NECHAKO RIVER SUBSTRATE QUALITY AND COMPOSITION PROJECT COMPARISON OF 1992 AND 2000 FREEZE-CORE SAMPLE RESULTS

NECHAKO FISHERIES CONSERVATION PROGRAM
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EXECUTIVE SUMMARY

The Nechako Fisheries Conservation Program (NFCP) Technical Committee began a substrate monitoring program in the Nechako River in 1988, known as the Nechako River Substrate Quality and Composition Project. The overall objective of the monitoring program is to detect long-term changes in gravel quality as it affects chinook salmon spawning and rearing habitat.

Baseline gravel quality (substrate) samples were first collected in 1992 at three sites between Cheslatta Falls and Fort Fraser; the program was repeated in 2000. Roughly 36 samples were collected at each site in each sampling year, using a modified freeze-core sampler, thought sufficient to detect a 10% change in mean fine-sediment content. Each sample was broken into a top (surface layer) and bottom (sub-surface layer) that were analyzed separately. A two-tailed t-test (= 0.10) was used to assess the significance of the observed changes in mean percent fines at each site, treating the surface and lower layer samples separately.

Fine sediment content increased by less than 10% in the surface layer at all three sites. However, the fine and medium sand content - a constituent of fine sediment - increased by around 30% and was significant at two sites. Changes in the more abundant constituent, coarse sand, were variable and less pronounced. Silt and clay content was consistently low, in the range of sample error.

Fine sediment content increased by 5% or less in the sub-surface layer at two sites (Sites 1 and 2). Again, the increase in fine and medium sand was dominant, while the changes in coarse sand content were variable, and silt and clay content were negligible. Deposition of coarse sediment over the previous substrate at Site 3 resulted in a decrease in fine sediment content there.

Future sampling will be required to determine whether the observed trends are truly occurring as described. We recommend collecting another set of samples around 2011.

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ACKNOWLEDGEMENTS

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- Bill Rublee, R.P.Bio., ARC Environmental Ltd.
- Ellen Petticrew, University of Northern British Columbia.

Local residents were instrumental in the success of the sampling programs. We thank riverfront property owners Bert Irvine and Hill Larson, who permitted access to Sites 1 and 2, across their property. Local technician Colin Barnard provided field assistance and the use of his workshop in 2000, as well as occasional home-cooked meals.

The 1992 and 2000 substrate samples were analyzed at the University of British Columbia in the Geography Department laboratory, under the supervision of Dr. Michael Church. Dr. Church provided the results of his previous analysis of gravel samples from the Nechako River and also provided advice on analytic methods.

INTRODUCTION

The Nechako Fisheries Conservation Program (NFCP) Technical Committee initiated a substrate monitoring program in the Nechako River in 1988, known as the Nechako River Substrate Quality and Composition Project. The overall objective of the monitoring program is to detect long-term changes in gravel quality as it affects chinook salmon spawning and rearing habitat. Previous studies (e.g. Rood and Neill, 1987) had predicted that the content of fine sediment (< 2 mm diameter) in the gravel substrate might increase over time due to regulated flows, infrequent transport of bed material, and continued sediment supply from tributaries and other sources. An increase in fine sediment content could have negative impacts on spawning and incubation success and the quality of rearing habitat for chinook salmon in the Nechako River.

The first phase of the program reviewed gravel sampling techniques and prepared a background report that recommended methods for monitoring substrate quality and composition along the Nechako River (Rood 1998). The second phase designed a gravel quality sampling program based on the freeze-core technique, completed a pilot program to test methods and equipment, and measured baseline substrate quality at one site on the Nechako River (Rood 1998). These initial samples were used to estimate the variability in substrate composition, so that a larger sampling program could be designed, that would be capable of detecting a 10% change in substrate composition.

The next sampling program was in 1992. Substrate samples were collected at three sites along the Nechako River between Cheslatta Falls and Fort Fraser (nhc 1992). Roughly 36 samples were collected at each site with a modified freeze-core sampler, in which liquid nitrogen is used to freeze cylindrical blocks - 20 cm in diameter by 30 cm deep - of riverbed gravels within the wetted channel (Rood and Church, 1994). At each sample point, the surface substrate layer was separated from the sub-surface layer, where the surface layer is approximately 15 cm thick, or about equal to the diameter of the largest stones in the substrate (Church et al, 1987). The surface layer was relatively coarser and contained much less fine sediment than the sub-surface material. The grain size characteristics of the substrate samples were later analyzed at the Department of Geography laboratory at the University of British Columbia (Collett and Church, 1993).

The sampling program was repeated in 2000, using the same field sites, data collection techniques and laboratory analysis methods. This report summarizes the results of the 2000 sampling program, and compares the grain size characteristics measured in 1992 and 2000 to determine whether the fine sediment content in the gravel substrate of the Nechako River at the sampling sites has significantly increased in the intervening eight years.

SUBSTRATE SAMPLING FIELD PROGRAM

Sample Collection

In 1992, three sampling sites were selected in known chinook spawning areas between Cheslatta Falls and Fort Fraser. The sites - described in the following section (2.2) and in Appendix A - are located as follows:

- Site 1: Below Cheslatta Falls (Bert Irvine's).
- Site 2: Near Lily Lake (Hill Larson's).
- Site 3: Below Diamond Island (Horn Road).

In 1992, at each site, substrate samples were collected along two transects spaced 10 m apart that spanned the entire wetted channel width. The sample points were spaced along each transect so that they were distributed evenly across the channel. In 1992, we recorded water depths at the sample points and measured distances to the sample points from permanent transect endpoint markers. The same transects were used in 2000, and the 1992 sample points were replicated as closely as possible. In 2000, channel cross-sections were surveyed to provide a better basis for future assessment of channel stability.

Substrate samples were not collected along channel margins where flow was much slower and shallower than along the rest of the channel cross-section. Samples could not be collected where water depth exceeded 1.0 m, which occurred in the middle of the channel at Site 2 (in 1992 and 2000) and along the left bank at Site 3 (in 1992).

In 1992, samples were collected between March 13 and 29; in 2000, samples were collected between March 21 and April 12. Discharges at the Water Survey of Canada (WSC) Gauge 08JA017 (Nechako River below Cheslatta Falls) were about the same during each sampling period (Table 1).

Sampling Sites

Site 1: Below Cheslatta Falls

Site 1 is about 7 km downstream of Cheslatta Falls and 1.5 km upstream of Bert Irvine's home and boat launch and WSC Gauge 08JA017 (Nechako River below Cheslatta Falls), as shown in Appendix A. Bert Irvine permitted vehicle access and the use of his boat launch, which remains ice-free through most of the winter due to its proximity to the reservoir.

The wetted channel at Site 1 was 112 m wide and about 0.9 m deep during the 1992 and 2000 substrate sampling periods, under similar flows (Table 1). The air photo sequence in Appendix A shows that the channel has been laterally stable since 1953, with side channels and gravel bars subject to vegetation encroachment. The channel cross-section did not change measurably during the interval between 1992 and 2000.

Table 1
Average Daily Discharge in Nechako River during Substrate Sampling Periods

Site	Sample Period		Discharge (m^3/s) below Cheslatta Falls [1]		Discharge (m^3/s) at Vanderhoof [2]	
	1992	2000	1992	2000	1992	2000
1	13 Mar - 19 Mar	21 Mar - 28 Mar	33	35	70	46
2	20 Mar - 24 Mar	31 Mar - 05 Apr	35	35	83	53
3	25 Mar - 29 Mar	07 Apr - 12 Apr	35	35	90	61

Notes:
1. Nechako River below Cheslatta Falls: Water Survey of Canada Gauge No. 08JA017.
2. Nechako River at Vanderhoof: Water Survey of Canada Gauge No. 08JC001.

Site 1 is near the downstream limit of bedrock control in the Nechako River, although there is no exposed bedrock at the site itself. The bed is composed of cobbles and boulders. Pockets of sand occur throughout the area, especially in the lee of lag boulders. The large bed material was difficult to sample. At a number of the sample points, the outer barrel of the corer could not be driven deeply enough into the riverbed to obtain a suitable sample. At several other points, only a surface layer sample ("Top") could be obtained as the sampler could only be driven about 15 cm into the substrate. The distribution of samples across the channel is summarized in Table 2; sample characteristics are summarized in Table 3.

The gravel substrate at Site 1 is relatively thin. In the thalweg near the right bank, the corer occasionally penetrated through the substrate into a seam of non-alluvial clay. Bedrock exposed a short distance downstream also indicates the alluvium is shallow.

Site 2: Near Lily Lake

Site 2 is about 46 km downstream of Cheslatta Falls near the home of Hill Larson and the settlement of Lily Lake, as shown in Appendix A. Hill Larson permitted vehicle access to the river. The riverboat could not be launched at Site 2 in 2000 because of thick shore ice, so it was run down-river from Site 1.

The wetted channel at Site 2 was 72 m wide, with a maximum depth of about 1.4 m, during the 1992 and 2000 substrate sampling periods, under similar flows (Table 1). The air photo sequence in Appendix A shows that the channel has been laterally stable since 1953, with side channels and gravel bars subject to vegetation encroachment. The channel cross-section did not appear to change significantly between 1992 and 2000, except the thalweg may have become slightly wider or deeper.

The bed material at Site 2 ranged from pebbles to cobbles and it was not as difficult to sample as at Site 1. Deep water prevented sampling in the middle portion of the channel, where the maximum depth exceeded 1.0 m. The distribution of samples across the channel is summarized in Table 2; sample characteristics are summarized in Table 3. The stability of the channel at Site 2 suggests that bedload transport rates are low and the bed material on either side of the thalweg may have remained immobile between the sampling programs.

Site 3: Below Diamond Island

Site 3 is about 69 km downstream of Cheslatta Falls and 16 km upstream of Fort Fraser, as shown in Appendix A. The site is located 500 m downstream of Diamond Island and 250 m upstream from the end of Horn Road, which provides public access. The riverboat used in 2000 could not be launched at Site 3 because of thick shore ice, so it was run down-river from Site 2.

The wetted channel at Site 3 was 94 m wide during the 1992 and 2000 substrate sampling periods, under similar flows. In 1992, the thalweg near the left bank was at least 1.3 m deep - too deep to wade or sample. In 2000, however, the thalweg was only 0.8 m deep, allowing sample collection. Significant gravel deposition appears to have occurred between the two dates. The air photo sequence in Appendix A shows the trend of vegetation encroachment since 1953 along the river upstream of Site 3. It also shows that some riverbanks near the downstream end of Diamond Island have continued to erode, supplying alluvial gravels and sands to Site 3, which is immediately downstream.

The bed material at Site 3 consists of pebbles to cobbles and it was not difficult to sample. The distribution of samples across the channel is summarized in Table 2; sample characteristics are summarized in Table 3.

Location of Transects

In both 1992 and 2000, our substrate sampling occurred after ice breakup but before the spring freshet so that flows and water depths were at a minimum. This allowed sampling of the greatest portion of the streambed. Salmon eggs were also incubating in the gravel at this same time. Consequently, our transects were situated near the spawning dunes created by the chinook salmon during spawning, but away from any known concentrations of redds.

Our samples are collected in substrate that has not been recently disturbed by spawning salmon and they may not reflect the condition in redds or in substrate that has been selected for spawning. However, our sampling program will reflect the overall pattern of substrate changes that occur along the Nechako River because of sediment supply, transport and deposition

Table 2
Substrate Sampling Distribution

Site	Wetted Width (m) during Sampling		Maximum Depth (m) during Sampling		Unsampled Width (m) Right Bank Margin		Unsampled Width (m) Left Bank Margin		Unsampled Width (m) Thalweg		Total Width (m) Sampled	
	1992	2000	1992	2000	1992	2000	1992	2000	1992	2000	1992	2000
1	112	112	0.9	0.9	5	5	32	32	0	0	75	75
2	72	72	1.4	1.4	6	4	4	2	18	28	44	38
3	94	94	1.3	0.8	32	32	0	4	11	0	51	58

Notes:
1. Thalweg at Site 2 is in mid-channel. Thalweg width increased from 1992 to 2000; change in depth not known.
2. Thalweg at Site 3 is along the left bank. Thalweg was too deep to sample in 1992 but became shallow enough to sample in 2000.

Table 3
Substrate Sampling Intensity

Table 3a. Total Sampling Quantities

Site	No. of Sample Points		No. of Samples Split		Total Sample Mass (kg)		Sample Mass < 64 mm (kg)		Average Sample Mass (kg)		Average Mass, < 64 mm (kg)	
	1992	2000	1992	2000	1992	2000	1992	2000	1992	2000	1992	2000
1	34	41	25	31	423.3	530.7	371.2	470.4	12.5	12.9	10.9	11.5
2	36	36	33	36	552.8	542.9	529.8	516.7	15.4	15.1	14.7	14.4
3	36	39	34	39	589.6	585.8	558.9	563.7	16.4	15.0	15.5	14.5
Total	106	116	92	106	1,565.7	1,659.4	1,459.9	1,550.7	14.8	14.3	13.8	13.4

Table 3b. Samples Split into Tops and Bottoms

Site	No. of Tops		No. of Bottoms		Mass, < 64 mm Tops (kg)		Mass, < 64 mm Bottoms (kg)		Avg. Mass, < 64 mm Tops (kg)		Avg. Mass, < 64 mm Bottoms (kg)	
	1992	2000	1992	2000	1992	2000	1992	2000	1992	2000	1992	2000
1	31	38	25	31	196.8	232.6	147.9	204.4	6.3	6.1	5.9	6.6
2	34	36	33	36	253.8	259.5	250.9	257.2	7.5	7.2	7.6	7.1
3	34	39	34	39	298.5	278.8	241.8	284.9	8.8	7.1	7.1	7.3
Total	99	113	92	106	749.1	770.9	640.6	746.5	7.6	6.8	7.0	7.0

Notes:
1. Top and Bottom values summed in Table 3b do not necessarily agree with values in Table 3a because "large" Top only samples were omitted. These are samples that should have been split into Top and Bottom halves but were not, for example if the entire sample crumbled out into the tray at once and got mixed up. These are not actually Top samples but rather unsplit T+B samples.

and the results may be simpler to interpret as gravel disturbance by spawning salmon does affect grain size characteristics.

