	0	0.00	0.00	low	low	low
	114	tree wind. w deb.	2	2.00	2.00	low	low	low
	115	beaver lodge	20	23.00	20.00	mod.	mod.	mod.
	116	log wind. w deb.	10	11.00	10.00	low	low	low
	117	tree windfall	14	16.00	14.00	low	low	low
	118	instream veg.	7	8.00	7.00	low	low	low
	119	beaver lodge	2	2.00	2.00	low	low	low
	120	instream veg.	16	18.00	16.00	low	low	low
	121	debris accum.	1	1.00	1.00	low	low	low
	122	log wind. w deb.	30	33.00	30.00	mod.	mod.	mod.
	123	tree wind. w deb.	49	54.00	49.00	high	high	high
	124	beaver lodge	35	39.00	35.00	mod.	mod.	mod.
	125	log wind. w deb.	50	56.00	50.00	high	high	high
	126	tree wind. w deb.	134	155.00	134.00	high	high	high
	127	tree windfall	25	29.00	25.00	mod.	mod.	mod.
	128	tree windfall	18	21.00	18.00	low	mod.	low
	129	tree wind. w deb.	17	20.00	17.00	low	mod.	low
	130	beaver lodge	10	12.00	10.00	low	low	low
	131	tree wind. w deb.	2	2.00	2.00	low	low	low
	132	beaver lodge	1	1.00	1.00	low	low	low
	133	beaver lodge	20	23.00	20.00	mod.	mod.	mod.
	134	instream veg.	15	17.00	15.00	low	low	low
	135	log wind. w deb.	12	14.00	12.00	low	low	low
	136	beaver lodge	28	30.00	28.00	mod.	mod.	mod.
	137	beaver lodge	22	24.00	22.00	mod.	mod.	mod.
	138	debris accum.	20	22.00	20.00	mod.	mod.	mod.
	139	log wind. w deb.	11	12.00	11.00	low	low	low
	140	log wind. w deb.	20	22.00	20.00	mod.	mod.	mod.
	141	tree wind. w deb.	25	27.00	25.00	mod.	mod.	mod.
	142	beaver lodge	23	25.00	23.00	mod.	mod.	mod.

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	143	instream veg.	22	24.00	22.00	mod.	mod.	mod.
	144	overhang veg.	27	29.00	27.00	mod.	mod.	mod.
	145	beaver lodge	25	27.00	25.00	mod.	mod.	mod.
	146	beaver lodge	22	24.00	22.00	mod.	mod.	mod.
5	147	debris accum.	2	2.00	2.00	low	low	low
	148	dock/boat	40	43.00	40.00	mod.	high	mod.
	150	tree windfall	65	71.00	65.00	high	high	high
	152	debris accum.	3	3.00	3.00	low	low	low
	153	beaver lodge	17	18.00	17.00	low	low	low
	154	debris accum.	3	3.00	3.00	low	low	low
	155	debris accum.	0	0.00	0.00	low	low	low
	156	tree wind. w deb.	22	24.00	22.00	mod.	mod.	mod.
	157	tree wind. w deb.	23	25.00	23.00	mod.	mod.	mod.
	158	tree wind. w deb.	12	13.00	12.00	low	low	low
	159	log wind. w deb.	49	53.00	49.00	high	high	high
	160	instream veg.	4	4.00	4.00	low	low	low
	161	log wind. w deb.	10	11.00	10.00	low	low	low
	162	instream veg.	17	18.00	17.00	low	low	low
	163	beaver lodge	10	11.00	10.00	low	low	low
	164	debris accum.	46	50.00	46.00	high	high	high
	165	tree wind. w deb.	43	46.00	43.00	high	high	high
	166	tree wind. w deb.	73	79.00	73.00	high	high	high
	167	instream veg.	74	80.00	74.00	high	high	high
	168	beaver lodge	16	17.00	16.00	low	low	low
	169	debris accum.	25	27.00	25.00	mod.	mod.	mod.
	170	tree wind. w deb.	23	25.00	23.00	mod.	mod.	mod.
	171	debris accum.	32	35.00	32.00	mod.	mod.	mod.
	172	cutbank	62	67.00	62.00	high	high	high
	173	debris scat.	60	65.00	60.00	high	high	high
	174	tree wind. w deb.	17	18.00	17.00	low	low	low
	175	tree wind. w deb.	14	15.00	14.00	low	low	low
	176	tree wind. w deb.	44	48.00	44.00	high	high	high
	177	instream veg.	18	19.00	18.00	low	low	low
	178	debris accum.	36	39.00	36.00	mod.	mod.	mod.
	179	tree wind. w deb.	20	22.00	20.00	mod.	mod.	mod.
	180	instream veg.	29	31.00	29.00	mod.	mod.	mod.
	181	instream veg.	14	15.00	14.00	low	low	low
	182	debris accum.	32	35.00	32.00	mod.	mod.	mod.
	183	debris accum.	10	10.00	10.00	low	low	low
	184	offshore tree/log	16	17.00	16.00	low	low	low
	185	debris accum.	20	21.00	20.00	mod.	mod.	mod.
	186	beaver lodge	18	19.00	18.00	low	low	low
	187	beaver lodge	46	48.00	46.00	high	high	high
	188	tree wind. w deb.	15	16.00	15.00	low	low	low

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
5	189	debris accum.	30	31.00	30.00	mod.	mod.	mod.
	190	tree wind. w deb.	33	34.00	33.00	mod.	mod.	mod.
	191	instream veg.	15	16.00	15.00	low	low	low
	192	beaver lodge	38	39.00	38.00	mod.	mod.	mod.
	193	instream veg.	0	0.00	0.00	low	low	low
	194	instream veg.	23	24.00	23.00	mod.	mod.	mod.
	195	tree wind. w deb.	30	31.00	30.00	mod.	mod.	mod.
	196	tree wind. w deb.	32	33.00	32.00	mod.	mod.	mod.
	197	overhang veg.	94	98.00	94.00	high	high	high
	198	overhang veg.	22	23.00	22.00	mod.	mod.	mod.
	199	instream veg.	65	68.00	65.00	high	high	high
	200	beaver lodge	20	21.00	20.00	mod.	mod.	mod.
	201	instream veg.	2	2.00	2.00	low	low	low
	202	beaver lodge	10	10.00	10.00	low	low	low
	203	tree wind. w deb.	73	76.00	73.00	high	high	high
	204	instream veg.	46	48.00	46.00	high	high	high
	206	debris accum.	25	26.00	25.00	mod.	mod.	mod.
	207	log wind. w deb.	5	5.00	5.00	low	low	low
	208	beaver lodge	47	50.00	47.00	high	high	high
	209	log wind. w deb.	35	37.00	35.00	mod.	mod.	mod.
	210	instream veg.	92	97.00	92.00	high	high	high
211	cutbank	92	97.00	92.00	high	high	high	
6	1	log wind. w deb.	3	3.00	3.00	low	low	low
	2	log wind. w deb.	5	6.00	5.00	low	low	low
	3	debris accum.	12	14.00	12.00	low	low	low
	4	log wind. w deb.	5	6.00	5.00	low	low	low
	5	debris accum.	15	17.00	15.00	low	low	low
	6	instream veg.	27	31.00	27.00	mod.	mod.	mod.
	7	beaver lodge	14	16.00	14.00	low	low	low
	8	instream veg.	27	31.00	27.00	mod.	mod.	mod.
	9	instream veg.	41	46.00	41.00	high	high	high
	10	overhang veg.	17	18.00	17.00	low	low	low
	11	instream veg.	17	18.00	17.00	low	low	low
	12	debris accum.	2	2.00	2.00	low	low	low
	13	instream veg.	20	22.00	20.00	mod.	mod.	mod.
	15	debris accum.	29	31.00	29.00	mod.	mod.	mod.
16	instream veg.	13	14.00	13.00	low	low	low	
18	instream veg.	2	2.00	2.00	low	low	low	
20	overhang veg.	32	35.00	32.00	mod.	mod.	mod.	
21	tree wind. w deb.	48	52.00	48.00	high	high	high	
22	dock/boat	18	18.00	18.00	low	low	low	
23	instream veg.	17	17.00	17.00	low	low	low	
24	instream veg.	16	16.00	16.00	low	low	low	



Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	25	offshore tree/log	36	37.00	36.00	mod.	mod.	mod.
	26	instream veg.	44	45.00	44.00	high	high	high
	27	instream veg.	23	23.00	23.00	mod.	mod.	mod.
	28	instream veg.	33	33.00	33.00	mod.	mod.	mod.
	29	instream veg.	23	23.00	23.00	mod.	mod.	mod.
	30	log wind. w deb.	32	32.00	32.00	mod.	mod.	mod.
	31	debris scat.	1	1.00	1.00	low	low	low
	32	log wind. w deb.	26	26.00	26.00	mod.	mod.	mod.
	33	instream veg.	10	10.00	10.00	low	low	low
	34	beaver lodge	37	38.00	37.00	mod.	mod.	mod.
	35	beaver lodge	8	8.00	8.00	low	low	low
	36	instream veg.	27	27.00	27.00	mod.	mod.	mod.
	37	instream veg.	37	38.00	37.00	mod.	mod.	mod.
	38	log windfall	25	25.00	25.00	mod.	mod.	mod.
6	39	beaver lodge	20	20.00	20.00	mod.	mod.	mod.
	40	instream veg.	18	18.00	18.00	low	low	low
	41	log wind. w deb.	44	45.00	44.00	high	high	high
	42	instream veg.	15	15.00	15.00	low	low	low
	43	overhang veg.	24	26.00	24.00	mod.	mod.	mod.
	44	instream veg.	27	29.00	27.00	mod.	mod.	mod.
	45	instream veg.	29	31.00	29.00	mod.	mod.	mod.
	46	debris accum.	33	35.00	33.00	mod.	mod.	mod.
	47	instream veg.	40	43.00	40.00	mod.	high	mod.
	48	beaver lodge	29	31.00	29.00	mod.	mod.	mod.
	49	instream veg.	43	46.00	43.00	high	high	high
	50	instream veg.	43	46.00	43.00	high	high	high
	51	instream veg.	35	37.00	35.00	mod.	mod.	mod.
	52	instream veg.	35	37.00	35.00	mod.	mod.	mod.
	53	instream veg.	37	39.00	37.00	mod.	mod.	mod.
	54	log wind. w deb.	85	91.00	86.00	high	high	high
	55	log wind. w deb.	16	17.00	16.00	low	low	low
	56	instream veg.	20	21.00	20.00	mod.	mod.	mod.
	58	instream veg.	20	21.00	20.00	mod.	mod.	mod.
	59	overhang veg.	31	33.00	31.00	mod.	mod.	mod.
	60	beaver lodge	29	31.00	29.00	mod.	mod.	mod.
	61	instream veg.	25	27.00	25.00	mod.	mod.	mod.
	62	instream veg.	23	24.00	23.00	mod.	mod.	mod.
	63	instream veg.	26	28.00	26.00	mod.	mod.	mod.
	64	log wind. w deb.	15	16.00	15.00	low	low	low
	65	instream veg.	23	25.00	23.00	mod.	mod.	mod.
	66	debris accum.	3	3.00	3.00	low	low	low
	67	instream veg.	21	23.00	21.00	mod.	mod.	mod.
	68	log wind. w deb.	8	9.00	8.00	low	low	low
	69	beaver lodge	35	39.00	35.00	mod.	mod.	mod.