Substrate Sample Collection

Equipment

All substrate samples were collected with a freeze-core sampler that consisted of an outer barrel, an inner probe, and a driving head. Manufacturing drawings of the sampler components are provided in Appendix B. The procedure also requires a metal funnel, a Dewar flask for liquid nitrogen, and safety gear (thick gloves and a face shield) for handling the nitrogen. The refrigerated liquid nitrogen is supplied in large cylinders, which must remain upright at all times. Road access to, or very near, the sampling sites is needed to provide the large quantities of liquid nitrogen required for freeze coring. In 2000, we used eleven 101-m^3 cylinders, each of which produced approximately 75 L of liquid nitrogen once released from the cylinder into the Dewar flasks. We used a total of 775 L of liquid nitrogen for 116 sample points.

Collection Procedure

Rood and Church (1994) described the procedure in detail. Appendix B provides photos taken during the 2000 sampling program. Sampling procedures were the same in 1992 and 2000, except for the type of boat used, as follows:

- Grind the outer barrel into the substrate to a depth of 30 cm.
- Place the inner probe inside the outer barrel and pound the probe into the substrate, hitting the driving head with a sledgehammer. Pound the probe until the probe tip is at the same depth as the bottom of the outer barrel.
- Place the funnel into the open top of the inner probe.
- Slowly pour liquid nitrogen into the funnel; approximately 7 L over a period of 20 to 25 minutes is required to freeze the substrate inside the outer barrel.
- Pull the outer barrel from the riverbed, with the inner probe and surrounding substrate frozen inside the outer barrel.
- Place the barrel, probe, and core sample into the boat, which has been moored to a tagline alongside the sample point.
- An open, stable workspace is required to extract the frozen substrate sample from the sampler. In 1992, we towed an inflatable Zodiac raft to shore with each sample so we could work on a stable surface. In 2000, we used a more stable riverboat that served as a mid-river working platform.
- Place the open bottom end of the barrel into a large clean tray to catch the sample.
- Pound the inner probe forward, then backward, to loosen frozen sample. The frozen sample crumbles out of the barrel into the tray.
- As the sample comes out, split the sample into upper (“Top”) and lower (“Bottom”) halves and bag them separately for analysis.
- In deep water or cobbly substrate, the outer barrel often could not be inserted to the full 30-cm depth. In these cases, the smaller-than-usual sample was considered a Top with no corresponding Bottom.

Field Work Component

In both 1992 and 2000 a three-person crew required five to seven days to complete each site, plus a few days for preparation and wrap-up. Disbursements included airfare, accommodation, meals, vehicle and boat rental, fuel, equipment and sample shipment, and liquid nitrogen. In 2000, the cost of eleven 101-m^3 cylinders of refrigerated liquid nitrogen was $3,000, plus $500 for shipment from Prince George to a drop-off site near Vanderhoof.

Lab Analysis

The 1992 and 2000 substrate samples were analyzed for grain-size distribution at the University of British Columbia in the Geography Department laboratory, under the supervision of Dr. Michael Church. Each Top or Bottom split was considered a separate sample for analysis. Samples were oven-dried, weighed, and sieved to determine grain-size distribution. For quality control, 10% of the samples were randomly selected and re-analyzed.

The grain size distributions from 1992 are reported in Collett and Church (1993). Condensed laboratory results for the 1992 and 2000 samples are provided in Appendix C. The sample ID codes consist of site number, transect number, distance in metres along transect, and top or bottom split.

The unit cost of lab analysis in 1992 and 2000 was $50 per sample (including GST). In 2000, the cost amounted to $12,850, for 257 sample analyses including quality control replicates. The cost in 1992 was slightly less due to the smaller number of samples (Table 3).

GRAIN SIZE DISTRIBUTION ANALYSES

Data Truncation

Grain-size distributions for each sample were truncated at 64 mm, meaning that all stones larger than 64 mm were removed from the analysis. Because the mass of individual stones increases in proportion with the cube of diameter, the presence or absence of a single large stone can greatly affect the relative distribution of other grain sizes. Figure B-2 shows the mass of sample required to adequately represent sediment with a specified maximum grain size (either a natural maximum size or a maximum size imposed through truncation). Our samples provided a nominal weight of around 13.5 kg each, or around 6.5 to 7.0 kg each for Top or Bottom splits. These are adequate to describe the distribution to 45 mm (1% criterion) or 56 mm (2% criterion) for the whole core, or 36 mm (1% criterion) or 45 mm (2% criterion) for the splits. The 64 mm truncation point provides very relaxed criterion for sample size but was adopted to retain as much information as possible regarding the size distributions. Combining samples at each site - as recommended by Wolcott and Church (1991) - created composite weights of 150 to 300 kg for surface or sub-surface layers at each site, adequate to describe the grain size distribution in detail at each site.

Grain Size Statistics

We investigated the overall fine sediment content (< 2 mm) and then looked more closely at each of following three fine sediment constituents:

- Silt and clay (< 0.063 mm).
- Fine and medium sand (0.063 - 0.5 mm).
- Coarse sand (0.5 - 2 mm).

The portion of fine sediment in each size range was expressed as a percentage of the sample mass, as truncated at 64 mm. Our comparison of 1992 and 2000 sample results looks at changes in the mean percentages in each size range. For example, if a set of 1992 samples has a mean of 20% fine (< 2mm) sediment, and the corresponding set of 2000 samples has a mean of 22% fine sediment, then the change in fine sediment content was expressed as:

Change (2000 from 1992) = (0.22 - 0.20) / 0.20 = 10% increase.

The increase may or may not be statistically significant, depending on the variability within the set of samples, as discussed in the next section.

Statistical Analysis

At each site, we separated the surface layer samples (Tops) from the sub-surface layer samples (Bottoms), and performed two-tailed t-tests for changes in the mean percentage of fines, coarse sand, fine and medium sand, and silt and clay, at a significance level of (= 0.10. In essence, the t-test statistic determines whether the difference in mean values between sample years is large enough, given the variability of the samples, to reject the null hypothesis of no change in fine sediment content.

Sources of Error

Freeze-core sampling tends to bias substrate samples in favour of coarser grain sizes, for the following reasons.

- Larger stones preferentially freeze to the bottom of the sample without the finer sediment that originally surrounded them. Use of the outer barrel reduces this effect on the sides of the sample, but the problem cannot be practically eliminated on the bottom of the sample.

- Disturbance associated with grinding the outer barrel into the riverbed may displace fine sediment that can be transported away by the current. However, the volume of the potential loss relative to sample volume is considered small.

- Fine sediment is more prone than coarser particles to miscellaneous handling losses in the field. We kept as clean a workplace as possible in the field to keep losses to a minimum.

- By collecting samples in a consistent manner, the error associated with net change in substrate composition should be less than the error in absolute composition estimates.

Lab analysis adds error to the substrate composition estimates. All grain-size analyses were presented along with a sieve error. The sieve error is the difference between the sample mass after drying but before sieving, minus the sum of masses retained on each sieve. The error represents any sediment lost during sieving as well as mistakenly recorded numbers. In the 1992 and 2000 lab analyses, only one sample analysis had a sieve error greater than 0.5%. The sample in question had an error of 5%, much greater than any other sample, so it was removed from the data set.

For further quality control, 10% of grain-size analyses were replicated. None were found to exceed 1% difference in portions within any given grain-size range, an acceptable error given that we are looking for changes of 10% in grain-size portions. For the sake of simplicity, the first result of a replicate was used for further data analysis, rather than averaging the two results.

RESULTS AND DISCUSSION

Summary of Results

Surface versus Sub-Surface Substrate

The surface layer of a gravel bed river usually contains less fine sediment than the underlying sub-surface layer due to winnowing or the consequences of equilibrium bed material transport (Church et al, 1987). Lumping all the surface layer (Top) splits and all sub-surface layer (Bottom) splits by year, shows that the difference between Tops and Bottoms far exceeds the difference between years (Table 4). The Tops average around 9.4% fine sediment, and the Bottoms average around 17.3%. The difference between lumped Tops and Bottoms is much greater than temporal changes observed at any given site, which justifies the separate analysis of top and bottom halves of samples collected at each sample point.

General Composition

Mean fine-sediment content in the surface layers at the three sites in 1992 and 2000 ranged from around 8% to 11% (Table 5). In the sub-surface layers the range was around 16% to 18%. Silt and clay (< 0.063 mm) content was generally very low, with site means of about 0.1% in the Tops and 0.2% in the Bottoms. The silt and clay contents are within the range of sampling and analysis errors, so we have not analyzed changes from 1992 to 2000.

Fine and medium sand (0.063 - 0.5 mm) were considerably more abundant, while coarse sand (0.5 - 2 mm)

Table 4
Vertical Stratification in Nechako River Substrate Samples

Site	Year	n	Portion of Fine Sediment (< 2 mm) as Percent of Truncated Sample Mass		
			Mean	Std. Dev.	Change in Mean
Tops	1992	99	9.16	7.35	
	2000	113	9.67	6.32	5.6%
Bottoms	1992	92	17.51	5.29	
	2000	106	17.01	7.35	-2.9%

Notes:
'1. Sample analyses truncated at 64 mm upper limit; open lower limit.

Table 5

was the most abundant. The approximate range in site mean percentages of fine sediment, considering both sample years, is summarised below.

Constituent	Range in Content - Tops	Range in Content - Bottoms
Silt & Clay	0.1%	0.2% - 0.3%
Fine & Medium Sand	3% - 5%	6% - 8%
Coarse Sand	5% - 7%	9% - 12%
Total Fine Sediment	8% - 11%	16% - 18%

Change over Time: Tops (Surface Layer)

At all three sites, the mean fine-sediment content in the surface layer samples increased between 1992 and 2000, although by less than 10%. Looking at the constituents of fine sediment, the content of fine and medium sand increased at all three sites by around 30%; the increases in mean value were statistically significant at Sites 1 and 3, but not at Site 2 because of the larger variability (Table 5). Coarse sand content was virtually unchanged at Sites 1 and 3, but decreased more than 10% at Site 2. This decrease was not statistically significant.

Change over Time: Bottoms (Sub-surface Layer)

At Sites 1 and 2, the mean fine-sediment content in the sub-surface samples increased between 1992 and 2000, but by 5% or less. As in the upper layer, the increased fine-sediment content mostly occurred in the fine and medium sand range, where mean percentages increased by more than 10% from 1992 to 2000. However, these increases were not statistically significant. Coarse sand was a greater portion of the overall fine sediment content than fine and medium sand. However, the observed changes from 1992 to 2000 in this fraction were smaller and inconsistent.

Site 3 showed different results than Sites 1 and 2. Mean fine-sediment content decreased by 14.5% between 1992 and 2000. The decrease occurred in fine, medium, and coarse sand components, but the greatest decrease occurred in coarse sand content (18.9% decrease). The decreases in total fine sediment and in the coarse sand component were statistically significant.

Interpretation of Results

Silt and clay content was low at all three sites, in both sample years, in both the surface and sub-surface layers, as is typical of gravel river substrates. Silt and clay are supplied to the Nechako River by tributaries and by floodplain and terrace erosion along the river. These very fine materials are transported as wash load - in suspension under all flows - and they do not settle out in significant quantities in the bed of the main river.

The portion of fine and medium sand increased over time in the surface layer at all three sites, and in the subsurface gravels at two out of three sites. These sediment sizes are thought to be transported in suspension or saltation during flood flows but to settle from suspension during waning flows. Where they are deposited on the surface of the riverbed they are prone to re-mobilization, except where well sheltered between cobbles or behind boulders. Some of the fine and medium sand later moves down into the sub-surface layer, particularly during floods, when bed stresses are powerful enough to jiggle the gravel framework, but not powerful enough to entrain the gravel and initiate bedload transport.

The sedimentation regime described above is consistent with the little that is known of sediment transport on the Nechako River. Miscellaneous measurements during summer cooling flows in 1986, and other anecdotal observations, indicate that suspended sediment transport is essentially zero in the Nechako River at low and moderate flows, with modest concentrations in suspension during the highest spring or summer flows (Rood and Neill, 1987). Bed material transport only occurs at few sites. Most fine and medium sand transport - from the riverbed or from other sources - would occur during rising flood flows. The sand would remain in suspension until flows begin to wane, when it would be deposited on the riverbed.

The observed decrease in the portion of fine and medium sand at Site 3 does not fit with the above assumptions regarding sedimentation regime. One possibility is that the fine and medium sand in the lower layer were flushed away during general bedload transport. However, a more satisfactory explanation is that the previous surface layer was partly filled and buried by coarse sediment transported from upstream.

This agrees with field evidence, particularly the thalweg infilling and the actively eroding riverbanks a short distance upstream.

Coarse sand can be transported in suspension during high flows, but this is thought to occur very infrequently under the regulated flow regime. It is more likely that it now moves as bedload, over and between the riverbed gravel and cobbles when flows are not sufficiently powerful to entrain the gravel framework. No clear trend in coarse sand content was evident, probably because transport is localized and sporadic. The observed minor reductions likely are an artifact of the increased fine and medium sand content.

SUMMARY AND RECOMMENDATIONS

Our sampling program indicates a general trend to increased content of fine sediment in the surface and sub-surface layers of the substrate. The observed increases in mean percentage content of fine sediment are less than 10% since 1992. These changes are small relative to the variability within a site in a given sample year and are not statistically significant. Much of the increase occurs in the content of fine and medium sand. The portion of these fractions increased in the upper layer at all three sites and in the lower layer at two out of three sites. However, only two of the five mean differences were sufficiently large to be considered statistically significant (= 0.10).

Further sampling would be required to determine whether the observed trends are occurring as described, or whether some of the "trends" reflect errors inherent in randomly sampling a variable population. Table 6 extrapolates the observed changes in substrate composition to guide future sampling. If the observed changes are real and continue at the same rate as they did between 1992 and 2000, then Table 6 predicts the year in which the changes would likely be sufficiently large to be considered statistically significant (= 0.05). The extrapolated trends in Table 6 indicate that the increase in all five means would be significant at (= 0.05 or better in 2011, if current rates of increase continue. This would be a good time to re-sample the Nechako River substrate.

The number of samples collected in 1992 and 2000 was selected to allow detection of a 10% change in substrate composition, given the variability of the substrate. We recommend that future sampling programs replicate the 1992 and 2000 programs.

Table 6
Extrapolation of Substrate Composition Trends to Guide Future Sampling

Table 6a. Tops

Site	Portion of Fine & Med. Sand (0.063 - 0.5 mm) as Percent of Truncated Sample Mass				
	Observed Change in Mean (2)		Significant Change in Mean (3)		Year Signif. (4)
1	0.74	27.4%	0.88	32.6%	2002
2	1.27	33.2%	3.03	79.1%	2011
3	0.80	31.6%	0.66	26.1%	Prior to 2000

Table 6b. Bottoms

Site	Portion of Fine & Med. Sand (0.063 - 0.5 mm) as Percent of Truncated Sample Mass				
	Observed Change in Mean (2)		Significant Change in Mean (3)		Year Signif. (4)
1	0.65	10.4%	1.42	22.8%	2009
2	1.89	32.8%	3.04	52.7%	2005
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Notes:
1. Sample analyses truncated at 64 mm upper limit; open lower limit.
2. Observed differences between 1992 and 2000; Site 3 Bottoms omitted because of uniqueness (see text).
3. Difference required for statistical significance (alpha = 5%, two-sided, assuming pooled 1992 / 2000 std dev).
4. Year in which significant difference detectable, assuming constant rate of change at 1992 - 2000 rate.

REFERENCES

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Rood, K. 1998. Nechako Substrate Quality and Composition. Nechako Fisheries Conservation Program Technical Report No M89-7. 43 pp.

Rood, K. and M. Church. 1994. Modified freeze-core technique for sampling the permanently wetted streambed. North American Journal of Fisheries Management, 14: 852-861.

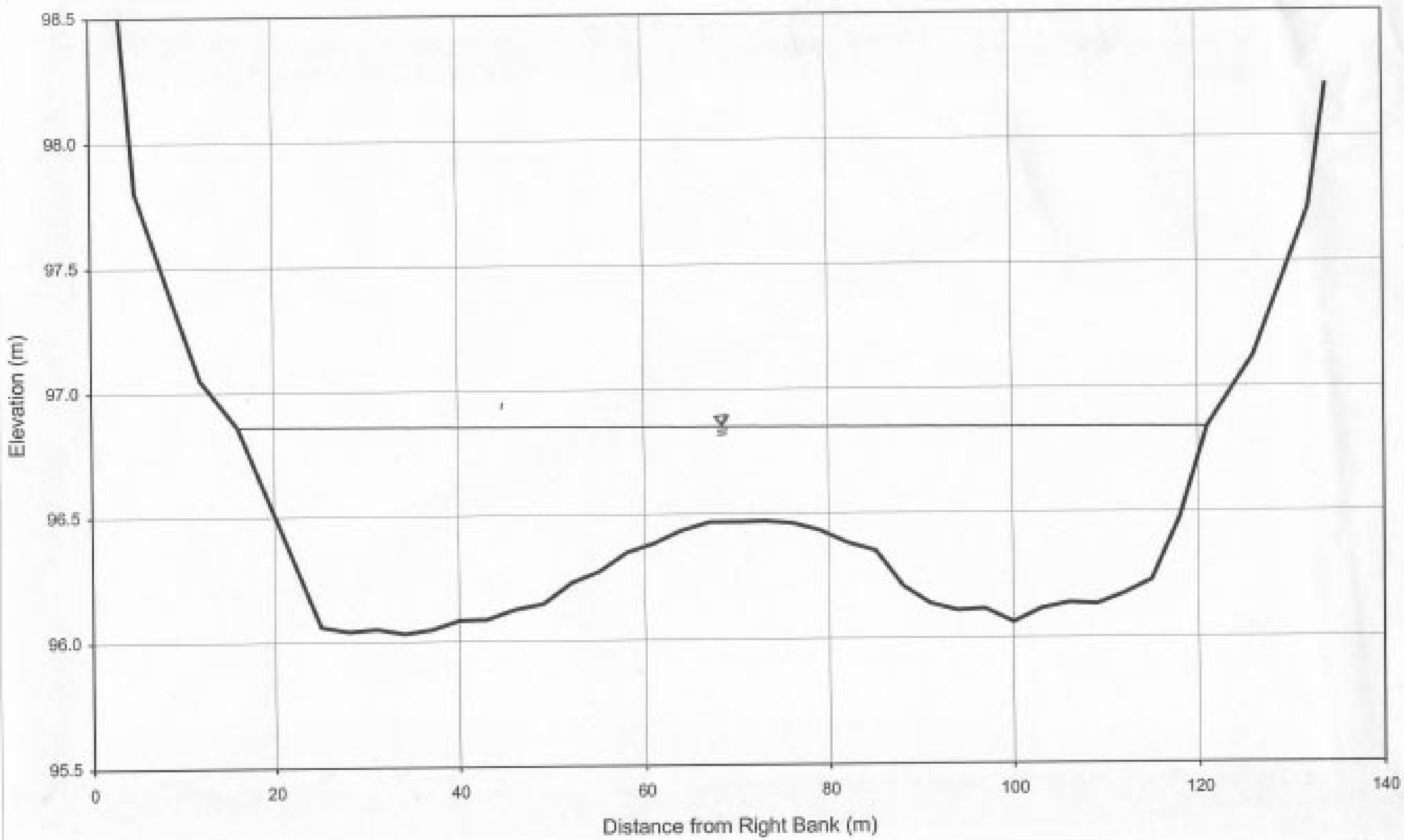
Rood, K.M. and C.R. Neill. 1987. A Study of Some Aspects of the Geomorphology of the Nechako River. Reid Crowther and Partners Ltd and Northwest Hydraulic Consultants Ltd. Prepared for Fisheries and Oceans Canada, Vancouver, BC. DSS File #FP501-6-0142/01-SB. 84 pp. plus appendices.

Wolcott, J. and M. Church. 1991. Strategies for sampling spatially heterogeneous phenomena: the example of river gravels. Journal of Sedimentary Petrology, 61: 534-543.

APPENDIX A

Sampling Site Information

- **Substrate Sampling Site Locations**
- **Site 1: Below Cheslatta Falls**
- **Site 2: Near Lily Lake**
- **Site 3: Below Diamond Island**



Notes:

1. Transect 1, looking upstream.
2. Vertical exaggeration approx. 30x.
3. Surveyed on 13 April, 2000.
4. Daily discharge below Cheslatta Falls: 35 m^3/s (WSC Gauge No. 08JA017).

NECHAKO RIVER SUBSTRATE PROJECT
Site 1 Channel Cross-Section
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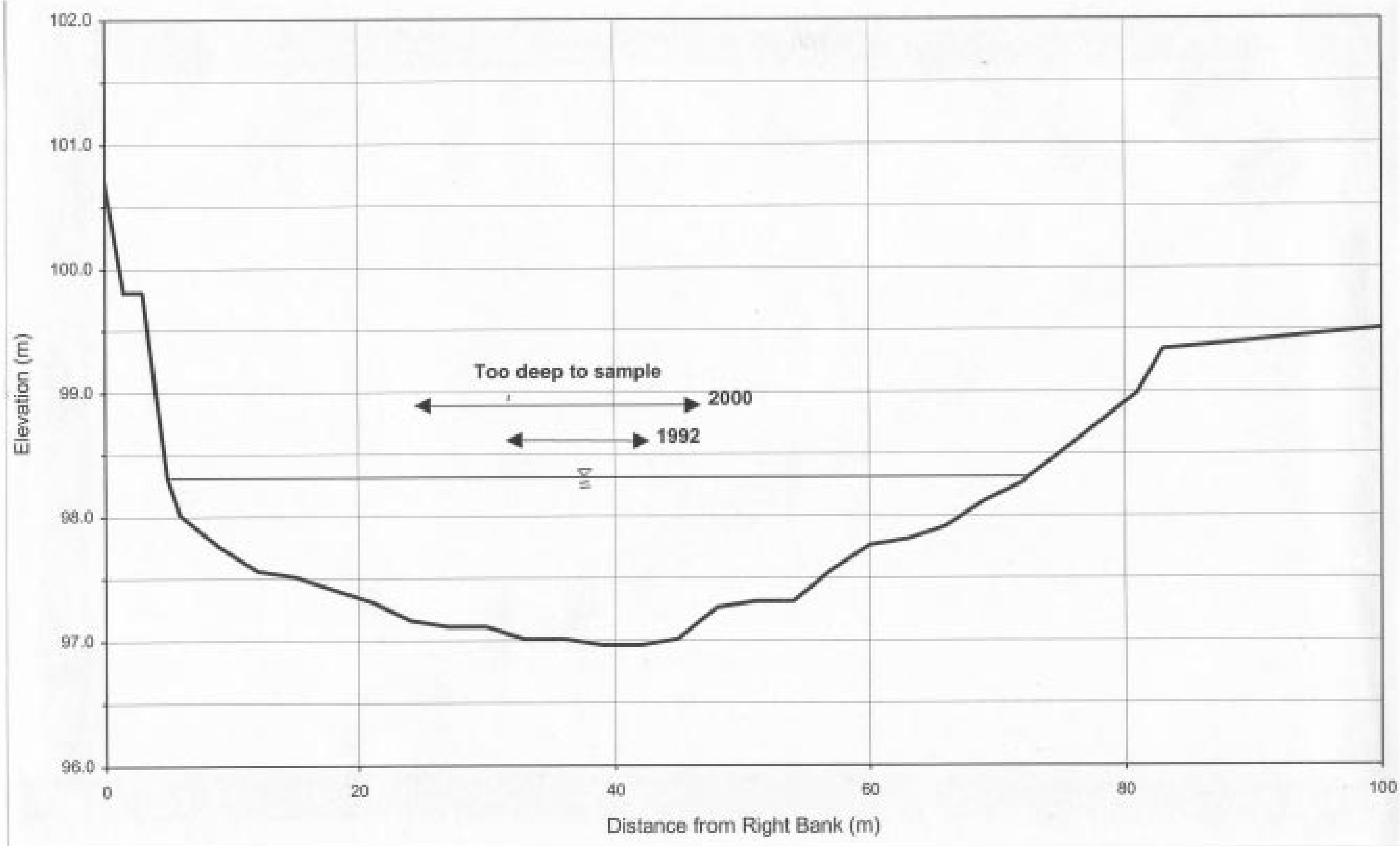

Notes:

1. Transect 1, looking upstream.
2. Vertical exaggeration approx. 10x.
3. Surveyed on 13 April, 2000.
4. Daily discharge below Cheslatta Falls: 35 m^3/s (WSC Gauge No. 08JA017).