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	70	log windfall	48	53.00	49.00	high	high	high
	71	overhang veg.	43	47.00	44.00	high	high	high
	72	tree wind. w deb.	30	33.00	30.00	mod.	mod.	mod.
	73	beaver lodge	0	0.00	0.00	low	low	low
	74	debris accum.	9	10.00	9.00	low	low	low
	75	beaver lodge	34	36.00	34.00	mod.	mod.	mod.
	76	beaver lodge	20	21.00	20.00	mod.	mod.	mod.
	78	dock/boat	7	7.00	7.00	low	low	low
	79	debris accum.	20	21.00	20.00	mod.	mod.	mod.
	80	log wind. w deb.	22	23.00	22.00	mod.	mod.	mod.
	81	dock/boat	0	0.00	0.00	low	low	low
	82	offshore tree/log	25	26.00	25.00	mod.	mod.	mod.
	83	debris accum.	23	24.00	23.00	mod.	mod.	mod.
	84	beaver lodge	48	50.00	48.00	high	high	high
	85	beaver lodge	5	5.00	5.00	low	low	low
	86	instream veg.	5	5.00	5.00	low	low	low
	87	dock/boat	29	31.00	29.00	mod.	mod.	mod.
	88	beaver lodge	17	18.00	17.00	low	low	low
	89	debris accum.	32	34.00	32.00	mod.	mod.	mod.
6	90	offshore tree/log	25	27.00	25.00	mod.	mod.	mod.
	91	beaver lodge	34	37.00	34.00	mod.	mod.	mod.
	92	beaver lodge	16	16.00	16.00	low	low	low
	93	tree wind. w deb.	48	49.00	48.00	high	high	high
	94	tree wind. w deb.	54	55.00	54.00	high	high	high
	95	tree wind. w deb.	25	25.00	25.00	mod.	mod.	mod.
	96	tree wind. w deb.	20	20.00	20.00	mod.	mod.	mod.
	97	beaver lodge	84	85.00	84.00	high	high	high
	98	instream veg.	32	32.00	32.00	mod.	mod.	mod.
	99	tree wind. w deb.	58	59.00	58.00	high	high	high
	100	tree wind. w deb.	54	55.00	54.00	high	high	high
	101	overhang veg.	59	60.00	59.00	high	high	high
	102	overhang veg.	60	64.00	61.00	high	high	high
	103	beaver lodge	76	81.00	77.00	high	high	high
	104	beaver lodge	24	26.00	24.00	mod.	mod.	mod.
	105	overhang veg.	88	94.00	89.00	high	high	high
	106	beaver lodge	0	0.00	0.00	low	low	low
	107	overhang veg.	3	3.00	3.00	low	low	low
	108	overhang veg.	0	0.00	0.00	low	low	low
	109	overhang veg.	0	0.00	0.00	low	low	low
	110	debris accum.	55	59.00	56.00	high	high	high
	111	overhang veg.	16	17.00	16.00	low	low	low
	112	beaver lodge	8	9.00	8.00	low	low	low
	113	beaver lodge	3	3.00	3.00	low	low	low
	114	beaver lodge	14	15.00	14.00	low	low	low

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	115	beaver lodge	0	0.00	0.00	low	low	low
	116	beaver lodge	20	21.00	20.00	mod.	mod.	mod.
	117	beaver lodge	37	39.00	37.00	mod.	mod.	mod.
	118	instream veg.	54	57.00	54.00	high	high	high
	119	offshore tree/log	20	20.00	20.00	mod.	mod.	mod.
	120	beaver lodge	12	12.00	12.00	low	low	low
	121	dock/boat	10	10.00	10.00	low	low	low
	122	concrete	20	20.00	20.00	mod.	mod.	mod.
	123	concrete	80	78.00	80.00	high	high	high
	124	car	4	4.00	4.00	low	low	low
	125	car	25	24.00	25.00	mod.	mod.	mod.
	126	car	25	24.00	25.00	mod.	mod.	mod.
	127	beaver lodge	38	37.00	38.00	mod.	mod.	mod.
	128	overhang veg.	55	54.00	55.00	high	high	high
	129	overhang veg.	20	20.00	20.00	mod.	mod.	mod.
	130	debris accum.	45	44.00	45.00	high	high	high
	131	beaver lodge	25	24.00	25.00	mod.	mod.	mod.
	132	overhang veg.	90	88.00	90.00	high	high	high
	133	beaver lodge	74	72.00	74.00	high	high	high
	134	beaver lodge	20	20.00	20.00	mod.	mod.	mod.
	135	instream veg.	23	22.00	23.00	mod.	mod.	mod.
	136	overhang veg.	6	6.00	6.00	low	low	low
	137	instream veg.	54	53.00	54.00	high	high	high
	138	overhang veg.	80	78.00	80.00	high	high	high
6	139	overhang veg.	80	78.00	80.00	high	high	high
	140	beaver lodge	65	64.00	65.00	high	high	high
	141	instream veg.	33	32.00	33.00	mod.	mod.	mod.
	142	instream veg.	59	58.00	59.00	high	high	high
	143	overhang veg.	84	82.00	84.00	high	high	high
	144	overhang veg.	59	58.00	59.00	high	high	high
	145	instream veg.	17	17.00	17.00	low	low	low
	146	overhang veg.	27	26.00	27.00	mod.	mod.	mod.
	147	overhang veg.	71	69.00	71.00	high	high	high
	148	overhang veg.	42	41.00	42.00	high	high	high
	149	instream veg.	50	49.00	50.00	high	high	high
	150	overhang veg.	39	38.00	39.00	mod.	mod.	mod.
	151	instream veg.	3	3.00	3.00	low	low	low
	152	cutbank	54	53.00	54.00	high	high	high
	153	overhang veg.	4	4.00	4.00	low	low	low
	154	overhang veg.	30	29.00	30.00	mod.	mod.	mod.
	155	beaver lodge	30	29.00	30.00	mod.	mod.	mod.
	156	overhang veg.	30	29.00	30.00	mod.	mod.	mod.
	157	instream veg.	21	21.00	21.00	mod.	mod.	mod.
	158	beaver lodge	20	20.00	20.00	mod.	mod.	mod.

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	159	beaver lodge	51	50.00	51.00	high	high	high
	160	beaver lodge	27	26.00	27.00	mod.	mod.	mod.
	161	beaver lodge	27	26.00	27.00	mod.	mod.	mod.
	162	beaver lodge	20	20.00	20.00	mod.	mod.	mod.
	163	concrete	41	40.00	41.00	high	mod.	high
	164	beaver lodge	57	56.00	57.00	high	high	high
	165	concrete	57	56.00	57.00	high	high	high
	166	debris accum.	10	11.00	10.00	low	low	low
	167	dock/boat	2	2.00	2.00	low	low	low
	168	dock/boat	5	5.00	5.00	low	low	low
	169	dock/boat	10	11.00	10.00	low	low	low
	170	dock/boat	32	35.00	32.00	mod.	mod.	mod.
	171	dock/boat	31	34.00	31.00	mod.	mod.	mod.
	172	dock/boat	25	27.00	25.00	mod.	mod.	mod.
	173	dock/boat	23	25.00	23.00	mod.	mod.	mod.
	174	dock/boat	17	19.00	17.00	low	low	low
7	1	log wind. w deb.	24	27.00	25.00	mod.	mod.	mod.
	2	dock/boat	18	21.00	19.00	low	mod.	low
	3	beaver lodge	3	3.00	3.00	low	low	low
	4	dock/boat	5	6.00	5.00	low	low	low
	5	dock/boat	23	26.00	24.00	mod.	mod.	mod.
	6	debris accum.	21	24.00	22.00	mod.	mod.	mod.
	7	instream veg.	21	24.00	22.00	mod.	mod.	mod.
	8	beaver lodge	33	38.00	34.00	mod.	mod.	mod.
	9	debris accum.	10	11.00	10.00	low	low	low
	10	rip rap	5	6.00	5.00	low	low	low
	11	beaver lodge	8	9.00	8.00	low	low	low
	12	rip rap	15	17.00	15.00	low	low	low
7	13	beaver lodge	17	19.00	18.00	low	low	low
	14	instream veg.	19	22.00	20.00	low	mod.	mod.
	15	dock/boat	46	52.00	47.00	high	high	high
	17	log wind. w deb.	21	24.00	22.00	mod.	mod.	mod.
	18	debris accum.	16	18.00	16.00	low	low	low
	19	debris accum.	10	11.00	10.00	low	low	low
	20	beaver lodge	6	7.00	6.00	low	low	low
	21	log wind. w deb.	19	22.00	20.00	low	mod.	mod.
	22	dock/boat	3	3.00	3.00	low	low	low
	23	dock/boat	2	2.00	2.00	low	low	low
	24	dock/boat	15	16.00	15.00	low	low	low
	25	dock/boat	4	4.00	4.00	low	low	low
	26	overhang veg.	10	11.00	10.00	low	low	low
	27	instream veg.	11	12.00	11.00	low	low	low
	28	instream veg.	10	11.00	10.00	low	low	low

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	29	log wind. w deb.	17	19.00	17.00	low	low	low
	30	log wind. w deb.	23	25.00	24.00	mod.	mod.	mod.
	31	dock/boat	12	13.00	12.00	low	low	low
	32	dock/boat	8	9.00	8.00	low	low	low
	33	log wind. w deb.	31	34.00	32.00	mod.	mod.	mod.
	34	instream veg.	28	31.00	29.00	mod.	mod.	mod.
	35	tree wind. w deb.	18	20.00	18.00	low	mod.	low
	36	tree wind. w deb.	16	18.00	16.00	low	low	low
	37	tree wind. w deb.	29	32.00	30.00	mod.	mod.	mod.
	38	tree wind. w deb.	21	23.00	22.00	mod.	mod.	mod.
	39	tree wind. w deb.	25	27.00	26.00	mod.	mod.	mod.
	40	instream veg.	30	33.00	31.00	mod.	mod.	mod.
	41	instream veg.	31	34.00	32.00	mod.	mod.	mod.
	42	instream veg.	16	18.00	16.00	low	low	low
	43	log wind. w deb.	21	23.00	22.00	mod.	mod.	mod.
	44	log wind. w deb.	20	22.00	20.00	mod.	mod.	mod.
	45	log wind. w deb.	25	27.00	26.00	mod.	mod.	mod.
	46	debris accum.	31	34.00	32.00	mod.	mod.	mod.
	47	log wind. w deb.	15	16.00	15.00	low	low	low
	48	debris accum.	16	18.00	16.00	low	low	low
	49	beaver lodge	19	21.00	19.00	low	mod.	low
	50	beaver lodge	19	21.00	19.00	low	mod.	low
	51	debris accum.	10	11.00	10.00	low	low	low
	52	debris accum.	11	13.00	11.00	low	low	low
	53	rip rap	16	18.00	17.00	low	low	low
	54	rip rap	11	13.00	11.00	low	low	low
	55	rip rap	3	3.00	3.00	low	low	low
	56	beaver lodge	32	37.00	33.00	mod.	mod.	mod.
	57	debris accum.	16	18.00	17.00	low	low	low
	58	debris accum.	30	34.00	31.00	mod.	mod.	mod.
	59	tree wind. w deb.	29	33.00	30.00	mod.	mod.	mod.
	60	tree wind. w deb.	27	31.00	28.00	mod.	mod.	mod.
	61	beaver lodge	9	10.00	9.00	low	low	low
	62	log wind. w deb.	26	29.00	27.00	mod.	mod.	mod.
7	63	overhang veg.	21	23.00	22.00	mod.	mod.	mod.
	64	instream veg.	7	8.00	7.00	low	low	low
	65	instream veg.	22	24.00	23.00	mod.	mod.	mod.
	66	instream veg.	23	25.00	24.00	mod.	mod.	mod.
	67	beaver lodge	12	13.00	12.00	low	low	low
	68	debris accum.	4	4.00	4.00	low	low	low
	69	debris scat.	12	13.00	12.00	low	low	low
	70	debris scat.	5	5.00	5.00	low	low	low
	71	cutbank	5	5.00	5.00	low	low	low
	72	beaver lodge	17	19.00	17.00	low	low	low