NECHAKO RIVER SUBSTRATE PROJECT

Site 2

Channel Cross-Section

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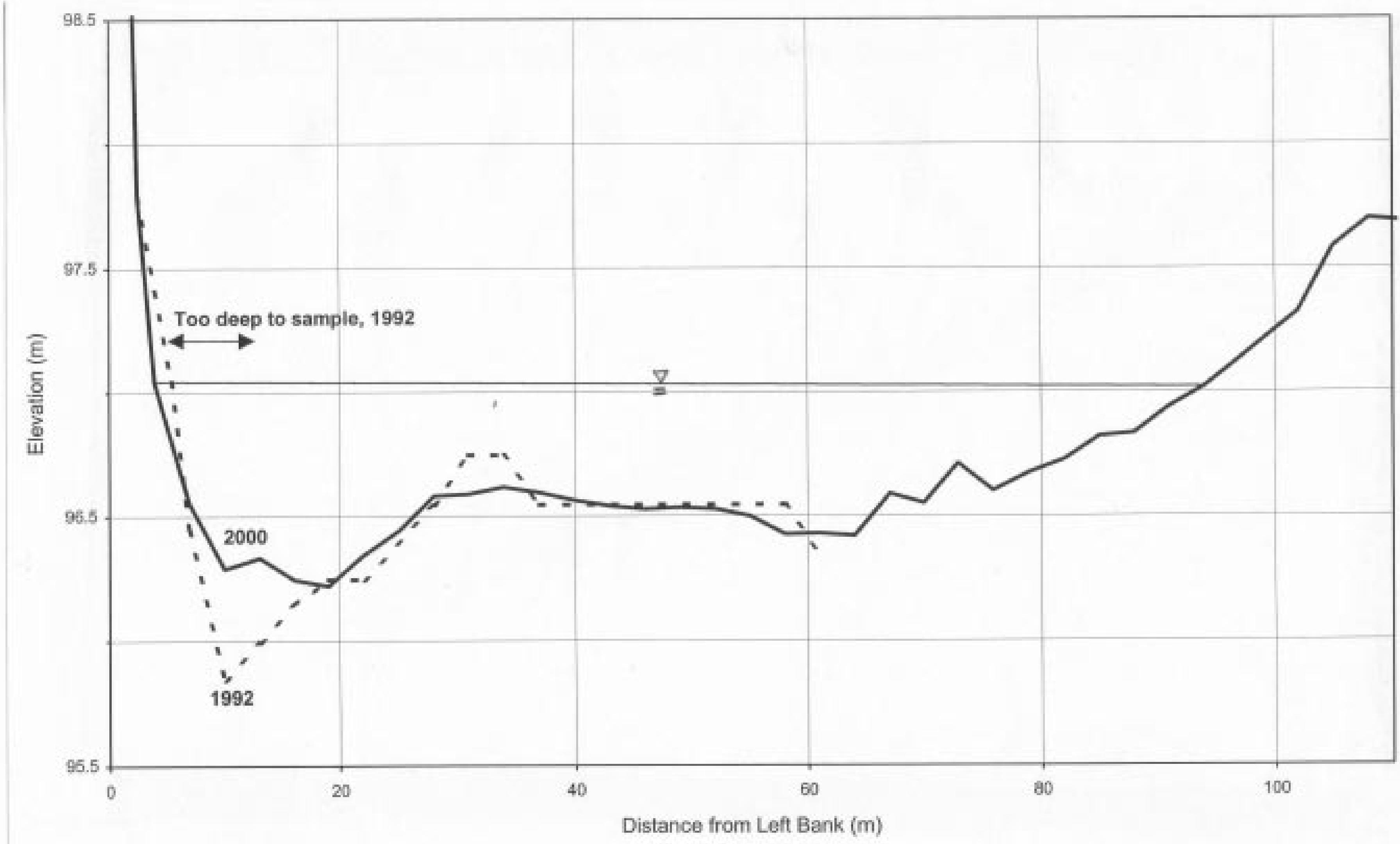

Notes:

1. Transect 2, looking downstream.
2. Vertical exaggeration approx. 20x.
3. Surveyed on 13 April, 2000.
4. 1992 cross-section approximated from sample notes, 27–29 March, 1992.
5. Daily discharge below Cheslatta Falls: 36 m^3/s in 1992 and 35 m^3/s in 2000 (WSC Gauge No. 08JA017).

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NECHAKO RIVER SUBSTRATE PROJECT

Site 3

Channel Cross-Section

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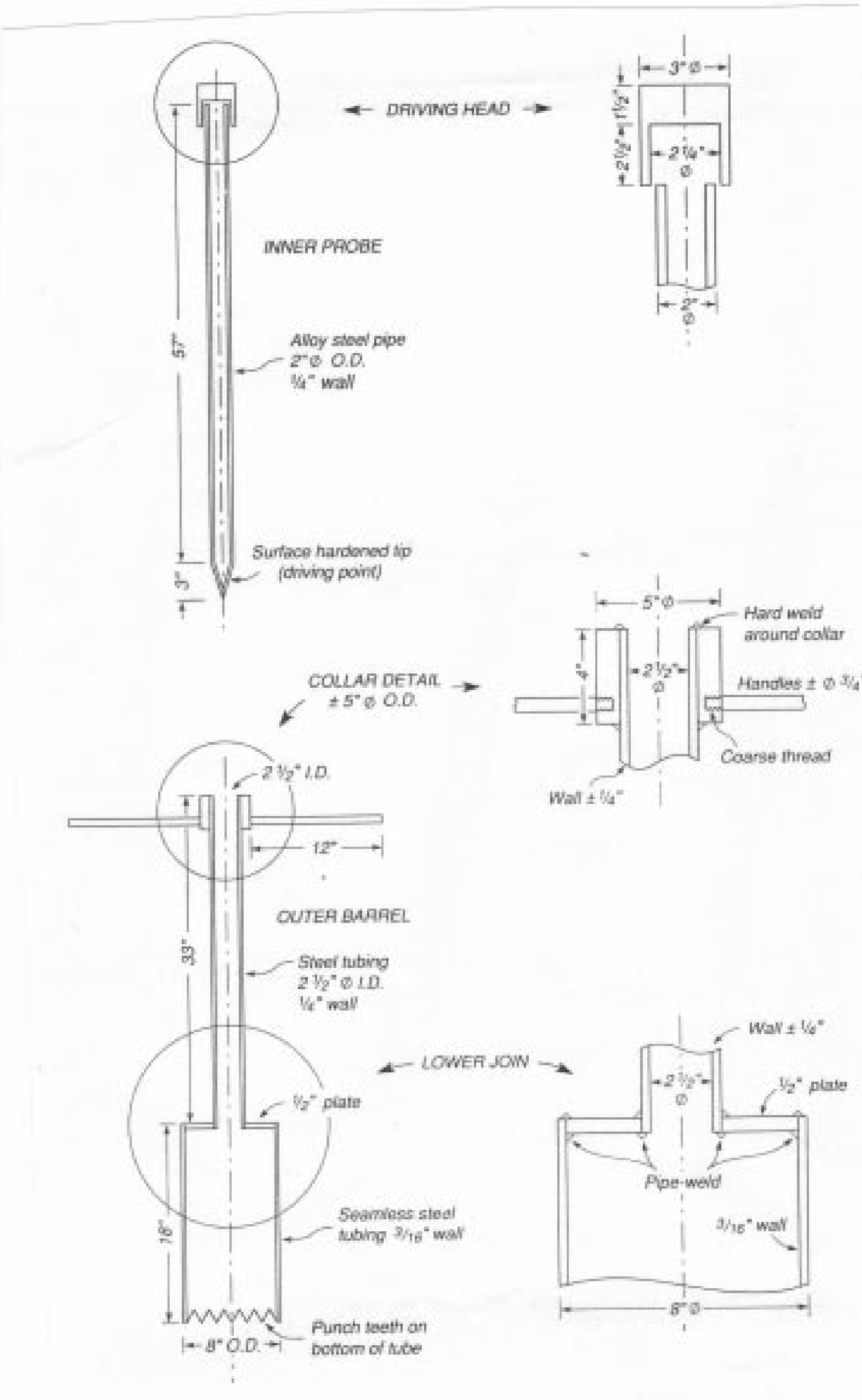
APPENDIX B

Freeze-Core Sample Collection Methods

- **Figures from Rood and Church (1994)**
- **Photos of Freeze-Core Sample Collection in 2000**



Notes:

Manufacturing Drawings for the outer barrel and inner probe of the freeze-corer. Some lines in the drawing have been shortened for compact presentation.

Source:

Rood and Church (1994), Figure 1.

NECHAKO RIVER SUBSTRATE PROJECT

Freeze-Core Sampler Drawings

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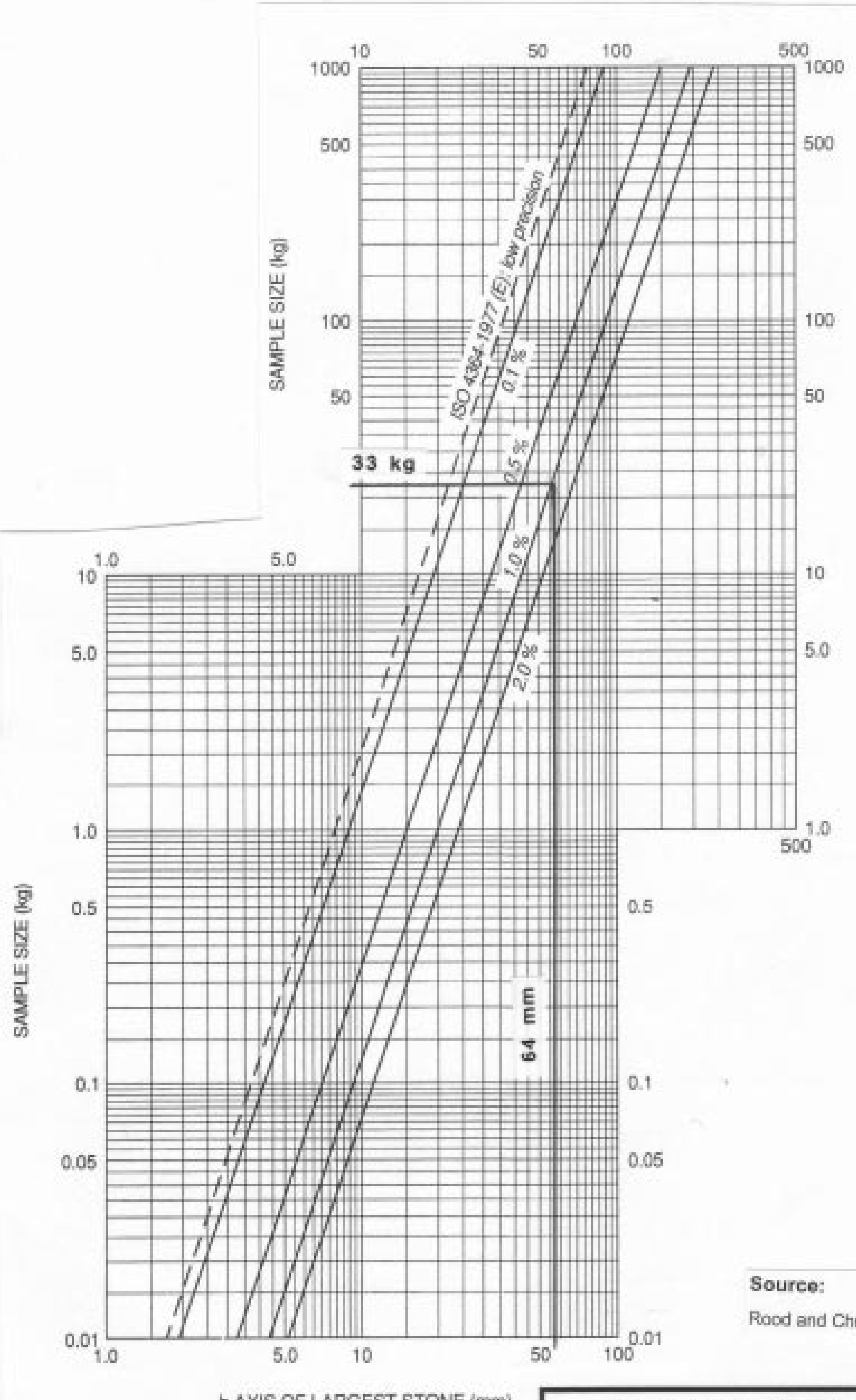
Figure B-1



Source:

Rood and Church (1994), Figure 2.

Notes:

Bulk sample standards proposed by Church et al. (1987).
The percentage assigned to the individual lines is the percent by weight of the sample that is contributed by the largest stone.

NECHAKO RIVER SUBSTRATE PROJECT

Substrate Sampling Standards

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Figure B-2

Photo 1-1. Looking up

Photo 1-2. Looking dow

pstream from Site 1.

wnstream from Site 1.

Photo 1-3. Site 1, right bank. Tra

Photo 1-4. Site 1, left bank. Transec

nsect endpoints labeled “T1” and “T2”.

t endpoints labeled “T1” and “T2”.

Photo 2-1. Looking u

Photo 2-2. Looking do

stream from Site 2.

wnstream toward Site 2.

Photo 2-3. Looking toward left bank at Site 2. Transect endpoints labeled "T1" and "T2".

Photo 2-4. Site 2, vehicle access point. Thick shore ice prevented boat launch.

Photo 3-1. Loo

Photo 3-2. Lookir

ing upstream from Site 3.

g downstream toward Site 3.

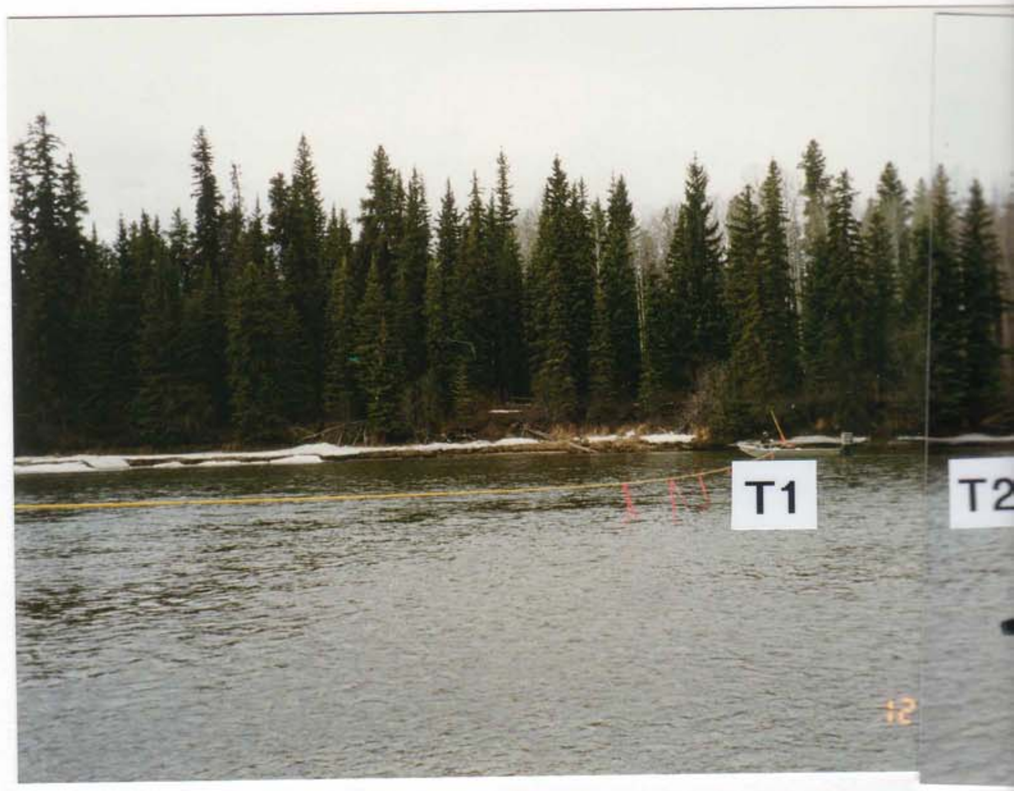


Photo 3-3. Site 3, left bank. Transec

t endpoints labeled “T1” and “T2”.