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	73	instream veg.	4	4.00	4.00	low	low	low
	74	instream veg.	5	6.00	5.00	low	low	low
	75	instream veg.	3	3.00	3.00	low	low	low
	76	instream veg.	15	17.00	15.00	low	low	low
	77	log wind. w deb.	23	26.00	24.00	mod.	mod.	mod.
	78	instream veg.	21	23.00	22.00	mod.	mod.	mod.
	79	instream veg.	10	11.00	10.00	low	low	low
	80	rip rap	40	45.00	41.00	mod.	high	high
	81	beaver lodge	24	27.00	25.00	mod.	mod.	mod.
	82	tree wind. w deb.	19	21.00	20.00	low	mod.	mod.
	83	tree wind. w deb.	21	23.00	22.00	mod.	mod.	mod.
	84	tree wind. w deb.	14	16.00	14.00	low	low	low
	85	tree wind. w deb.	7	8.00	7.00	low	low	low
	86	tree wind. w deb.	3	3.00	3.00	low	low	low
	87	tree windfall	11	12.00	11.00	low	low	low
	88	beaver lodge	14	16.00	14.00	low	low	low
	89	rip rap	20	22.00	21.00	mod.	mod.	mod.
	90	rip rap	18	20.00	19.00	low	mod.	low
	91	tree wind. w deb.	22	24.00	23.00	mod.	mod.	mod.
	92	beaver lodge	16	18.00	16.00	low	low	low
	93	tree wind. w deb.	24	27.00	25.00	mod.	mod.	mod.
	94	tree windfall	7	8.00	7.00	low	low	low
	95	beaver lodge	16	18.00	17.00	low	low	low
	96	tree wind. w deb.	23	26.00	24.00	mod.	mod.	mod.
	97	instream veg.	19	22.00	20.00	low	mod.	mod.
	98	log wind. w deb.	30	35.00	31.00	mod.	mod.	mod.
	99	beaver lodge	20	23.00	21.00	mod.	mod.	mod.
	100	beaver lodge	38	44.00	40.00	mod.	high	mod.
	101	beaver lodge	2	2.00	2.00	low	low	low
	102	beaver lodge	8	9.00	8.00	low	low	low
	103	dock/boat	28	32.00	29.00	mod.	mod.	mod.
	104	dock/boat	4	5.00	4.00	low	low	low
	105	dock/boat	6	7.00	6.00	low	low	low
	106	dock/boat	8	9.00	8.00	low	low	low
	107	tree wind. w deb.	10	12.00	10.00	low	low	low
	108	debris accum.	17	20.00	18.00	low	mod.	low
	109	offshore tree/log	25	29.00	26.00	mod.	mod.	mod.
	110	beaver lodge	30	35.00	31.00	mod.	mod.	mod.
	111	tree wind. w deb.	22	23.00	22.00	mod.	mod.	mod.
7	112	tree windfall	32	34.00	33.00	mod.	mod.	mod.
	113	beaver lodge	0	0.00	0.00	low	low	low
	114	beaver lodge	5	5.00	5.00	low	low	low
	115	beaver lodge	33	35.00	34.00	mod.	mod.	mod.
	116	dock/boat	5	5.00	5.00	low	low	low

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	117	tree wind. w deb.	5	5.00	5.00	low	low	low
	118	log wind. w deb.	1	1.00	1.00	low	low	low
	119	tree wind. w deb.	5	5.00	5.00	low	low	low
	120	instream veg.	8	9.00	8.00	low	low	low
	121	log wind. w deb.	10	11.00	10.00	low	low	low
	122	debris accum.	7	7.00	7.00	low	low	low
	123	tree windfall	8	9.00	8.00	low	low	low
	124	beaver lodge	11	12.00	11.00	low	low	low
	125	beaver lodge	32	37.00	34.00	mod.	mod.	mod.
	126	instream veg.	17	20.00	18.00	low	mod.	low
	127	instream veg.	5	6.00	5.00	low	low	low
	128	rip rap	7	8.00	7.00	low	low	low
	129	instream veg.	17	20.00	18.00	low	mod.	low
	130	instream veg.	17	20.00	18.00	low	mod.	low
	131	beaver lodge	20	23.00	21.00	mod.	mod.	mod.
	132	dock/boat	12	14.00	13.00	low	low	low
	133	log wind. w deb.	5	6.00	5.00	low	low	low
	134	dock/boat	22	26.00	23.00	mod.	mod.	mod.
	135	debris accum.	14	16.00	15.00	low	low	low
	136	tree windfall	20	23.00	21.00	mod.	mod.	mod.
	137	cutbank	12	14.00	13.00	low	low	low
	138	instream veg.	0	0.00	0.00	low	low	low
	139	instream veg.	12	14.00	13.00	low	low	low
	140	beaver lodge	9	10.00	9.00	low	low	low
	141	instream veg.	4	5.00	4.00	low	low	low
	142	instream veg.	12	14.00	13.00	low	low	low
	143	beaver lodge	15	17.00	16.00	low	low	low
	144	debris accum.	8	9.00	8.00	low	low	low
	145	log wind. w deb.	18	21.00	19.00	low	mod.	low
	146	instream veg.	25	29.00	26.00	mod.	mod.	mod.
	147	instream veg.	18	21.00	19.00	low	mod.	low
	148	tree wind. w deb.	10	12.00	11.00	low	low	low
	149	instream veg.	20	23.00	21.00	mod.	mod.	mod.
	150	instream veg.	7	8.00	7.00	low	low	low
	151	instream veg.	2	2.00	2.00	low	low	low
	152	rip rap	13	15.00	14.00	low	low	low
	153	overhang veg.	8	9.00	8.00	low	low	low
	154	instream veg.	8	9.00	8.00	low	low	low
	155	debris accum.	6	7.00	6.00	low	low	low
	156	instream veg.	15	17.00	16.00	low	low	low
	157	instream veg.	6	7.00	6.00	low	low	low
	158	debris scat.	8	9.00	8.00	low	low	low
	159	log wind. w deb.	7	8.00	7.00	low	low	low
	160	instream veg.	3	3.00	3.00	low	low	low

Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
7	161	instream veg.	7	8.00	7.00	low	low	low
	162	log wind. w deb.	8	9.00	8.00	low	low	low
	163	debris accum.	10	11.00	10.00	low	low	low
	164	instream veg.	13	15.00	14.00	low	low	low
	165	log wind. w deb.	11	13.00	12.00	low	low	low
	166	log wind. w deb.	15	17.00	16.00	low	low	low
	167	tree wind. w deb.	10	12.00	11.00	low	low	low
	168	log wind. w deb.	12	15.00	13.00	low	low	low
	169	log wind. w deb.	11	13.00	12.00	low	low	low
	170	log wind. w deb.	19	23.00	20.00	low	mod.	mod.
	171	instream veg.	23	28.00	25.00	mod.	mod.	mod.
	172	instream veg.	16	20.00	17.00	low	mod.	low
	173	log wind. w deb.	26	32.00	28.00	mod.	mod.	mod.
	174	tree wind. w deb.	29	35.00	31.00	mod.	mod.	mod.
	175	log wind. w deb.	14	17.00	15.00	low	low	low
	176	log wind. w deb.	12	15.00	13.00	low	low	low
	177	beaver lodge	18	22.00	19.00	low	mod.	low
	178	instream veg.	32	39.00	34.00	mod.	mod.	mod.
	179	instream veg.	17	21.00	18.00	low	mod.	low
	180	instream veg.	21	26.00	23.00	mod.	mod.	mod.
	181	debris accum.	19	23.00	20.00	low	mod.	mod.
	182	log wind. w deb.	25	30.00	27.00	mod.	mod.	mod.
	183	instream veg.	9	11.00	10.00	low	low	low
	184	log wind. w deb.	25	30.00	27.00	mod.	mod.	mod.
	185	debris accum.	14	17.00	15.00	low	low	low
	186	debris accum.	5	6.00	5.00	low	low	low
	187	debris accum.	8	10.00	9.00	low	low	low
	188	beaver lodge	10	12.00	11.00	low	low	low
	189	log wind. w deb.	15	18.00	16.00	low	low	low
	190	beaver lodge	7	9.00	8.00	low	low	low
	191	log wind. w deb.	12	15.00	13.00	low	low	low
	192	beaver lodge	10	12.00	11.00	low	low	low
	193	rip rap	51	62.00	55.00	high	high	high
	194	instream veg.	16	18.00	17.00	low	low	low
	195	log wind. w deb.	7	8.00	7.00	low	low	low
	196	beaver lodge	10	11.00	10.00	low	low	low
	197	dock/boat	45	52.00	48.00	high	high	high
	198	beaver lodge	5	6.00	5.00	low	low	low
	199	log wind. w deb.	6	7.00	6.00	low	low	low
	200	log wind. w deb.	5	6.00	5.00	low	low	low
	201	log wind. w deb.	7	8.00	7.00	low	low	low
	202	beaver lodge	13	14.00	14.00	low	low	low
	203	bin wall	5	6.00	5.00	low	low	low
	204	tree windfall	17	19.00	18.00	low	low	low



Appendix 4 (continued)  
 Comparison of Measured and Calculated Approach Velocities at Major Cover Sites in the  
 Lower Nechako River During May 23 - June 2, 1989<sup>a</sup>

River Reach	Site No.	Cover Type <sup>b</sup>	Measured Approach Velocity <sup>c</sup> (cm/s)	Calculated Short-Term Approach Velocity <sup>d</sup> (cm/s)	Calculated Long-Term Approach Velocity <sup>d</sup> (cm/s)	Measured Velocity Rating <sup>e</sup>	Calculated Short-Term Velocity Rating <sup>e</sup>	Calculated Long-Term Velocity Rating <sup>e</sup>
	205	beaver lodge	4	4.00	4.00	low	low	low
	206	instream veg.	16	18.00	17.00	low	low	low
	207	concrete	14	16.00	15.00	low	low	low
	208	tree wind. w deb.	10	11.00	10.00	low	low	low
	209	tree wind. w deb.	47	53.00	49.00	high	high	high
7	210	beaver lodge	11	12.00	11.00	low	low	low
	211	debris accum.	6	7.00	6.00	low	low	low
	212	instream veg.	8	9.00	8.00	low	low	low
	213	debris accum.	8	9.00	8.00	low	low	low
	214	debris accum.	11	12.00	11.00	low	low	low
	215	instream veg.	10	11.00	10.00	low	low	low
	216	beaver lodge	7	8.00	7.00	low	low	low
	217	beaver lodge	28	31.00	29.00	mod.	mod.	mod.
	218	beaver lodge	16	19.00	17.00	low	low	low
	219	beaver lodge	11	13.00	12.00	low	low	low
	220	beaver lodge	10	12.00	11.00	low	low	low
	221	overhang veg.	35	41.00	37.00	mod.	high	mod.
	222	instream veg.	23	27.00	24.00	mod.	mod.	mod.
	223	dock/boat	3	3.00	3.00	low	low	low
	224	rip rap	14	16.00	15.00	low	low	low
	226	beaver lodge	22	27.00	24.00	mod.	mod.	mod.
	227	beaver lodge	8	10.00	9.00	low	low	low
	228	beaver lodge	9	11.00	10.00	low	low	low
	229	rip rap	22	27.00	24.00	mod.	mod.	mod.
	230	beaver lodge	11	13.00	12.00	low	low	low
	231	tree wind. w deb.	13	16.00	14.00	low	low	low
	232	tree windfall	15	18.00	16.00	low	low	low
	233	instream veg.	11	13.00	12.00	low	low	low
	234	beaver lodge	8	10.00	9.00	low	low	low
	235	rip rap	15	18.00	16.00	low	low	low
	236	rip rap	31	38.00	34.00	mod.	mod.	mod.
	237	log wind. w deb.	10	12.00	11.00	low	low	low
	238	tree wind. w deb.	19	23.00	21.00	low	mod.	mod.

<sup>a</sup> Excludes point bars and backeddies.

<sup>b</sup> Cover type abbreviations: debris accum. = debris accumulations or jams; log wind. w deb. = log windfall with debris; debris scat. = debris scattered; tree wind. w deb. = tree windfall with debris; overhanging veg. = overhanging vegetation; offshore tree/log = offshore tree or log; dock/boat = dock, boat or float plane; instream veg. = overhanging vegetation with instream vegetation or instream debris cover; and boulder clus. = boulder cluster.

<sup>c</sup> Measured upstream of the cover feature during the May-June, 1989 inventory.

<sup>d</sup> Calculated short-term and long-term approach velocities as per adjustment factors shown in Appendix 2.