Photo 3-4. Site 3, Transect 1, left bank.

Photo 3-5. Site 3, Transect 2, left bank.

Photo 3-6. Site 3, Transect 1, right bank.

Photo 3-7. Site 3, Transect 2, right bank.

Photo B-1. Grinding outer barrel into substrate.

Photo B-2.

Pounding inner probe into substrate.

Photo B-3. Filling Dewar flasks with liquid nitrogen.

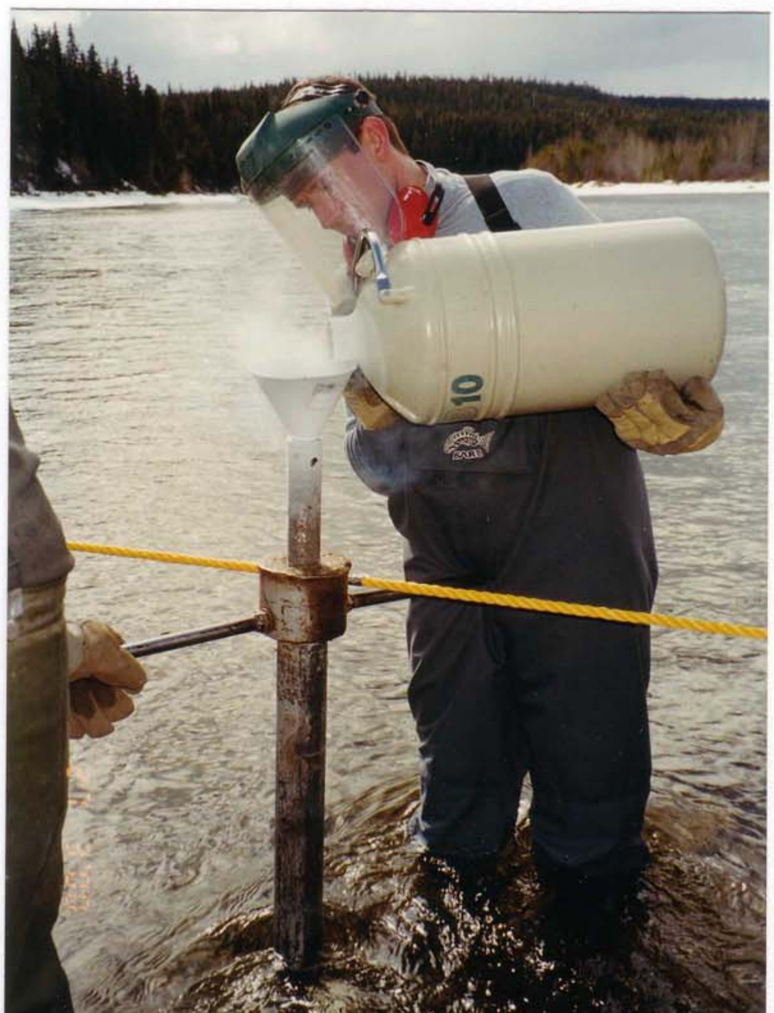


Photo B-4.

Pouring liquid nitrogen into inner probe.

Photo B-5. Boat moored to a tagline to serve as an instream working platform.

Photo B-6. Sampler pulled from substrate and lifted into boat for sample extraction.

Photo B-7. Close-up of sampler containing frozen substrate sample.

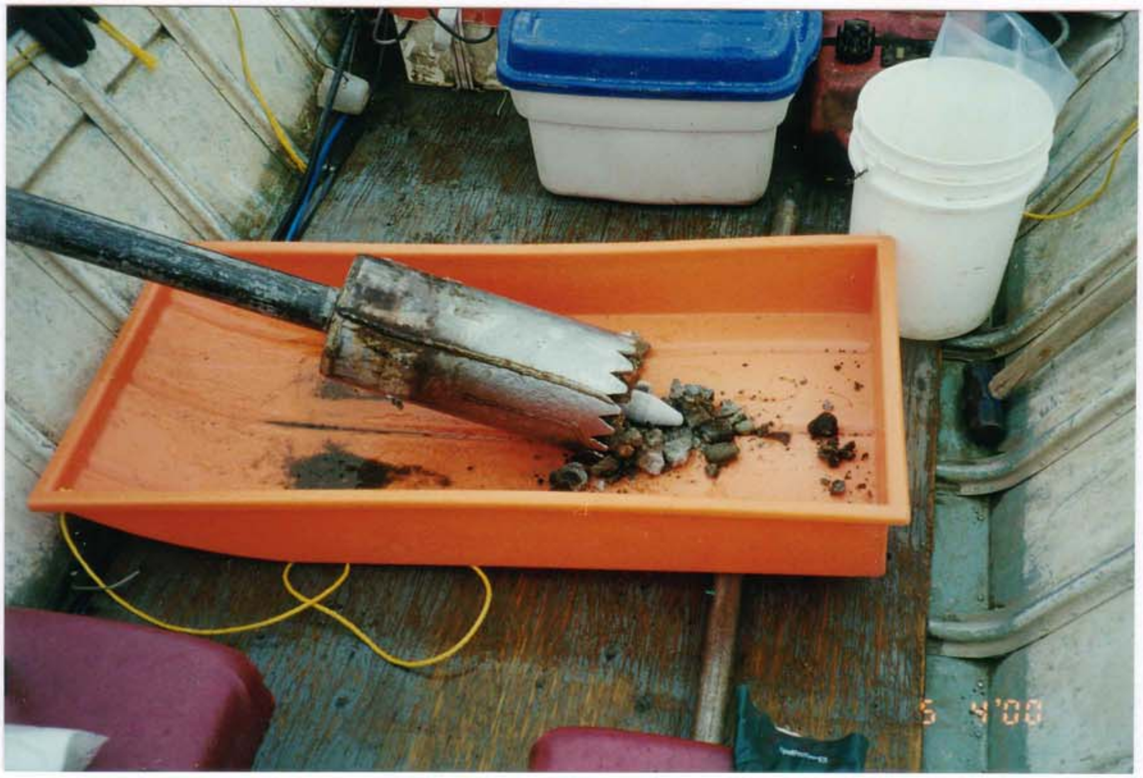
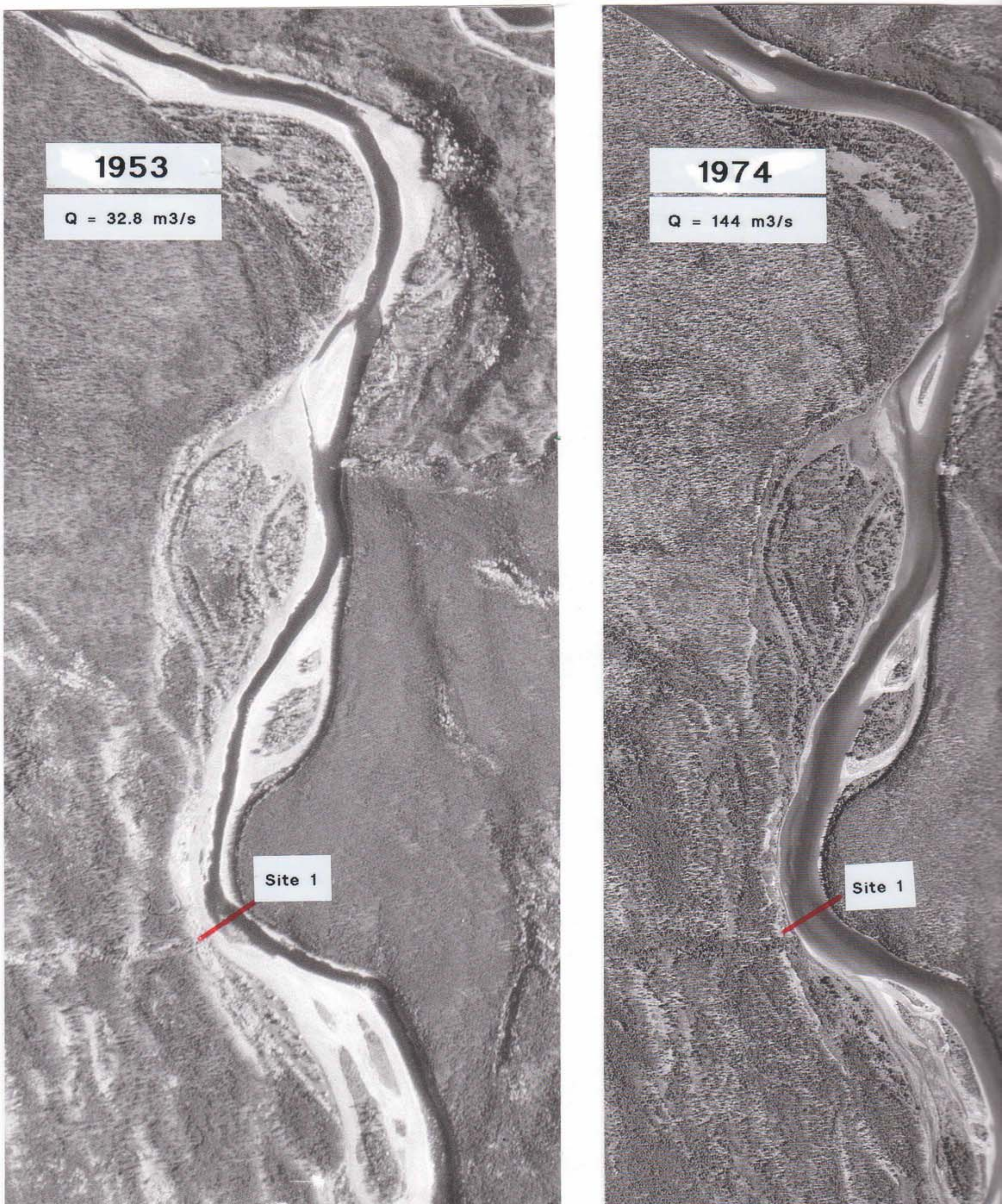
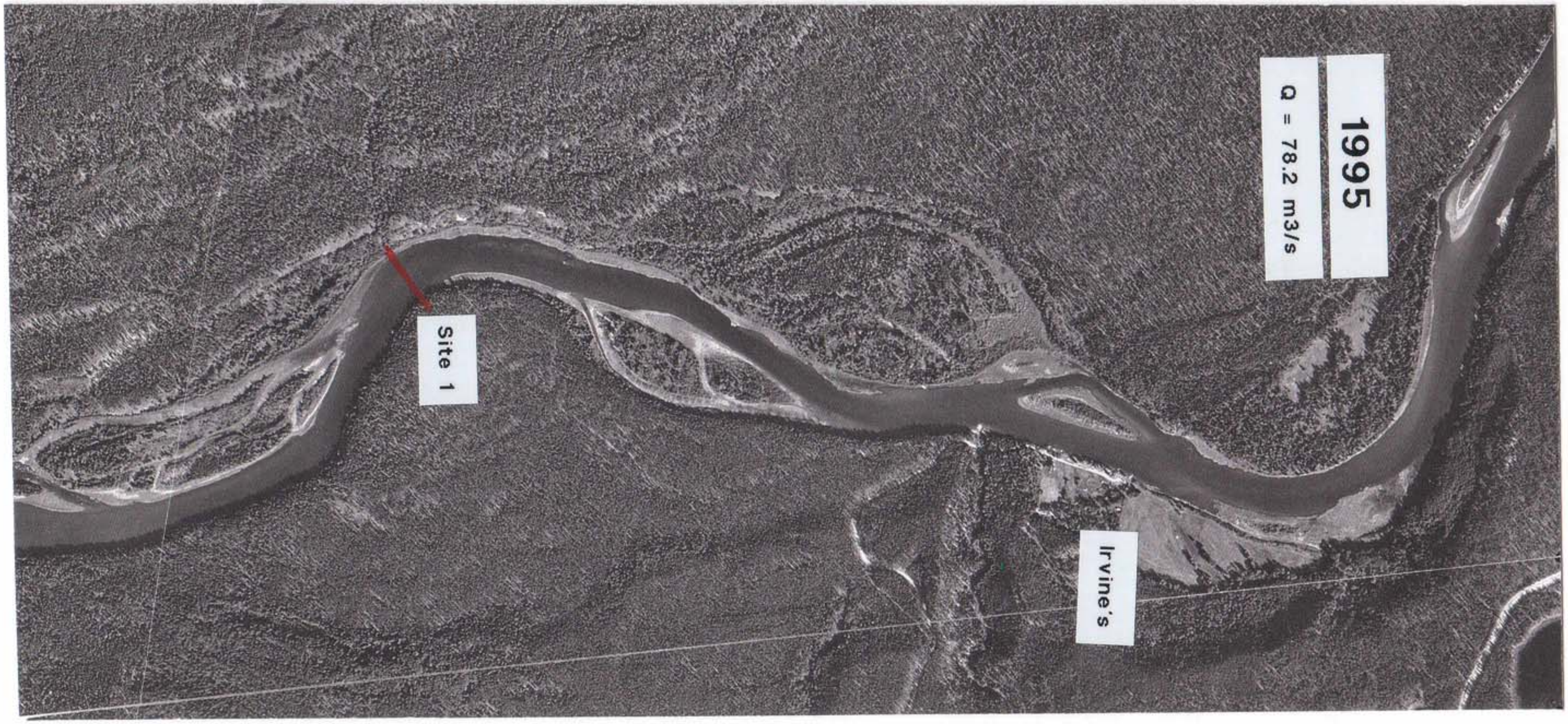


Photo B-8. Tip of inner probe exposed as it is pounded through the outer barrel to loosen frozen sample.