## **APPENDIX 5**

**Estimated Change in Chinook Use of Major Cover Sites  
in the Lower Nechako River Based on Hypothetical Changes  
in Short Term and Long Term Approach Velocities**



Appendix 5  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
5	1	debris scat.	5.00	mod.	mod.	4.00	4.00	3.00	3.00
	2	log wind. w deb.	7.00	low	low	0.00	0.00	0.00	0.00
	3	instream veg.	7.50	low	low	0.00	0.00	0.00	0.00
	4	log wind. w deb.	3.00	low	low	0.00	0.00	0.00	0.00
	5	tree wind. w deb.	16.40	mod.	mod.	54.00	54.00	53.00	53.00
	6	instream veg.	10.00	mod.	mod.	4.00	4.00	3.00	3.00
	7	instream veg.	8.00	mod.	mod.	3.00	3.00	2.00	2.00
	8	debris scat.	21.00	mod.	mod.	13.00	13.00	14.00	14.00
	9	instream veg.	26.50	mod.	mod.	6.00	6.00	7.00	7.00
	10	instream veg.	10.00	high	mod.	14.00	4.00	11.00	3.00
	11	debris accum.	27.00	mod.	mod.	13.00	13.00	18.00	18.00
	12	beaver lodge	35.50	low	low	1.00	1.00	1.00	1.00
	13	log wind. w deb.	4.00	mod.	mod.	12.00	12.00	12.00	12.00
	14	instream veg.	12.00	mod.	mod.	4.00	4.00	3.00	3.00
	16	log wind. w deb.	6.40	mod.	low	20.00	0.00	19.00	0.00
	17	tree wind. w deb.	41.00	mod.	mod.	54.00	54.00	134.00	134.00
	18	log wind. w deb.	15.00	low	low	1.00	1.00	1.00	1.00
	20	beaver lodge	22.00	low	low	1.00	1.00	1.00	1.00
	21	instream veg.	15.00	low	low	0.00	0.00	0.00	0.00
	22	debris accum.	5.50	low	low	0.00	0.00	0.00	0.00
	24	offshore tree/log	6.00	high	high	2.00	2.00	2.00	2.00
	26	beaver lodge	10.00	mod.	mod.	9.00	9.00	7.00	7.00
	27	offshore tree/log	7.00	low	low	1.00	1.00	1.00	1.00
	28	beaver lodge	36.00	mod.	mod.	13.00	13.00	24.00	24.00
	29	overhang veg.	8.00	low	low	0.00	0.00	0.00	0.00
	30	log wind. w deb.	11.50	mod.	mod.	35.00	35.00	33.00	33.00
	32	debris accum.	354.00	low	low	1.00	1.00	11.00	11.00
	33	tree windfall	10.00	high	high	60.00	60.00	60.00	60.00
	34	tree wind. w deb.	4.50	high	high	13.00	13.00	11.00	11.00
	35	beaver lodge	6.00	mod.	mod.	5.00	5.00	4.00	4.00
	36	tree wind. w deb.	24.00	mod.	mod.	54.00	54.00	78.00	78.00
	37	beaver lodge	56.00	low	low	1.00	1.00	2.00	2.00
	38	debris accum.	4.00	mod.	mod.	3.00	3.00	3.00	3.00
	39	tree wind. w deb.	6.70	mod.	mod.	24.00	24.00	22.00	22.00
	40	tree wind. w deb.	4.50	mod.	mod.	16.00	16.00	15.00	15.00
	41	beaver lodge	4.00	mod.	low	3.00	0.00	3.00	0.00
	42	tree windfall	7.00	mod.	mod.	21.00	21.00	20.00	20.00
	43	tree windfall	43.00	low	low	1.00	1.00	3.00	3.00
	44	tree wind. w deb.	17.00	mod.	mod.	54.00	54.00	55.00	55.00
	45	beaver lodge	16.50	mod.	mod.	13.00	13.00	11.00	11.00
	46	beaver lodge	18.00	mod.	mod.	13.00	13.00	12.00	12.00
	47	tree windfall	6.00	low	low	0.00	0.00	0.00	0.00
	48	instream veg.	4.00	low	low	0.00	0.00	0.00	0.00
	49	beaver lodge	25.00	low	low	1.00	1.00	1.00	1.00
	50	beaver lodge	26.00	low	low	1.00	1.00	1.00	1.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	51	overhang veg.	6.00	mod.	mod.	2.00	2.00	2.00	2.00
	52	beaver lodge	7.70	high	high	17.00	17.00	14.00	14.00
	53	debris accum.	4.50	low	low	0.00	0.00	0.00	0.00
	54	beaver lodge	30.00	low	low	1.00	1.00	1.00	1.00
	55	instream veg.	4.30	mod.	mod.	2.00	2.00	1.00	1.00
	56	beaver lodge	28.00	low	low	1.00	1.00	1.00	1.00
	57	beaver lodge	2.50	low	low	0.00	0.00	0.00	0.00
	59	overhang veg.	4.00	high	high	6.00	6.00	4.00	4.00
	60	debris scat.	2.50	mod.	mod.	2.00	2.00	2.00	2.00
	61	instream veg.	2.00	mod.	mod.	1.00	1.00	1.00	1.00
	62	tree windfall	2.00	mod.	mod.	6.00	6.00	6.00	6.00
	63	debris accum.	5.00	mod.	mod.	4.00	4.00	3.00	3.00
	64	beaver lodge	12.00	mod.	mod.	10.00	10.00	8.00	8.00
	65	debris accum.	7.30	low	low	0.00	0.00	0.00	0.00
	66	instream veg.	18.00	mod.	mod.	6.00	6.00	5.00	5.00
	67	instream veg.	7.00	low	low	0.00	0.00	0.00	0.00
	68	beaver lodge	20.00	low	low	1.00	1.00	1.00	1.00
	69	instream veg.	11.00	mod.	mod.	4.00	4.00	3.00	3.00
	70	instream veg.	3.50	mod.	mod.	1.00	1.00	1.00	1.00
	71	instream veg.	9.00	mod.	mod.	3.00	3.00	2.00	2.00
	72	tree windfall	13.00	mod.	mod.	40.00	40.00	38.00	38.00
	73	instream veg.	7.00	mod.	mod.	3.00	3.00	2.00	2.00
	74	debris accum.	3.00	mod.	mod.	3.00	3.00	2.00	2.00
	75	instream veg.	5.50	low	low	0.00	0.00	0.00	0.00
	76	beaver lodge	21.50	low	low	1.00	1.00	1.00	1.00
	77	log wind. w deb.	1.80	mod.	mod.	5.00	5.00	5.00	5.00
	78	beaver lodge	20.00	low	low	1.00	1.00	1.00	1.00
	79	tree wind. w deb.	6.50	low	low	2.00	2.00	2.00	2.00
	80	overhang veg.	11.00	mod.	mod.	4.00	4.00	3.00	3.00
	81	beaver lodge	4.50	mod.	mod.	4.00	4.00	3.00	3.00
	82	beaver lodge	3.00	mod.	mod.	3.00	3.00	2.00	2.00
	83	log wind. w deb.	15.00	mod.	mod.	46.00	46.00	44.00	44.00
	85	beaver lodge	21.00	low	low	1.00	1.00	1.00	1.00
	86	tree wind. w deb.	73.50	mod.	mod.	54.00	54.00	240.00	240.00
	88	beaver lodge	20.00	low	low	1.00	1.00	1.00	1.00
	89	overhang veg.	73.00	mod.	mod.	6.00	6.00	18.00	18.00
	90	log wind. w deb.	41.00	low	low	1.00	1.00	3.00	3.00
	92	debris accum.	15.00	low	low	1.00	1.00	0.00	0.00
	93	tree windfall	10.00	mod.	mod.	31.00	31.00	29.00	29.00
	94	beaver lodge	35.00	mod.	mod.	13.00	13.00	23.00	23.00
	95	log wind. w deb.	7.30	mod.	mod.	22.00	22.00	21.00	21.00
	96	tree windfall	20.00	mod.	mod.	46.00	46.00	58.00	58.00
	97	beaver lodge	29.00	mod.	mod.	13.00	13.00	19.00	19.00
	99	log wind. w deb.	2.80	mod.	mod.	9.00	9.00	8.00	8.00
	100	log wind. w deb.	5.00	low	low	0.00	0.00	0.00	0.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	101	tree wind. w deb.	8.00	mod.	mod.	29.00	29.00	26.00	26.00
	102	beaver lodge	10.20	low	low	1.00	1.00	0.00	0.00
	103	debris accum.	9.00	mod.	mod.	8.00	8.00	6.00	6.00
	104	instream veg.	4.00	low	low	0.00	0.00	0.00	0.00
	105	beaver lodge	47.00	high	mod.	33.00	13.00	86.00	31.00
	106	tree windfall	9.00	low	low	1.00	1.00	1.00	1.00
	107	beaver lodge	5.40	mod.	mod.	5.00	5.00	4.00	4.00
	108	tree windfall	5.00	low	low	0.00	0.00	0.00	0.00
	109	instream veg.	6.80	mod.	mod.	3.00	3.00	2.00	2.00
	110	overhang veg.	3.50	mod.	mod.	1.00	1.00	1.00	1.00
	111	beaver lodge	28.00	mod.	mod.	13.00	13.00	19.00	19.00
	112	instream veg.	4.50	low	low	0.00	0.00	0.00	0.00
	113	log wind. w deb.	7.00	low	low	0.00	0.00	0.00	0.00
	114	tree wind. w deb.	10.50	low	low	3.00	3.00	3.00	3.00
	115	beaver lodge	28.00	mod.	mod.	13.00	13.00	19.00	19.00
	116	log wind. w deb.	5.00	low	low	0.00	0.00	0.00	0.00
	117	tree windfall	5.00	low	low	0.00	0.00	0.00	0.00
	118	instream veg.	9.00	low	low	0.00	0.00	0.00	0.00
	119	beaver lodge	31.50	low	low	1.00	1.00	1.00	1.00
	120	instream veg.	12.00	low	low	0.00	0.00	0.00	0.00
	121	debris accum.	6.00	low	low	0.00	0.00	0.00	0.00
	122	log wind. w deb.	8.20	mod.	mod.	25.00	25.00	24.00	24.00
	123	tree wind. w deb.	13.50	high	high	40.00	40.00	32.00	32.00
	124	beaver lodge	17.50	mod.	mod.	13.00	13.00	12.00	12.00
	125	log wind. w deb.	9.00	high	high	54.00	54.00	54.00	54.00
	126	tree wind. w deb.	25.00	high	high	44.00	44.00	59.00	59.00
	127	tree windfall	11.00	mod.	mod.	34.00	34.00	32.00	32.00
	128	tree windfall	4.00	mod.	low	12.00	0.00	12.00	0.00
	129	tree wind. w deb.	7.50	mod.	low	27.00	2.00	24.00	2.00
	130	beaver lodge	17.00	low	low	1.00	1.00	1.00	1.00
	131	tree wind. w deb.	5.00	low	low	1.00	1.00	1.00	1.00
	132	beaver lodge	12.80	low	low	1.00	1.00	0.00	0.00
	133	beaver lodge	25.00	mod.	mod.	13.00	13.00	17.00	17.00
	134	instream veg.	7.00	low	low	0.00	0.00	0.00	0.00
	135	log wind. w deb.	2.70	low	low	0.00	0.00	0.00	0.00
	136	beaver lodge	11.00	mod.	mod.	9.00	9.00	7.00	7.00
	137	beaver lodge	7.00	mod.	mod.	6.00	6.00	5.00	5.00
	138	debris accum.	14.00	mod.	mod.	12.00	12.00	9.00	9.00
	139	log wind. w deb.	5.00	low	low	0.00	0.00	0.00	0.00
	140	log wind. w deb.	5.00	mod.	mod.	15.00	15.00	15.00	15.00
	141	tree wind. w deb.	18.40	mod.	mod.	54.00	54.00	60.00	60.00
	142	beaver lodge	19.00	mod.	mod.	13.00	13.00	13.00	13.00
	143	instream veg.	7.50	mod.	mod.	3.00	3.00	2.00	2.00
	144	overhang veg.	14.00	mod.	mod.	5.00	5.00	4.00	4.00
	145	beaver lodge	15.00	mod.	mod.	13.00	13.00	10.00	10.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	146	beaver lodge	20.50	mod.	mod.	13.00	13.00	14.00	14.00
	147	debris accum.	33.00	low	low	1.00	1.00	1.00	1.00
	148	dock/boat	4.50	high	mod.	31.00	2.00	21.00	2.00
	150	tree windfall	9.50	high	high	57.00	57.00	57.00	57.00
	152	debris accum.	140.00	low	low	1.00	1.00	4.00	4.00
	153	beaver lodge	15.00	low	low	1.00	1.00	0.00	0.00
	154	debris accum.	14.00	low	low	1.00	1.00	0.00	0.00
	155	debris accum.	36.00	low	low	1.00	1.00	1.00	1.00
	156	tree wind. w deb.	51.00	mod.	mod.	54.00	54.00	166.00	166.00
	157	tree wind. w deb.	3.00	mod.	mod.	11.00	11.00	10.00	10.00
	158	tree wind. w deb.	33.00	low	low	4.00	4.00	9.00	9.00
	159	log wind. w deb.	21.30	high	high	90.00	90.00	128.00	128.00
	160	instream veg.	11.50	low	low	0.00	0.00	0.00	0.00
	161	log wind. w deb.	8.40	low	low	1.00	1.00	1.00	1.00
	162	instream veg.	8.00	low	low	0.00	0.00	0.00	0.00
	163	beaver lodge	26.00	low	low	1.00	1.00	1.00	1.00
	164	debris accum.	53.00	high	high	33.00	33.00	98.00	98.00
	165	tree wind. w deb.	10.00	high	high	30.00	30.00	24.00	24.00
	166	tree wind. w deb.	9.50	high	high	28.00	28.00	22.00	22.00
	167	instream veg.	12.50	high	high	18.00	18.00	14.00	14.00
	168	beaver lodge	2.90	low	low	0.00	0.00	0.00	0.00
	169	debris accum.	24.00	mod.	mod.	13.00	13.00	16.00	16.00
	170	tree wind. w deb.	4.00	mod.	mod.	14.00	14.00	13.00	13.00
	171	debris accum.	37.00	mod.	mod.	13.00	13.00	25.00	25.00
	172	cutbank	16.00	high	high	9.00	9.00	7.00	7.00
	173	debris scat.	8.00	high	high	18.00	18.00	15.00	15.00
	174	tree wind. w deb.	4.80	low	low	1.00	1.00	1.00	1.00
	175	tree wind. w deb.	5.00	low	low	1.00	1.00	1.00	1.00
	176	tree wind. w deb.	19.00	high	high	44.00	44.00	45.00	45.00
	177	instream veg.	27.50	low	low	0.00	0.00	0.00	0.00
	178	debris accum.	5.00	mod.	mod.	4.00	4.00	3.00	3.00
	179	tree wind. w deb.	30.50	mod.	mod.	54.00	54.00	99.00	99.00
	180	instream veg.	18.00	mod.	mod.	6.00	6.00	5.00	5.00
	181	instream veg.	17.00	low	low	0.00	0.00	0.00	0.00
	182	debris accum.	2.40	mod.	mod.	2.00	2.00	2.00	2.00
	183	debris accum.	20.50	low	low	1.00	1.00	1.00	1.00
	184	offshore tree/log	5.00	low	low	0.00	0.00	0.00	0.00
	185	debris accum.	30.00	mod.	mod.	13.00	13.00	20.00	20.00
	186	beaver lodge	26.00	low	low	1.00	1.00	1.00	1.00
	187	beaver lodge	22.00	high	high	33.00	33.00	40.00	40.00
	188	tree wind. w deb.	11.50	low	low	3.00	3.00	3.00	3.00
	189	debris accum.	7.00	mod.	mod.	6.00	6.00	5.00	5.00
	190	tree wind. w deb.	20.00	mod.	mod.	54.00	54.00	65.00	65.00
	191	instream veg.	73.00	low	low	0.00	0.00	1.00	1.00
	192	beaver lodge	21.00	mod.	mod.	13.00	13.00	14.00	14.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	193	instream veg.	11.00	low	low	0.00	0.00	0.00	0.00
	194	instream veg.	3.50	mod.	mod.	1.00	1.00	1.00	1.00
	195	tree wind. w deb.	12.50	mod.	mod.	45.00	45.00	41.00	41.00
	196	tree wind. w deb.	6.70	mod.	mod.	24.00	24.00	22.00	22.00
	197	overhang veg.	24.00	high	high	22.00	22.00	27.00	27.00
	198	overhang veg.	112.00	mod.	mod.	6.00	6.00	28.00	28.00
	199	instream veg.	43.00	high	high	22.00	22.00	48.00	48.00
	200	beaver lodge	15.00	mod.	mod.	13.00	13.00	10.00	10.00
	201	instream veg.	68.00	low	low	0.00	0.00	1.00	1.00
	202	beaver lodge	31.00	low	low	1.00	1.00	1.00	1.00
	203	tree wind. w deb.	41.00	high	high	44.00	44.00	96.00	96.00
	204	instream veg.	7.00	high	high	10.00	10.00	8.00	8.00
	206	debris accum.	26.00	mod.	mod.	13.00	13.00	17.00	17.00
	207	log wind. w deb.	21.00	low	low	1.00	1.00	1.00	1.00
	208	beaver lodge	34.00	high	high	33.00	33.00	63.00	63.00
	209	log wind. w deb.	8.00	mod.	mod.	24.00	24.00	23.00	23.00
	210	instream veg.	7.00	high	high	10.00	10.00	8.00	8.00
	211	cutbank	8.00	high	high	5.00	5.00	3.00	3.00
SUM						2384.00	2265.00	3152.00	3014.00
6	1	log wind. w deb.	6.20	low	low	0.00	0.00	0.00	0.00
	2	log wind. w deb.	58.40	low	low	1.00	1.00	4.00	4.00
	3	debris accum.	36.00	low	low	1.00	1.00	1.00	1.00
	4	log wind. w deb.	5.50	low	low	0.00	0.00	0.00	0.00
	5	debris accum.	34.00	low	low	1.00	1.00	1.00	1.00
	6	instream veg.	14.00	mod.	mod.	5.00	5.00	4.00	4.00
	7	beaver lodge	19.00	low	low	1.00	1.00	1.00	1.00
	8	instream veg.	130.00	mod.	mod.	6.00	6.00	33.00	33.00
	9	instream veg.	16.00	high	high	22.00	22.00	18.00	18.00
	10	overhang veg.	36.00	low	low	0.00	0.00	0.00	0.00
	11	instream veg.	5.50	low	low	0.00	0.00	0.00	0.00
	12	debris accum.	3.50	low	low	0.00	0.00	0.00	0.00
	13	instream veg.	12.50	mod.	mod.	5.00	5.00	3.00	3.00
	15	debris accum.	19.00	mod.	mod.	13.00	13.00	13.00	13.00
	16	instream veg.	9.00	low	low	0.00	0.00	0.00	0.00
	18	instream veg.	4.00	low	low	0.00	0.00	0.00	0.00
	20	overhang veg.	61.00	mod.	mod.	6.00	6.00	15.00	15.00
	21	tree wind. w deb.	10.00	high	high	30.00	30.00	24.00	24.00
	22	dock/boat	8.00	low	low	0.00	0.00	0.00	0.00
	23	instream veg.	4.60	low	low	0.00	0.00	0.00	0.00
	24	instream veg.	53.00	low	low	0.00	0.00	1.00	1.00
	25	offshore tree/log	9.50	mod.	mod.	3.00	3.00	2.00	2.00
	26	instream veg.	156.00	high	high	22.00	22.00	175.00	175.00
	27	instream veg.	72.00	mod.	mod.	6.00	6.00	18.00	18.00
	28	instream veg.	25.00	mod.	mod.	6.00	6.00	6.00	6.00



Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	29	instream veg.	15.00	mod.	mod.	6.00	6.00	4.00	4.00
	30	log wind. w deb.	5.20	mod.	mod.	16.00	16.00	15.00	15.00
	31	debris scat.	9.00	low	low	1.00	1.00	0.00	0.00
	32	log wind. w deb.	9.50	mod.	mod.	29.00	29.00	28.00	28.00
	33	instream veg.	4.50	low	low	0.00	0.00	0.00	0.00
	34	beaver lodge	10.00	mod.	mod.	9.00	9.00	7.00	7.00
	35	beaver lodge	20.00	low	low	1.00	1.00	1.00	1.00
	36	instream veg.	14.50	mod.	mod.	5.00	5.00	4.00	4.00
	37	instream veg.	80.00	mod.	mod.	6.00	6.00	20.00	20.00
	38	log windfall	25.00	mod.	mod.	46.00	46.00	73.00	73.00
	39	beaver lodge	15.00	mod.	mod.	13.00	13.00	10.00	10.00
	40	instream veg.	46.00	low	low	0.00	0.00	0.00	0.00
	41	log wind. w deb.	15.00	high	high	90.00	90.00	90.00	90.00
	42	instream veg.	8.00	low	low	0.00	0.00	0.00	0.00
	43	overhang veg.	7.50	mod.	mod.	3.00	3.00	2.00	2.00
	44	instream veg.	31.50	mod.	mod.	6.00	6.00	8.00	8.00
	45	instream veg.	24.50	mod.	mod.	6.00	6.00	6.00	6.00
	46	debris accum.	3.00	mod.	mod.	3.00	3.00	2.00	2.00
	47	instream veg.	9.00	high	mod.	13.00	3.00	10.00	2.00
	48	beaver lodge	12.00	mod.	mod.	10.00	10.00	8.00	8.00
	49	instream veg.	38.00	high	high	22.00	22.00	43.00	43.00
	50	instream veg.	14.00	high	high	20.00	20.00	16.00	16.00
	51	instream veg.	67.00	mod.	mod.	6.00	6.00	17.00	17.00
	52	instream veg.	30.00	mod.	mod.	6.00	6.00	8.00	8.00
	53	instream veg.	540.00	mod.	mod.	6.00	6.00	135.00	135.00
	54	log wind. w deb.	16.50	high	high	90.00	90.00	99.00	99.00
	55	log wind. w deb.	7.50	low	low	1.00	1.00	1.00	1.00
	56	instream veg.	4.50	mod.	mod.	2.00	2.00	1.00	1.00
	58	instream veg.	12.00	mod.	mod.	4.00	4.00	3.00	3.00
	59	overhang veg.	11.00	mod.	mod.	4.00	4.00	3.00	3.00
	60	beaver lodge	3.50	mod.	mod.	3.00	3.00	2.00	2.00
	61	instream veg.	16.50	mod.	mod.	6.00	6.00	4.00	4.00
	62	instream veg.	35.00	mod.	mod.	6.00	6.00	9.00	9.00
	63	instream veg.	15.00	mod.	mod.	6.00	6.00	4.00	4.00
	64	log wind. w deb.	15.00	low	low	1.00	1.00	1.00	1.00
	65	instream veg.	6.00	mod.	mod.	2.00	2.00	2.00	2.00
	66	debris accum.	3.00	low	low	0.00	0.00	0.00	0.00
	67	instream veg.	6.00	mod.	mod.	2.00	2.00	2.00	2.00
	68	log wind. w deb.	10.00	low	low	1.00	1.00	1.00	1.00
	69	beaver lodge	31.60	mod.	mod.	13.00	13.00	21.00	21.00
	70	log windfall	23.00	high	high	90.00	90.00	138.00	138.00
	71	overhang veg.	6.00	high	high	9.00	9.00	7.00	7.00
	72	tree wind. w deb.	12.00	mod.	mod.	43.00	43.00	39.00	39.00
	73	beaver lodge	20.00	low	low	1.00	1.00	1.00	1.00
	74	debris accum.	2.50	low	low	0.00	0.00	0.00	0.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	75	beaver lodge	18.00	mod.	mod.	13.00	13.00	12.00	12.00
	76	beaver lodge	24.50	mod.	mod.	13.00	13.00	16.00	16.00
	78	dock/boat	3.50	low	low	0.00	0.00	0.00	0.00
	79	debris accum.	7.00	mod.	mod.	6.00	6.00	5.00	5.00
	80	log wind. w deb.	10.00	mod.	mod.	31.00	31.00	29.00	29.00
	81	dock/boat	16.00	low	low	1.00	1.00	1.00	1.00
	82	offshore tree/log	5.80	mod.	mod.	2.00	2.00	1.00	1.00
	83	debris accum.	3.50	mod.	mod.	3.00	3.00	2.00	2.00
	84	beaver lodge	13.00	high	high	29.00	29.00	24.00	24.00
	85	beaver lodge	9.00	low	low	1.00	1.00	0.00	0.00
	86	instream veg.	4.00	low	low	0.00	0.00	0.00	0.00
	87	dock/boat	16.80	mod.	mod.	6.00	6.00	7.00	7.00
	88	beaver lodge	6.00	low	low	0.00	0.00	0.00	0.00
	89	debris accum.	4.20	mod.	mod.	4.00	4.00	3.00	3.00
	90	offshore tree/log	4.00	mod.	mod.	1.00	1.00	1.00	1.00
	91	beaver lodge	4.50	mod.	mod.	4.00	4.00	3.00	3.00
	92	beaver lodge	4.00	low	low	0.00	0.00	0.00	0.00
	93	tree wind. w deb.	3.50	high	high	10.00	10.00	8.00	8.00
	94	tree wind. w deb.	19.20	high	high	44.00	44.00	45.00	45.00
	95	tree wind. w deb.	6.50	mod.	mod.	24.00	24.00	21.00	21.00
	96	tree wind. w deb.	5.50	mod.	mod.	20.00	20.00	18.00	18.00
	97	beaver lodge	23.00	high	high	33.00	33.00	42.00	42.00
	98	instream veg.	7.00	mod.	mod.	3.00	3.00	2.00	2.00
	99	tree wind. w deb.	11.50	high	high	34.00	34.00	27.00	27.00
	100	tree wind. w deb.	54.00	high	high	44.00	44.00	127.00	127.00
	101	overhang veg.	60.00	high	high	22.00	22.00	67.00	67.00
	102	overhang veg.	121.00	high	high	22.00	22.00	136.00	136.00
	103	beaver lodge	23.50	high	high	33.00	33.00	43.00	43.00
	104	beaver lodge	60.00	mod.	mod.	13.00	13.00	40.00	40.00
	105	overhang veg.	36.00	high	high	22.00	22.00	40.00	40.00
	106	beaver lodge	36.00	low	low	1.00	1.00	1.00	1.00
	107	overhang veg.	40.00	low	low	0.00	0.00	0.00	0.00
	108	overhang veg.	171.00	low	low	0.00	0.00	2.00	2.00
	109	overhang veg.	160.00	low	low	0.00	0.00	2.00	2.00
	110	debris accum.	33.00	high	high	33.00	33.00	61.00	61.00
	111	overhang veg.	50.00	low	low	0.00	0.00	1.00	1.00
	112	beaver lodge	4.00	low	low	0.00	0.00	0.00	0.00
	113	beaver lodge	8.00	low	low	0.00	0.00	0.00	0.00
	114	beaver lodge	2.50	low	low	0.00	0.00	0.00	0.00
	115	beaver lodge	17.00	low	low	1.00	1.00	1.00	1.00
	116	beaver lodge	18.00	mod.	mod.	13.00	13.00	12.00	12.00
	117	beaver lodge	63.00	mod.	mod.	13.00	13.00	42.00	42.00
	118	instream veg.	37.30	high	high	22.00	22.00	42.00	42.00
	119	offshore tree/log	4.40	mod.	mod.	2.00	2.00	1.00	1.00
	120	beaver lodge	8.00	low	low	0.00	0.00	0.00	0.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	121	dock/boat	7.20	low	low	0.00	0.00	0.00	0.00
	122	concrete	65.00	mod.	mod.	1.00	1.00	3.00	3.00
	123	concrete	45.00	high	high	1.00	1.00	2.00	2.00
	124	car	78.00	low	low	0.00	0.00	1.00	1.00
	125	car	8.00	mod.	mod.	1.00	1.00	0.00	0.00
	126	car	23.00	mod.	mod.	1.00	1.00	1.00	1.00
	127	beaver lodge	23.00	mod.	mod.	13.00	13.00	15.00	15.00
	128	overhang veg.	36.00	high	high	22.00	22.00	40.00	40.00
	129	overhang veg.	90.00	mod.	mod.	6.00	6.00	23.00	23.00
	130	debris accum.	8.00	high	high	18.00	18.00	15.00	15.00
	131	beaver lodge	5.00	mod.	mod.	4.00	4.00	3.00	3.00
	132	overhang veg.	32.00	high	high	22.00	22.00	36.00	36.00
	133	beaver lodge	11.50	high	high	25.00	25.00	21.00	21.00
	134	beaver lodge	6.00	mod.	mod.	5.00	5.00	4.00	4.00
	135	instream veg.	84.00	mod.	mod.	6.00	6.00	21.00	21.00
	136	overhang veg.	53.00	low	low	0.00	0.00	1.00	1.00
	137	instream veg.	29.00	high	high	22.00	22.00	32.00	32.00
	138	overhang veg.	60.00	high	high	22.00	22.00	67.00	67.00
	139	overhang veg.	210.00	high	high	22.00	22.00	235.00	235.00
	140	beaver lodge	30.00	high	high	33.00	33.00	55.00	55.00
	141	instream veg.	3.50	mod.	mod.	1.00	1.00	1.00	1.00
	142	instream veg.	57.00	high	high	22.00	22.00	64.00	64.00
	143	overhang veg.	45.00	high	high	22.00	22.00	50.00	50.00
	144	overhang veg.	80.00	high	high	22.00	22.00	90.00	90.00
	145	instream veg.	4.00	low	low	0.00	0.00	0.00	0.00
	146	overhang veg.	30.00	mod.	mod.	6.00	6.00	8.00	8.00
	147	overhang veg.	42.00	high	high	22.00	22.00	47.00	47.00
	148	overhang veg.	12.00	high	high	17.00	17.00	13.00	13.00
	149	instream veg.	13.20	high	high	19.00	19.00	15.00	15.00
	150	overhang veg.	16.00	mod.	mod.	6.00	6.00	4.00	4.00
	151	instream veg.	23.50	low	low	0.00	0.00	0.00	0.00
	152	cutbank	26.00	high	high	9.00	9.00	11.00	11.00
	153	overhang veg.	27.00	low	low	0.00	0.00	0.00	0.00
	154	overhang veg.	45.00	mod.	mod.	6.00	6.00	11.00	11.00
	155	beaver lodge	10.00	mod.	mod.	9.00	9.00	7.00	7.00
	156	overhang veg.	23.00	mod.	mod.	6.00	6.00	6.00	6.00
	157	instream veg.	74.00	mod.	mod.	6.00	6.00	19.00	19.00
	158	beaver lodge	4.00	mod.	mod.	3.00	3.00	3.00	3.00
	159	beaver lodge	72.00	high	high	33.00	33.00	132.00	132.00
	160	beaver lodge	55.00	mod.	mod.	13.00	13.00	37.00	37.00
	161	beaver lodge	27.00	mod.	mod.	13.00	13.00	18.00	18.00
	162	beaver lodge	24.00	mod.	mod.	13.00	13.00	16.00	16.00
	163	concrete	3.00	mod.	high	0.00	0.00	0.00	0.00
	164	beaver lodge	7.00	high	high	15.00	15.00	13.00	13.00
	165	concrete	18.00	high	high	1.00	1.00	1.00	1.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	166	debris accum.	5.00	low	low	0.00	0.00	0.00	0.00
	167	dock/boat	14.00	low	low	1.00	1.00	1.00	1.00
	168	dock/boat	17.00	low	low	1.00	1.00	1.00	1.00
	169	dock/boat	10.00	low	low	1.00	1.00	1.00	1.00
	170	dock/boat	27.00	mod.	mod.	6.00	6.00	11.00	11.00
	171	dock/boat	29.00	mod.	mod.	6.00	6.00	12.00	12.00
	172	dock/boat	24.00	mod.	mod.	6.00	6.00	10.00	10.00
	173	dock/boat	30.00	mod.	mod.	6.00	6.00	12.00	12.00
	174	dock/boat	15.00	low	low	1.00	1.00	1.00	1.00
SUM						1774.00	1764.00	3239.00	3231.00
7	1	log wind. w deb.	6.00	mod.	mod.	18.00	18.00	17.00	17.00
	2	dock/boat	27.40	mod.	low	6.00	1.00	11.00	1.00
	3	beaver lodge	25.00	low	low	1.00	1.00	1.00	1.00
	4	dock/boat	11.00	low	low	1.00	1.00	1.00	1.00
	5	dock/boat	31.00	mod.	mod.	6.00	6.00	12.00	12.00
	6	debris accum.	10.00	mod.	mod.	9.00	9.00	7.00	7.00
	7	instream veg.	5.00	mod.	mod.	2.00	2.00	1.00	1.00
	8	beaver lodge	12.50	mod.	mod.	11.00	11.00	8.00	8.00
	9	debris accum.	4.50	low	low	0.00	0.00	0.00	0.00
	10	rip rap	180.00	low	low	0.00	0.00	2.00	2.00