Photo B-9. Sample split into top and bottom halves.


1953
Q = 32.8 m3/s
Site 1
1974
Q = 144 m3/s
Site 1



Notes:

1. Approximate scale in all photos: 1:16,000.
2. River flow is from left to right.
3. Q = daily discharge at Vanderhoof (WSC Gauge No. 08JC001).

Air Photo Sources:

1953: BC 1813 #34 (Oct. 7)
1974: BC 7622 #118 (Aug. 18)
1995: BCB 95071 #77 (Aug. 30)

N

NECHAKO RIVER SUBSTRATE PROJECT

Site 1

Air Photo Sequence

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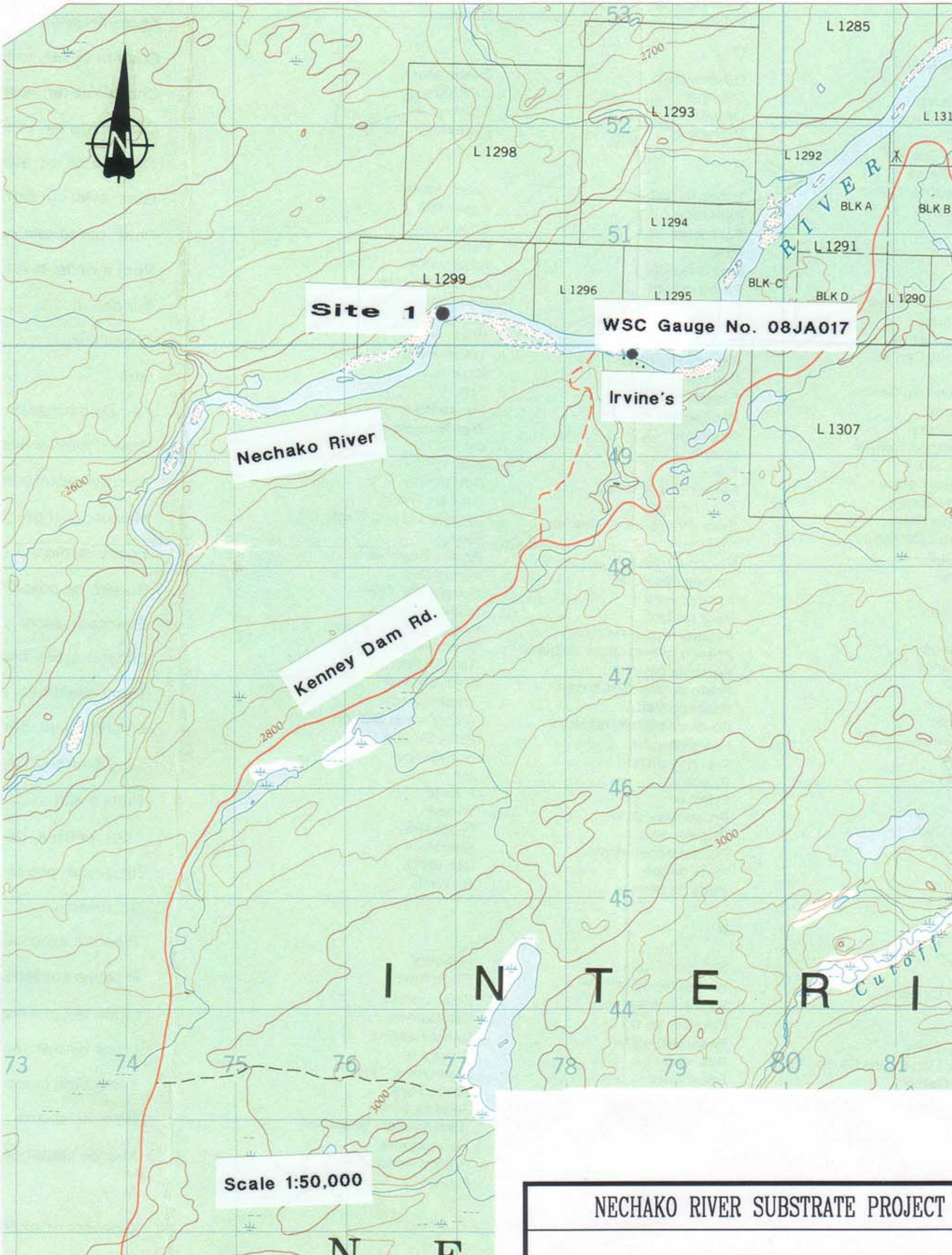

NECHAKO RIVER SUBSTRATE PROJECT

Site 1
Location Map

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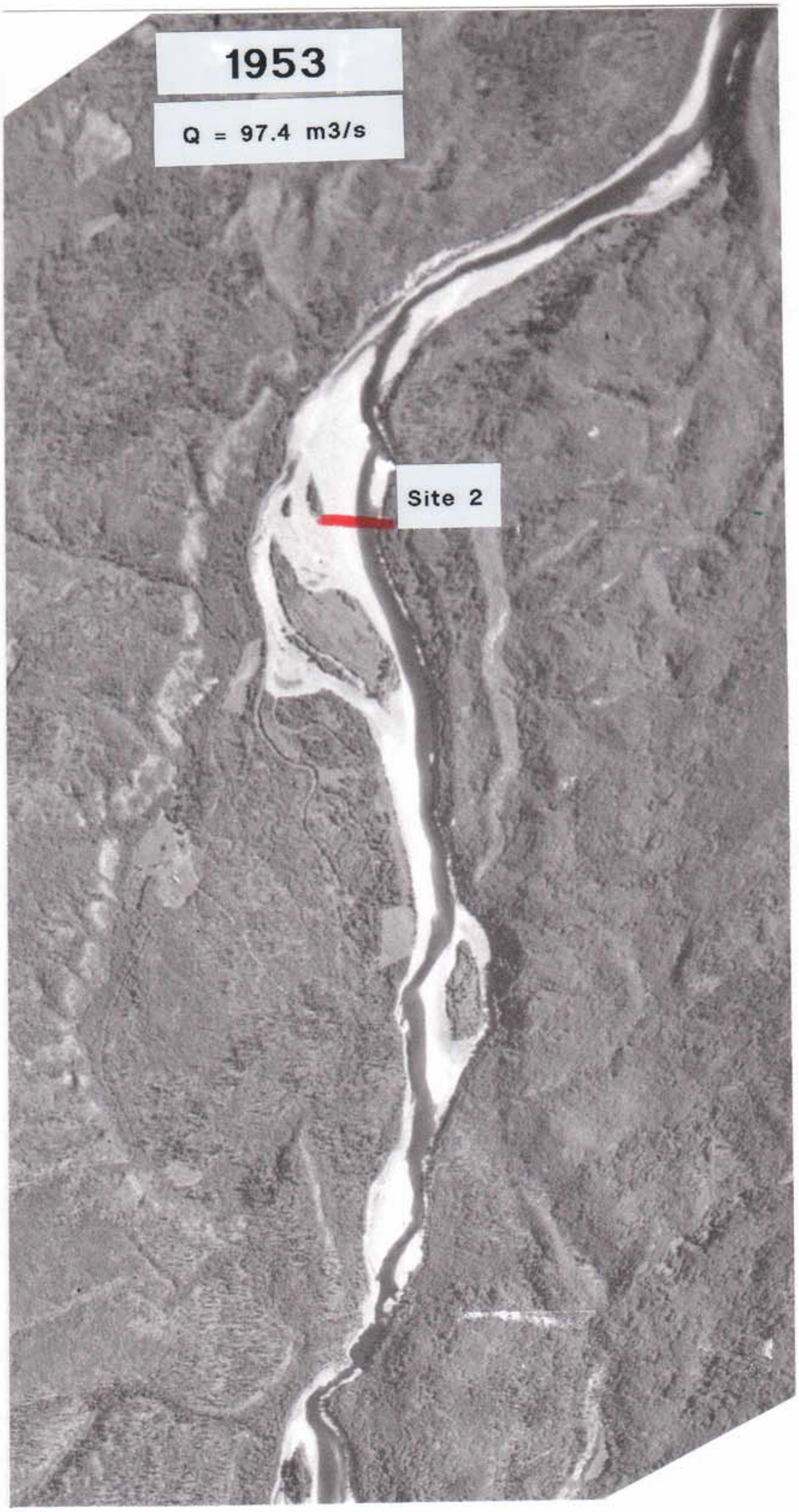
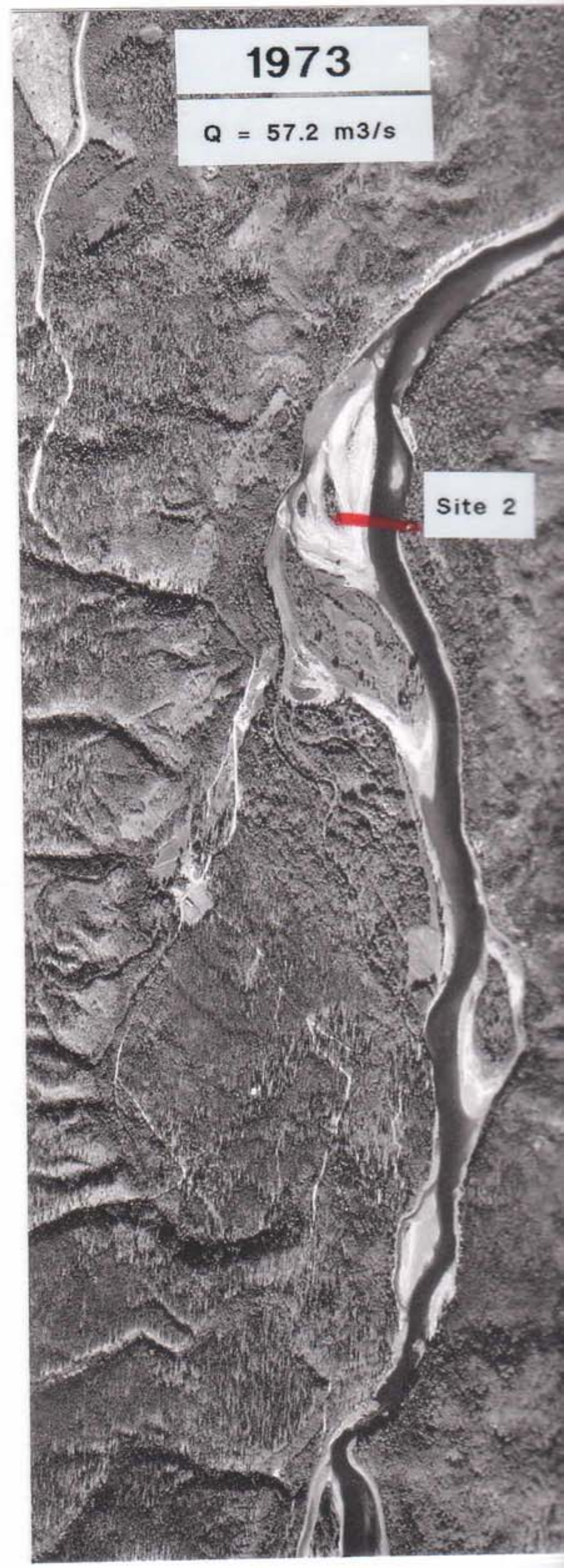
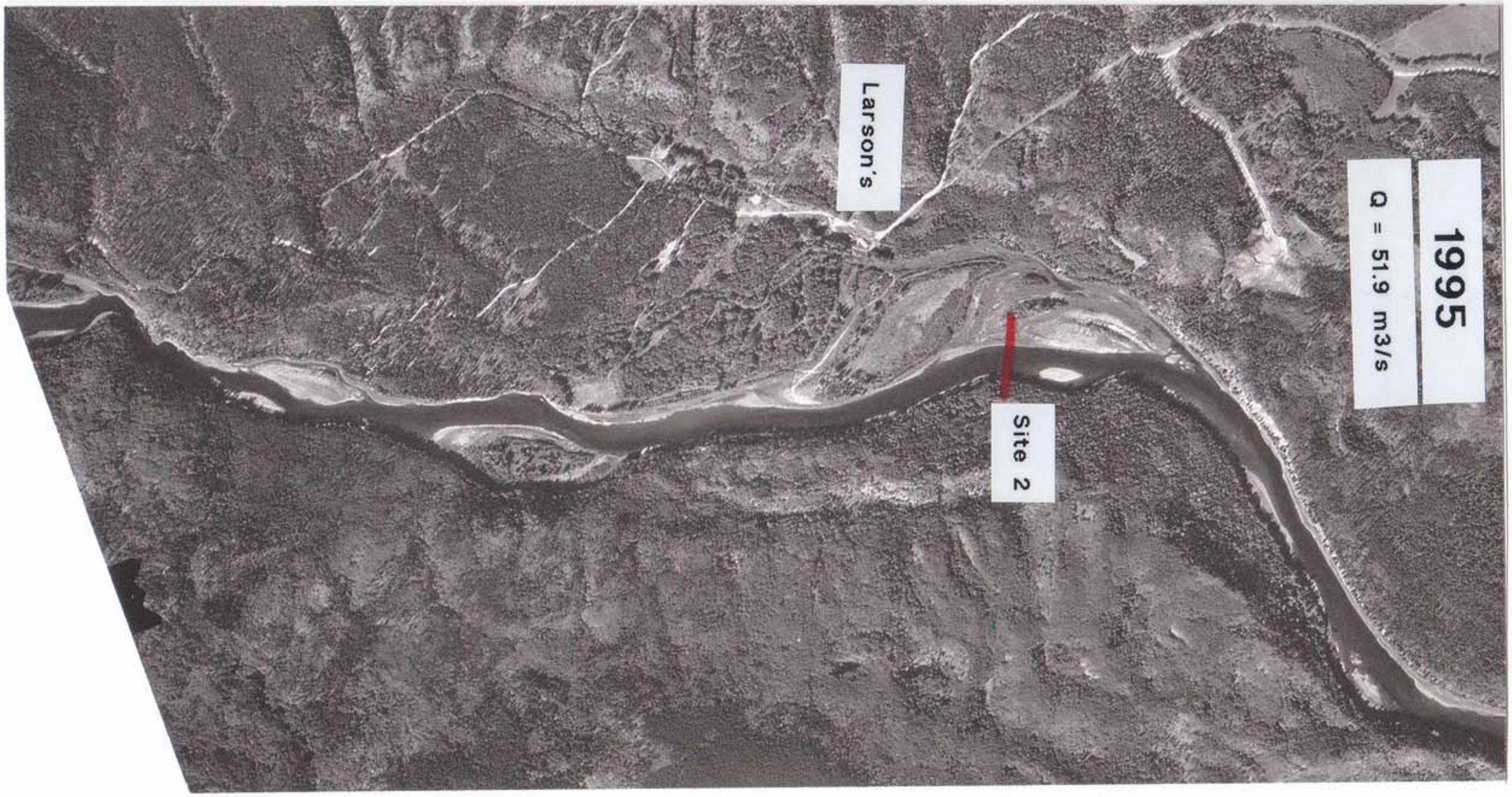

1953
Q = 97.4 m3/s
Site 2


1973
Q = 57.2 m3/s
Site 2



Notes:

1. Approximate scale in all photos: 1:16,000.
2. River flow is from left to right.
3. Q = daily discharge at Vanderhoof (WSC Gauge No. 08JC001).

Air Photo Sources:

1953: BC 1578 #2 (Jul. 7)
1974: BC 7563 #164 (Sep. 15)
1995: BCB 95101 #198 (Sep. 16)

N

NHCV

NECHAKO RIVER SUBSTRATE PROJECT

Site 2

Air Photo Sequence

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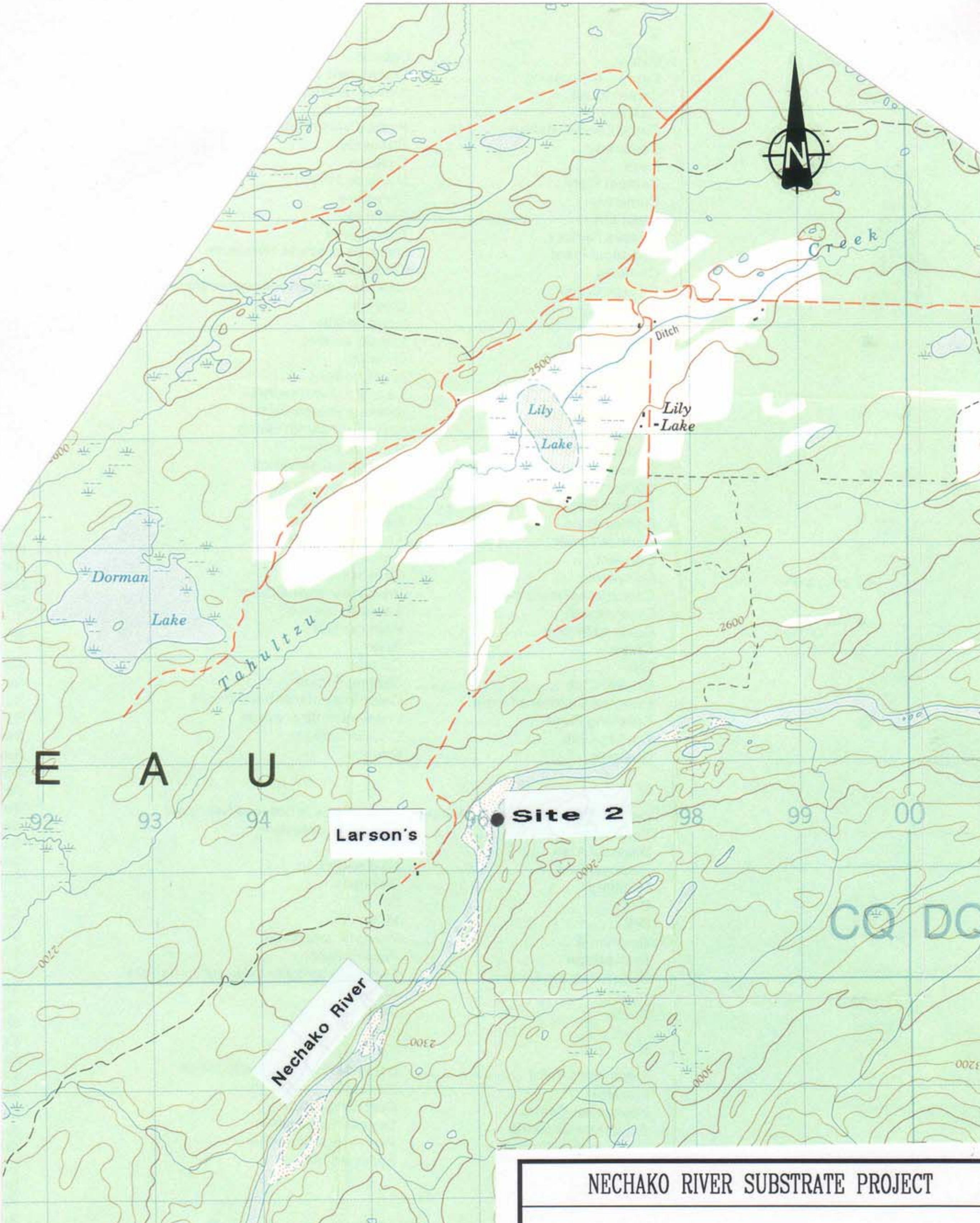

NECHAKO RIVER SUBSTRATE PROJECT

Site 2

Location Map

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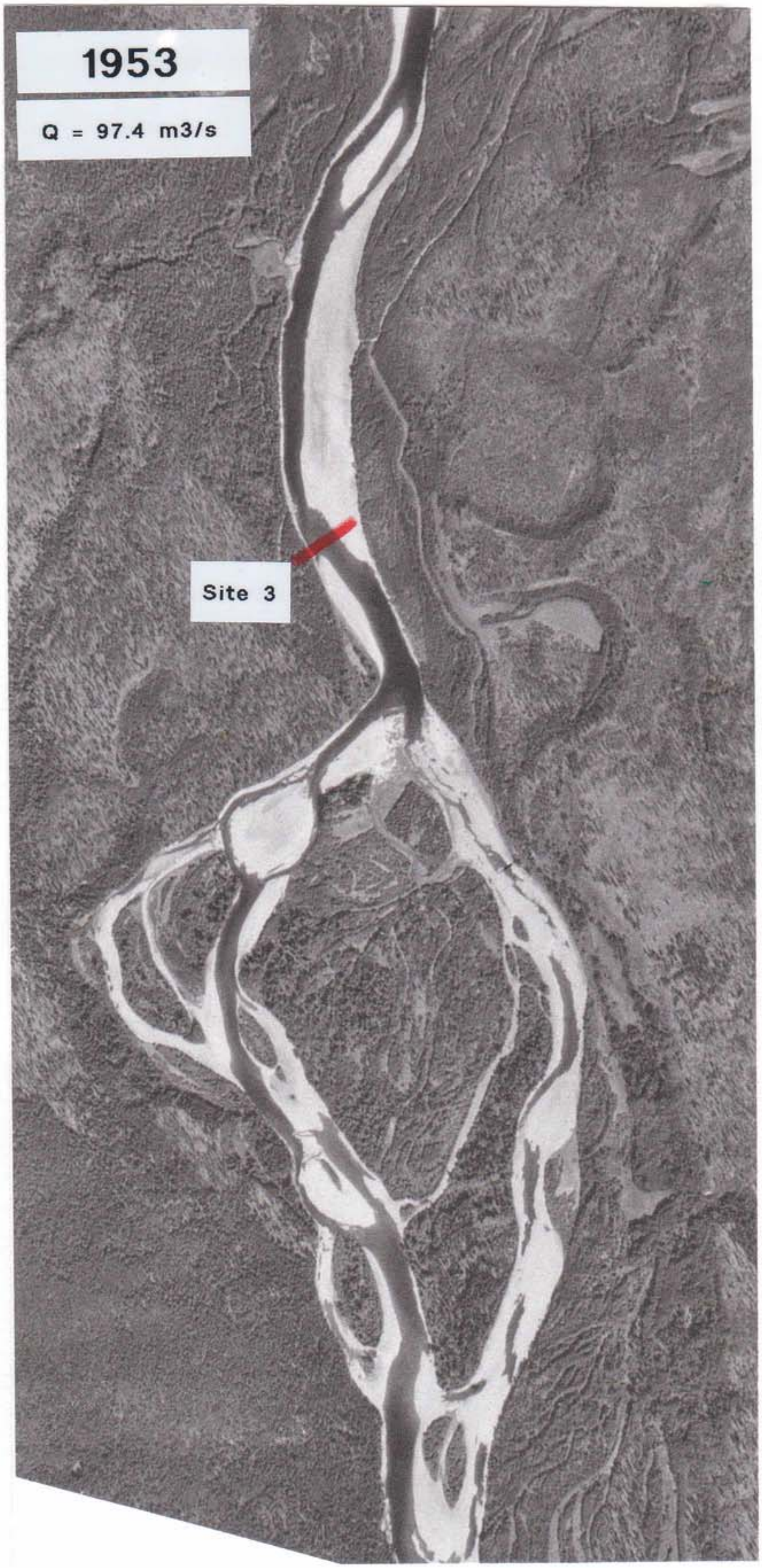
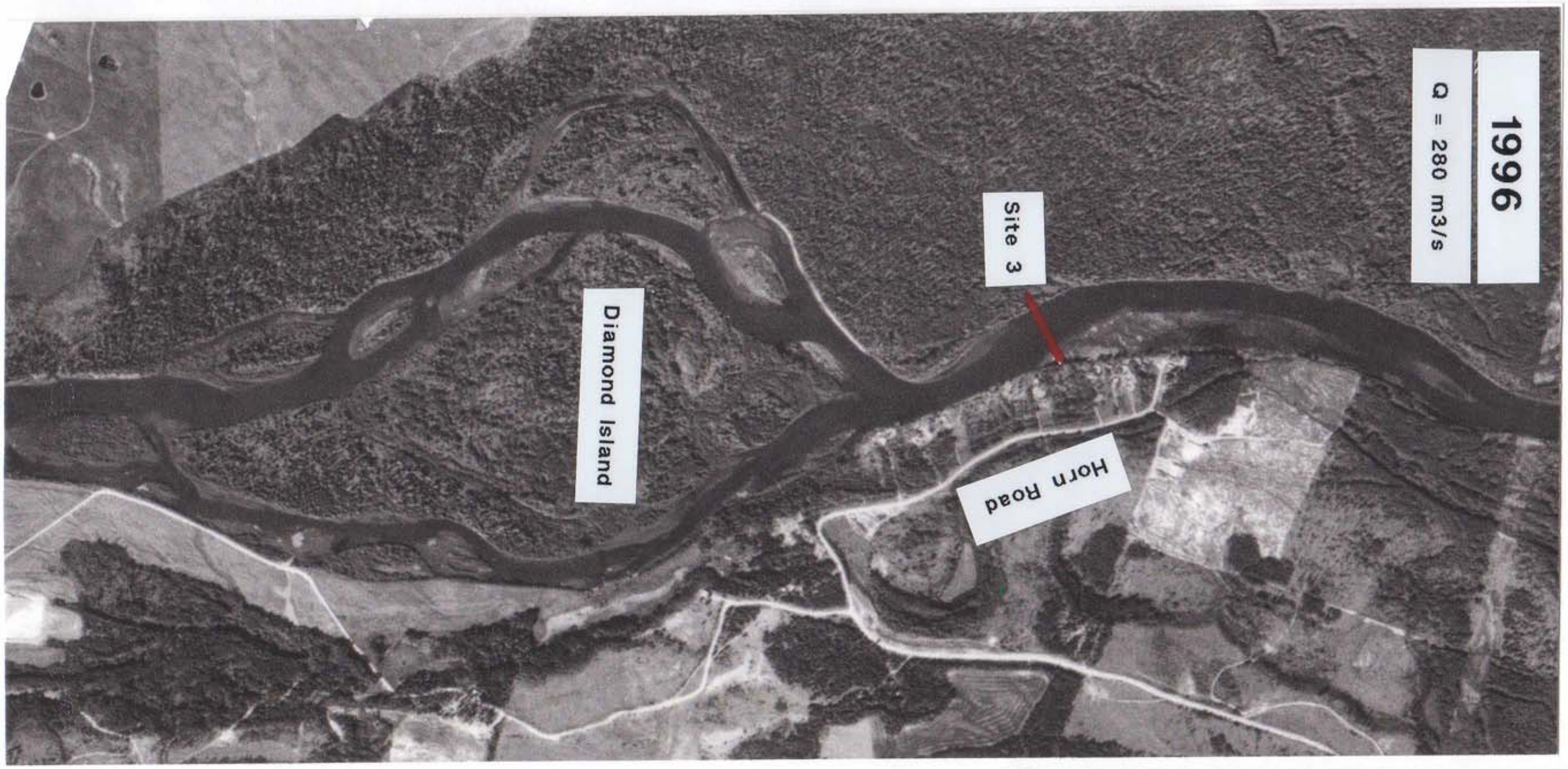
NHCV 2892-002


1953
Q = 97.4 m3/s
Site 3


1973
Q = 57.2 m3/s
Site 3



Notes:

1. Approximate scale in all photos: 1:16,000.
2. River flow is from left to right.
3. Q = daily discharge at Vanderhoof (WSC Gauge No. 08JC001).