	11	beaver lodge	17.00	low	low	1.00	1.00	1.00	1.00
	12	rip rap	1000.00	low	low	0.00	0.00	10.00	10.00
	13	beaver lodge	20.50	low	low	1.00	1.00	1.00	1.00
	14	instream veg.	9.00	mod.	mod.	3.00	3.00	2.00	2.00
	15	dock/boat	36.50	high	high	103.00	103.00	167.00	167.00
	17	log wind. w deb.	9.00	mod.	mod.	27.00	27.00	26.00	26.00
	18	debris accum.	5.00	low	low	0.00	0.00	0.00	0.00
	19	debris accum.	5.00	low	low	0.00	0.00	0.00	0.00
	20	beaver lodge	31.40	low	low	1.00	1.00	1.00	1.00
	21	log wind. w deb.	4.50	mod.	mod.	14.00	14.00	13.00	13.00
	22	dock/boat	31.40	low	low	1.00	1.00	2.00	2.00
	23	dock/boat	32.20	low	low	1.00	1.00	2.00	2.00
	24	dock/boat	18.00	low	low	1.00	1.00	1.00	1.00
	25	dock/boat	8.40	low	low	1.00	1.00	0.00	0.00
	26	overhang veg.	20.00	low	low	0.00	0.00	0.00	0.00
	27	instream veg.	10.00	low	low	0.00	0.00	0.00	0.00
	28	instream veg.	23.00	low	low	0.00	0.00	0.00	0.00
	29	log wind. w deb.	14.90	low	low	1.00	1.00	1.00	1.00
	30	log wind. w deb.	4.20	mod.	mod.	13.00	13.00	12.00	12.00
	31	dock/boat	19.00	low	low	1.00	1.00	1.00	1.00
	32	dock/boat	28.40	low	low	1.00	1.00	1.00	1.00
	33	log wind. w deb.	3.50	mod.	mod.	11.00	11.00	10.00	10.00
	34	instream veg.	3.50	mod.	mod.	1.00	1.00	1.00	1.00
	35	tree wind. w deb.	11.00	mod.	low	40.00	3.00	36.00	3.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	36	tree wind. w deb.	4.50	low	low	1.00	1.00	1.00	1.00
	37	tree wind. w deb.	6.50	mod.	mod.	24.00	24.00	21.00	21.00
	38	tree wind. w deb.	8.50	mod.	mod.	31.00	31.00	28.00	28.00
	39	tree wind. w deb.	11.00	mod.	mod.	40.00	40.00	36.00	36.00
	40	instream veg.	6.00	mod.	mod.	2.00	2.00	2.00	2.00
	41	instream veg.	10.00	mod.	mod.	4.00	4.00	3.00	3.00
	42	instream veg.	15.00	low	low	0.00	0.00	0.00	0.00
	43	log wind. w deb.	8.50	mod.	mod.	26.00	26.00	25.00	25.00
	44	log wind. w deb.	6.10	mod.	mod.	19.00	19.00	18.00	18.00
	45	log wind. w deb.	5.20	mod.	mod.	16.00	16.00	15.00	15.00
	46	debris accum.	14.00	mod.	mod.	12.00	12.00	9.00	9.00
	47	log wind. w deb.	4.20	low	low	0.00	0.00	0.00	0.00
	48	debris accum.	3.00	low	low	0.00	0.00	0.00	0.00
	49	beaver lodge	14.50	mod.	low	12.00	1.00	10.00	0.00
	50	beaver lodge	18.00	mod.	low	13.00	1.00	12.00	1.00
	51	debris accum.	5.00	low	low	0.00	0.00	0.00	0.00
	52	debris accum.	9.00	low	low	1.00	1.00	0.00	0.00
	53	rip rap	10.00	low	low	0.00	0.00	0.00	0.00
	54	rip rap	200.00	low	low	0.00	0.00	2.00	2.00
	55	rip rap	200.00	low	low	0.00	0.00	2.00	2.00
	56	beaver lodge	18.00	mod.	mod.	13.00	13.00	12.00	12.00
	57	debris accum.	4.30	low	low	0.00	0.00	0.00	0.00
	58	debris accum.	3.00	mod.	mod.	3.00	3.00	2.00	2.00
	59	tree wind. w deb.	5.00	mod.	mod.	18.00	18.00	16.00	16.00
	60	tree wind. w deb.	9.00	mod.	mod.	33.00	33.00	29.00	29.00
	61	beaver lodge	10.00	low	low	1.00	1.00	0.00	0.00
	62	log wind. w deb.	3.60	mod.	mod.	11.00	11.00	10.00	10.00
	63	overhang veg.	3.00	mod.	mod.	1.00	1.00	1.00	1.00
	64	instream veg.	15.00	low	low	0.00	0.00	0.00	0.00
	65	instream veg.	30.00	mod.	mod.	6.00	6.00	8.00	8.00
	66	instream veg.	44.00	mod.	mod.	6.00	6.00	11.00	11.00
	67	beaver lodge	27.00	low	low	1.00	1.00	1.00	1.00
	68	debris accum.	74.00	low	low	1.00	1.00	2.00	2.00
	69	debris scat.	10.00	low	low	1.00	1.00	0.00	0.00
	70	debris scat.	19.00	low	low	1.00	1.00	1.00	1.00
	71	cutbank	68.00	low	low	0.00	0.00	0.00	0.00
	72	beaver lodge	47.00	low	low	1.00	1.00	1.00	1.00
	73	instream veg.	8.00	low	low	0.00	0.00	0.00	0.00
	74	instream veg.	7.00	low	low	0.00	0.00	0.00	0.00
	75	instream veg.	48.00	low	low	0.00	0.00	0.00	0.00
	76	instream veg.	150.00	low	low	0.00	0.00	2.00	2.00
	77	log wind. w deb.	10.40	mod.	mod.	32.00	32.00	30.00	30.00
	78	instream veg.	320.00	mod.	mod.	6.00	6.00	80.00	80.00
	79	instream veg.	216.00	low	low	0.00	0.00	2.00	2.00
	80	rip rap	600.00	high	high	1.00	1.00	24.00	24.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	81	beaver lodge	18.60	mod.	mod.	13.00	13.00	12.00	12.00
	82	tree wind. w deb.	6.00	mod.	mod.	22.00	22.00	20.00	20.00
	83	tree wind. w deb.	6.00	mod.	mod.	22.00	22.00	20.00	20.00
	84	tree wind. w deb.	4.00	low	low	1.00	1.00	1.00	1.00
	85	tree wind. w deb.	3.50	low	low	1.00	1.00	1.00	1.00
	86	tree wind. w deb.	17.50	low	low	4.00	4.00	5.00	5.00
	87	tree windfall	9.50	low	low	1.00	1.00	1.00	1.00
	88	beaver lodge	23.00	low	low	1.00	1.00	1.00	1.00
	89	rip rap	40.00	mod.	mod.	1.00	1.00	2.00	2.00
	90	rip rap	300.00	mod.	low	1.00	1.00	12.00	3.00
	91	tree wind. w deb.	6.00	mod.	mod.	22.00	22.00	20.00	20.00
	92	beaver lodge	26.00	low	low	1.00	1.00	1.00	1.00
	93	tree wind. w deb.	10.00	mod.	mod.	36.00	36.00	33.00	33.00
	94	tree windfall	5.00	low	low	0.00	0.00	0.00	0.00
	95	beaver lodge	3.00	low	low	0.00	0.00	0.00	0.00
	96	tree wind. w deb.	4.00	mod.	mod.	14.00	14.00	13.00	13.00
	97	instream veg.	14.50	mod.	mod.	5.00	5.00	4.00	4.00
	98	log wind. w deb.	12.00	mod.	mod.	37.00	37.00	35.00	35.00
	99	beaver lodge	4.00	mod.	mod.	3.00	3.00	3.00	3.00
	100	beaver lodge	12.00	high	mod.	27.00	10.00	22.00	8.00
	101	beaver lodge	28.00	low	low	1.00	1.00	1.00	1.00
	102	beaver lodge	14.50	low	low	1.00	1.00	0.00	0.00
	103	dock/boat	107.00	mod.	mod.	6.00	6.00	43.00	43.00
	104	dock/boat	9.00	low	low	1.00	1.00	0.00	0.00
	105	dock/boat	7.50	low	low	0.00	0.00	0.00	0.00
	106	dock/boat	22.00	low	low	1.00	1.00	1.00	1.00
	107	tree wind. w deb.	4.00	low	low	1.00	1.00	1.00	1.00
	108	debris accum.	6.00	mod.	low	5.00	0.00	4.00	0.00
	109	offshore tree/log	15.00	mod.	mod.	5.00	5.00	3.00	3.00
	110	beaver lodge	39.50	mod.	mod.	13.00	13.00	26.00	26.00
	111	tree wind. w deb.	4.50	mod.	mod.	16.00	16.00	15.00	15.00
	112	tree windfall	7.00	mod.	mod.	21.00	21.00	20.00	20.00
	113	beaver lodge	10.50	low	low	1.00	1.00	0.00	0.00
	114	beaver lodge	17.00	low	low	1.00	1.00	1.00	1.00
	115	beaver lodge	21.00	mod.	mod.	13.00	13.00	14.00	14.00
	116	dock/boat	43.50	low	low	1.00	1.00	2.00	2.00
	117	tree wind. w deb.	7.00	low	low	2.00	2.00	2.00	2.00
	118	log wind. w deb.	19.80	low	low	1.00	1.00	1.00	1.00
	119	tree wind. w deb.	3.50	low	low	1.00	1.00	1.00	1.00
	120	instream veg.	7.00	low	low	0.00	0.00	0.00	0.00
	121	log wind. w deb.	7.50	low	low	1.00	1.00	1.00	1.00
	122	debris accum.	5.80	low	low	0.00	0.00	0.00	0.00
	123	tree windfall	7.00	low	low	0.00	0.00	0.00	0.00
	124	beaver lodge	17.50	low	low	1.00	1.00	1.00	1.00
	125	beaver lodge	6.50	mod.	mod.	6.00	6.00	4.00	4.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	126	instream veg.	40.00	mod.	low	6.00	0.00	10.00	0.00
	127	instream veg.	81.00	low	low	0.00	0.00	1.00	1.00
	128	rip rap	60.00	low	low	0.00	0.00	1.00	1.00
	129	instream veg.	60.00	mod.	low	6.00	0.00	15.00	1.00
	130	instream veg.	28.00	mod.	low	6.00	0.00	7.00	0.00
	131	beaver lodge	5.00	mod.	mod.	4.00	4.00	3.00	3.00
	132	dock/boat	19.20	low	low	1.00	1.00	1.00	1.00
	133	log wind. w deb.	23.00	low	low	1.00	1.00	2.00	2.00
	134	dock/boat	9.00	mod.	mod.	4.00	4.00	4.00	4.00
	135	debris accum.	7.00	low	low	0.00	0.00	0.00	0.00
	136	tree windfall	5.00	mod.	mod.	15.00	15.00	15.00	15.00
	137	cutbank	31.00	low	low	0.00	0.00	0.00	0.00
	138	instream veg.	20.50	low	low	0.00	0.00	0.00	0.00
	139	instream veg.	34.00	low	low	0.00	0.00	0.00	0.00
	140	beaver lodge	9.00	low	low	1.00	1.00	0.00	0.00
	141	instream veg.	16.50	low	low	0.00	0.00	0.00	0.00
	142	instream veg.	37.00	low	low	0.00	0.00	0.00	0.00
	143	beaver lodge	15.00	low	low	1.00	1.00	0.00	0.00
	144	debris accum.	9.00	low	low	1.00	1.00	0.00	0.00
	145	log wind. w deb.	13.00	mod.	low	40.00	1.00	38.00	1.00
	146	instream veg.	124.00	mod.	mod.	6.00	6.00	31.00	31.00
	147	instream veg.	6.50	mod.	low	2.00	0.00	2.00	0.00
	148	tree wind. w deb.	7.50	low	low	2.00	2.00	2.00	2.00
	149	instream veg.	46.00	mod.	mod.	6.00	6.00	12.00	12.00
	150	instream veg.	15.00	low	low	0.00	0.00	0.00	0.00
	151	instream veg.	5.00	low	low	0.00	0.00	0.00	0.00
	152	rip rap	500.00	low	low	0.00	0.00	5.00	5.00
	153	overhang veg.	24.00	low	low	0.00	0.00	0.00	0.00
	154	instream veg.	150.00	low	low	0.00	0.00	2.00	2.00
	155	debris accum.	4.50	low	low	0.00	0.00	0.00	0.00
	156	instream veg.	65.50	low	low	0.00	0.00	1.00	1.00
	157	instream veg.	13.00	low	low	0.00	0.00	0.00	0.00
	158	debris accum.	8.50	low	low	1.00	1.00	0.00	0.00
	159	log wind. w deb.	7.00	low	low	0.00	0.00	0.00	0.00
	160	instream veg.	19.00	low	low	0.00	0.00	0.00	0.00
	161	instream veg.	16.00	low	low	0.00	0.00	0.00	0.00
	162	log wind. w deb.	4.00	low	low	0.00	0.00	0.00	0.00
	163	debris accum.	3.00	low	low	0.00	0.00	0.00	0.00
	164	instream veg.	6.00	low	low	0.00	0.00	0.00	0.00
	165	log wind. w deb.	8.50	low	low	1.00	1.00	1.00	1.00
	166	log wind. w deb.	2.50	low	low	0.00	0.00	0.00	0.00
	167	tree wind. w deb.	15.60	low	low	4.00	4.00	4.00	4.00
	168	log wind. w deb.	5.00	low	low	0.00	0.00	0.00	0.00
	169	log wind. w deb.	3.00	low	low	0.00	0.00	0.00	0.00
	170	log wind. w deb.	11.00	mod.	mod.	34.00	34.00	32.00	32.00

Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	171	instream veg.	14.30	mod.	mod.	5.00	5.00	4.00	4.00
	172	instream veg.	16.00	mod.	low	6.00	0.00	4.00	0.00
	173	log wind. w deb.	6.50	mod.	mod.	20.00	20.00	19.00	19.00
	174	tree wind. w deb.	18.00	mod.	mod.	54.00	54.00	59.00	59.00
	175	log wind. w deb.	7.00	low	low	0.00	0.00	0.00	0.00
	176	log wind. w deb.	5.00	low	low	0.00	0.00	0.00	0.00
	177	beaver lodge	18.80	mod.	low	13.00	1.00	13.00	1.00
	178	instream veg.	5.00	mod.	mod.	2.00	2.00	1.00	1.00
	179	instream veg.	17.00	mod.	low	6.00	0.00	4.00	0.00
	180	instream veg.	5.00	mod.	mod.	2.00	2.00	1.00	1.00
	181	debris accum.	3.00	mod.	mod.	3.00	3.00	2.00	2.00
	182	log wind. w deb.	5.80	mod.	mod.	18.00	18.00	17.00	17.00
	183	instream veg.	4.00	low	low	0.00	0.00	0.00	0.00
	184	log wind. w deb.	4.20	mod.	mod.	13.00	13.00	12.00	12.00
	185	debris accum.	3.00	low	low	0.00	0.00	0.00	0.00
	186	debris accum.	3.50	low	low	0.00	0.00	0.00	0.00
	187	debris accum.	4.50	low	low	0.00	0.00	0.00	0.00
	188	beaver lodge	12.30	low	low	1.00	1.00	0.00	0.00
	189	log wind. w deb.	6.50	low	low	0.00	0.00	0.00	0.00
	190	beaver lodge	11.00	low	low	1.00	1.00	0.00	0.00
	191	log wind. w deb.	5.00	low	low	0.00	0.00	0.00	0.00
	192	beaver lodge	18.00	low	low	1.00	1.00	1.00	1.00
	193	rip rap	26.00	high	high	1.00	1.00	1.00	1.00
	194	instream veg.	40.00	low	low	0.00	0.00	0.00	0.00
	195	log wind. w deb.	5.50	low	low	0.00	0.00	0.00	0.00
	196	beaver lodge	17.00	low	low	1.00	1.00	1.00	1.00
	197	dock/boat	57.00	high	high	103.00	103.00	261.00	261.00
	198	beaver lodge	16.00	low	low	1.00	1.00	0.00	0.00
	199	log wind. w deb.	5.50	low	low	0.00	0.00	0.00	0.00
	200	log wind. w deb.	4.30	low	low	0.00	0.00	0.00	0.00
	201	log wind. w deb.	15.30	low	low	1.00	1.00	1.00	1.00
	202	beaver lodge	9.50	low	low	1.00	1.00	0.00	0.00
	203	bin wall	5.00	low	low	0.00	0.00	0.00	0.00
	204	tree windfall	2.80	low	low	0.00	0.00	0.00	0.00
	205	beaver lodge	9.00	low	low	1.00	1.00	0.00	0.00
	206	instream veg.	3.50	low	low	0.00	0.00	0.00	0.00
	207	concrete	4.80	low	low	0.00	0.00	0.00	0.00
	208	tree wind. w deb.	17.50	low	low	4.00	4.00	5.00	5.00
	209	tree wind. w deb.	36.00	high	high	44.00	44.00	85.00	85.00
	210	beaver lodge	13.00	low	low	1.00	1.00	0.00	0.00
	211	debris accum.	4.00	low	low	0.00	0.00	0.00	0.00
	212	instream veg.	11.40	low	low	0.00	0.00	0.00	0.00
	213	debris accum.	4.00	low	low	0.00	0.00	0.00	0.00
	214	debris accum.	3.90	low	low	0.00	0.00	0.00	0.00
	215	instream veg.	7.80	low	low	0.00	0.00	0.00	0.00



Appendix 5 (continued)  
 Estimated Change in Chinook Use of Major Cover Sites in the Lower Nechako River Based  
 on Hypothetical Changes in Short Term and Long Term Approach Velocities

Changes in major cover site suitability are indicated by estimated chinook populations,  
 using density data from June, 1989.

River Reach	Site No.	Cover Type <sup>a</sup>	Cover Area <sup>b</sup> (sq. m)	Velocity Rating <sup>c</sup>		Adjusted Population Estimate <sup>d</sup>		Unadjusted Population Estimate <sup>d</sup>	
				Short Term	Long Term	Short Term	Long Term	Short Term	Long Term
	216	beaver lodge	10.50	low	low	1.00	1.00	0.00	0.00
	217	beaver lodge	4.00	mod.	mod.	3.00	3.00	3.00	3.00
	218	beaver lodge	19.00	low	low	1.00	1.00	1.00	1.00
	219	beaver lodge	14.00	low	low	1.00	1.00	0.00	0.00
	220	beaver lodge	4.00	low	low	0.00	0.00	0.00	0.00
	221	overhang veg.	6.00	high	mod.	9.00	2.00	7.00	2.00
	222	instream veg.	18.00	mod.	mod.	6.00	6.00	5.00	5.00
	223	dock/boat	8.00	low	low	0.00	0.00	0.00	0.00
	224	rip rap	37.50	low	low	0.00	0.00	0.00	0.00
	226	beaver lodge	4.00	mod.	mod.	3.00	3.00	3.00	3.00
	227	beaver lodge	10.00	low	low	1.00	1.00	0.00	0.00
	228	beaver lodge	28.00	low	low	1.00	1.00	1.00	1.00
	229	rip rap	97.50	mod.	mod.	1.00	1.00	4.00	4.00
	230	beaver lodge	12.00	low	low	1.00	1.00	0.00	0.00
	231	tree wind. w deb.	56.50	low	low	4.00	4.00	15.00	15.00
	232	tree windfall	40.00	low	low	1.00	1.00	3.00	3.00
	233	instream veg.	14.00	low	low	0.00	0.00	0.00	0.00
	234	beaver lodge	10.00	low	low	1.00	1.00	0.00	0.00
	235	rip rap	300.00	low	low	0.00	0.00	3.00	3.00
	236	rip rap	450.00	mod.	mod.	1.00	1.00	18.00	18.00
	237	log wind. w deb.	6.80	low	low	0.00	0.00	0.00	0.00
	238	tree wind. w deb.	49.00	mod.	mod.	54.00	54.00	160.00	160.00
						1458.00	1281.00	2014.00	1828.00

<sup>a</sup> Cover type abbreviations: debris accum. = debris accumulations or jams; log wind. w deb. = log windfall with debris; debris scat. = debris scattered; tree wind. w deb. = tree windfall with debris; overhanging veg. = overhanging vegetation; offshore tree/log = offshore tree or log; dock/boat = dock, boat or float plane; instream veg. = overhanging vegetation with instream vegetation or instream debris cover; and boulder clus. = boulder cluster.

<sup>b</sup> Total cover area at the site.

<sup>c</sup> Derived from calculated short-term and long-term approach velocities shown in Appendix 4. Low = 0-19 cm/s; mod. = 20-40 cm/s; high = > 40 cm/s.

<sup>d</sup> Change in chinook habitat suitability were developed with 2 techniques relating to cover area, unadjusted and adjusted mean fish densities by habitat type and velocity class as shown in Table 3. These values were multiplied by the cover area to estimate chinook population at each site in the lower river under assumed short-term and long-term flow conditions.

## **APPENDIX 6**

**River Widths at Transects in the Nechako River Between  
Nautley River and Vanderhoof During Short Term (169.9 m<sup>3</sup>/s)  
and Long Term (141.6 m<sup>3</sup>/s) Flow Levels**



Appendix 6  
River Widths at Transects in the Nechako River Between Nautley River and Vanderhoof  
During Short Term (169.9 m<sup>3</sup>/s) and Long Term (141.6 m<sup>3</sup>/s) Flow Levels<sup>a</sup>

Transect Number <sup>b</sup>	River Width (m)		Width Difference (m)
	At 169.9 m <sup>3</sup> /s	At 141.6 m <sup>3</sup> /s	
55	97.2	94.8	2.4
56	142.3	139	3.3
57	122.8	121	1.8
58	82.3	71.3	11
59	171	160	11
60	83.2	70.7	12.5
61	171.9	167	4.9
62	93.6	92	1.6
63	189.6	188.7	0.9
64	157.6	156.7	0.9
65	144.8	141.7	3.1
66	128.6	127.1	1.5
67	178.3	153.9	24.4
68	124.7	116.4	8.3
69	126.2	114.9	11.3
70	100	88.4	11.6
71	106.1	89.6	16.5
72	141.7	139.6	2.1
73	140.2	134.7	5.5
74	109.4	100.9	8.5
75	132	121.9	10.1
76	158.8	149	9.8
77	114.9	104.2	10.7
78	171.9	165.5	6.4
79	197.5	175.6	21.9
80	310.9	265.2	45.7
81	126.8	106.7	20.1
82	122.2	117	5.2
		Mean	9.8
		SD	9.5

<sup>a</sup> Source: B. James, P.Eng., Triton Environmental Consultants Ltd.

<sup>b</sup> Transects established by International Pacific Fisheries Salmon Commission (IPFSC, 1979).

# HAY & COMPANY

## CONSULTANTS INC.

December 14, 1990

File: TRIT.003

Triton Environmental Consultants  
#120- 13511 Commerce Parkway  
RICHMOND, B.C.  
V6V 2L1

One West 7th Avenue  
Vancouver, B.C.  
Canada V5Y 1L5  
(604) 875-6391  
Fax: 875-8363

Attention: Mr. Brian James, P.Eng.  
Manager, Water Resources Engineering

Dear Sir:

Re: Nechako Fisheries Conservation Program  
Inventory of Habitat Cover  
Cover # RM90-10

As requested, Hay & Company Consultants Inc. have undertaken studies to assess the expected changes in water velocities in the Nechako River below the Nautley between the short-term and long-term flow regimes with particular emphasis on velocities within 5 metres of the margins. This work is a prerequisite for subsequent studies which will re-evaluate previously inventoried cover habitat sites (Ref. Lister report - December 1989).

The flows analyzed were the mean June discharges for both flow regimes. The month of June was identified in the Lister report as being the critical period for assessing the effects of flow reductions on juvenile chinook rearing.

The actual short-term and long-term flow distributions between the Nautley and Stuart confluences on the Nechako River were derived from the inflow analysis conducted by Envirocon (Jan. 1984) as listed in flow Tables 2.5.29 to 2.5.36 (with Kemano Completion: 1957-1981 data base). Derived inflows per river reach were adjusted to reflect the recent drier period (1982-88): a reduction factor of 0.9197 was obtained from an analysis of WSC flow records. Average June inflows between the Skins Lake Spillway and Vanderhoof were derived for the 1957-81 and 1957-88 periods. The ratio of these average inflows gave the aforementioned reduction factor. The resultant inflows per reach were then added to the short-term (56.6 m<sup>3</sup>/s) and long-term (31.1 m<sup>3</sup>/s) flow releases at Cheslatta Falls. The discharge at each of the supplied cross section locations was subsequently derived assuming a linear variation of discharge with distance along the river.

Similarly, discharges at the various cross section locations during the May 23-June 2, 1989 survey period were derived from the WSC flow records on a daily basis. The net inflow between

Skins and Vanderhoof was compared to the previously derived long-term average inflow for June (113.4 m<sup>3</sup>/s) and the resultant ratio was used to adjust the incremental inflow at each section.

The supplied hydraulic data for cross sections 55-102 was used to determine mean velocities at each section for both the short-term and long-term flow regimes. The ratio of percent velocity change: percent flow change was then determined at each cross section. These ratios were subsequently used to derive estimates of velocity changes relative to the inventoried habitat cover site measurements for both the short-term and long-term flow regimes. Since the discharges during the inventory survey period were in most cases lower than both the short and long-term flow regime discharges, velocities would be generally higher than documented for both flow regimes. The estimated velocity changes relative to inventoried conditions are summarized on Table 1. In general, velocity changes on a percentage basis were significantly lower than the corresponding changes in discharge.

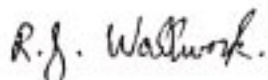
The relationship between velocity at the margin and mean velocity at the section was investigated using WSC stream gauging measurements. Meter notes from a total of 10 stream gaugings, included 4 on the Nechako River, were analyzed to determine the ratio of velocity 5 m from the margins to mean velocity. The Nechako stations gave a lower ratio (0.36) than was obtained from all 10 stations combined (0.57) which was attributable to shallower relative depths at the margins. A factor of 0.4 could be applied to the mean velocity at a section in order to give a rough estimate of velocity 5 m from the margin. In practice, velocities 5 m from the river margins have already been inventoried and only require adjustment to reflect differences in discharge for the two flow regimes relative to flow conditions during the inventory period.

We trust that the above information will allow a reassessment of the earlier habitat site inventory.

Please contact us if you have any questions or require further information.

Yours very truly,

HAY & COMPANY CONSULTANTS INC.



R.J. Wallwork, P.Eng.

/gs

Encl.