Air Photo Sources:

1953: BC 1578 #67 (Jul. 7)
1974: BC 7559 #221 (Sep. 15)
1995: BCB 96004 #111 (Jul. 7)

N

NHCV

NECHAKO RIVER SUBSTRATE PROJECT

Site 3

Air Photo Sequence

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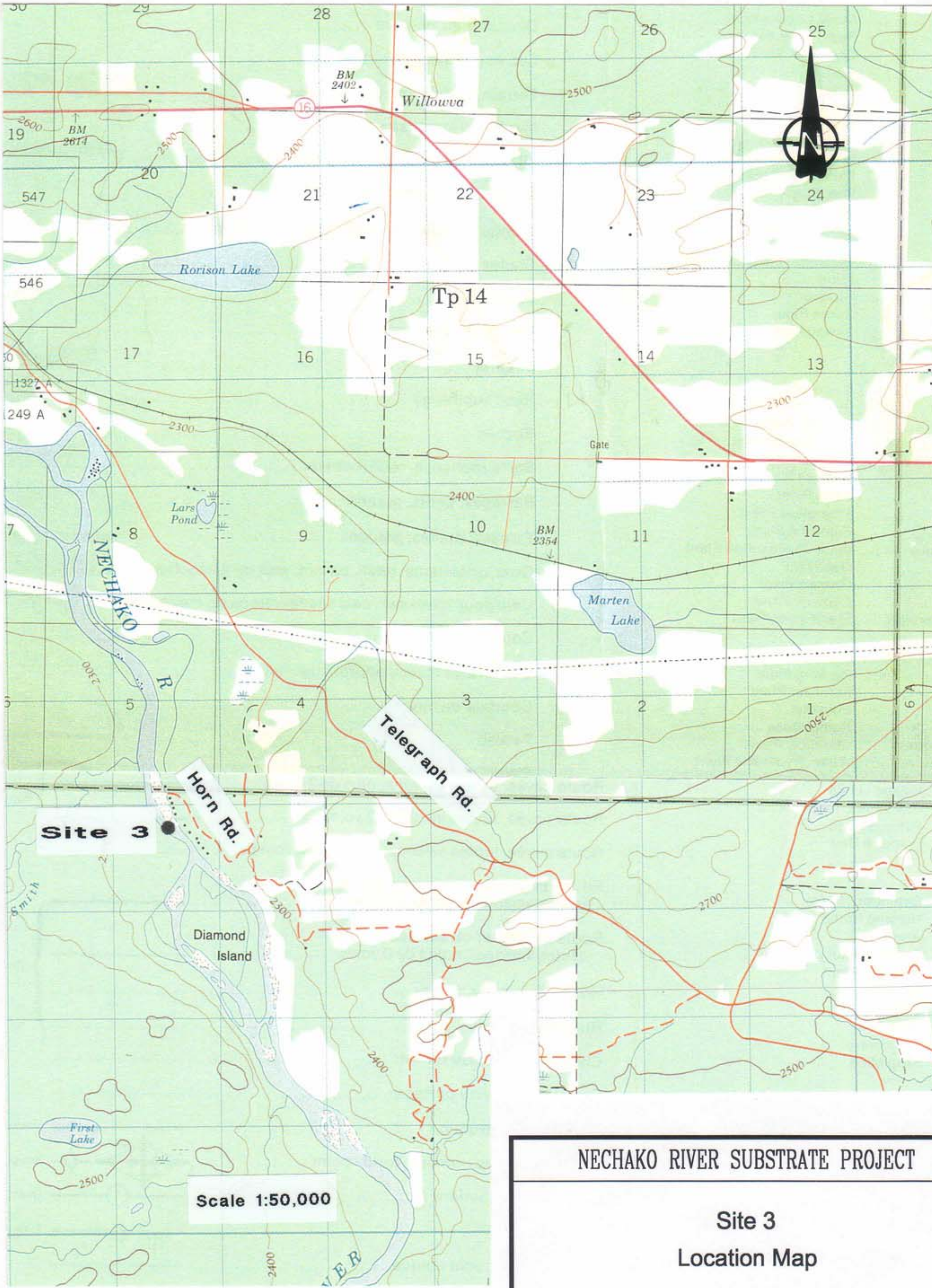

NECHAKO RIVER SUBSTRATE PROJECT

Site 3

Location Map

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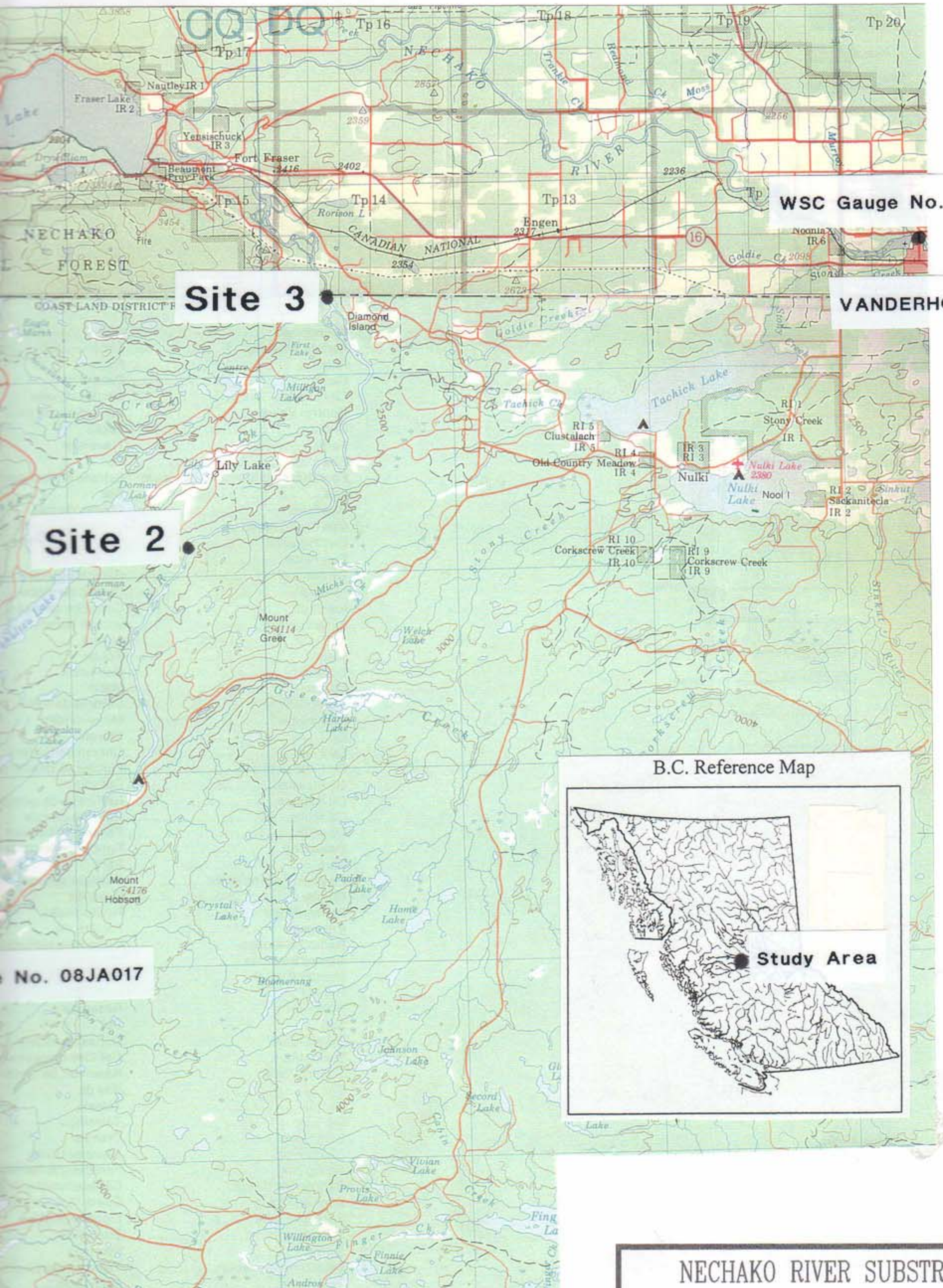
NHCV 2892-002

NHCV2892-001



NECHAKO RIVER SUBSTRATE PROJECT

Substrate Sampling

Site Locations

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APPENDIX C

Nechako River Substrate Sample Data

APPENDIX C
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
1992	1	1	25	T	1	9,120	6,859	22.23	3.99	1.01	0.27
1992	1	1	28	T	1	8,668	7,976	27.34	7.34	2.52	0.15
1992	1	1	28	B	0	4,573	4,573	30.45	9.80	3.52	0.29
1992	1	1	34	T	1	4,198	2,233	6.15	1.07	0.32	0.01
1992	1	1	34	B	1	6,612	4,393	15.67	2.85	0.81	0.15
1992	1	1	40	T	0	11,183	11,183	25.00	8.43	2.98	0.13
1992	1	1	43	T	0	6,387	6,387	14.16	2.03	0.53	0.05
1992	1	1	46	T	0	6,443	6,443	26.43	9.47	3.12	0.18
1992	1	1	46	B	0	6,389	6,389	17.26	3.92	1.27	0.04
1992	1	1	49	T	1	9,703	9,143	15.92	3.45	1.09	0.16
1992	1	1	52	T	0	5,192	5,192	17.42	4.36	1.46	0.02
1992	1	1	52	B	0	6,906	6,906	31.95	10.85	5.79	0.25
1992	1	1	55	T	1	7,164	6,619	32.70	10.50	3.76	0.05
1992	1	1	55	B	0	7,785	7,785	37.59	16.26	6.04	0.42
1992	1	1	58	T	0	6,937	6,937	25.68	6.71	2.73	0.17
1992	1	1	58	B	1	9,181	8,599	36.76	15.61	7.93	0.37
1992	1	1	61	T	0	7,194	7,194	27.64	7.63	3.13	0.06
1992	1	1	61	B	1	6,495	5,010	44.38	19.16	9.20	0.52
1992	1	1	64	T	0	7,808	7,808	31.66	11.30	4.39	0.23
1992	1	1	64	B	0	5,468	5,468	46.33	23.20	12.46	0.53
1992	1	1	67	T	0	6,332	6,332	36.17	13.11	3.85	0.12
1992	1	1	67	B	1	6,204	5,390	42.82	18.30	8.68	0.43
1992	1	1	70	T	0	9,581	9,581	33.45	13.98	5.67	0.18
1992	1	1	73	T	0	6,792	6,792	35.18	12.46	2.97	0.23
1992	1	1	73	B	1	5,388	4,723	39.30	19.29	7.29	0.29
1992	1	1	76	T	0	7,213	7,213	25.28	9.96	3.37	0.22
1992	1	1	76	B	0	5,627	5,627	37.15	17.47	5.27	0.26
1992	1	1	79	T	0	7,472	7,472	32.85	13.77	3.86	0.13
1992	1	1	79	B	0	6,601	6,601	33.52	18.17	7.31	0.45
1992	1	1	82	T	0	3,658	3,658	9.54	2.35	0.57	0.02
1992	1	1	82	B	1	7,720	5,802	33.56	16.19	5.66	0.34
1992	1	1	85	T	1	4,935	3,872	16.81	4.80	1.04	0.05
1992	1	1	85	B	1	7,494	6,587	39.08	18.37	5.13	0.35
1992	1	1	88	T	1	4,365	1,426	12.20	2.59	0.59	0.07
1992	1	1	88	B	1	7,538	6,966	36.26	15.48	3.76	0.25
1992	1	1	91	T	1	9,194	8,752	26.79	11.83	3.67	0.17
1992	1	1	91	B	1	5,499	4,732	41.31	22.67	6.11	0.42
1992	1	1	94	T	1	7,569	5,509	23.64	8.62	2.89	0.25
1992	1	1	94	B	0	5,697	5,697	43.99	21.62	8.58	0.43
1992	1	1	97	T	1	6,874	2,714	29.41	13.00	4.76	0.20
1992	1	1	97	B	1	9,764	7,593	30.58	14.52	4.06	0.14
1992	1	2	38	T	1	13,366	7,579	16.15	2.96	1.06	0.16
1992	1	2	44	T	1	8,880	8,423	31.54	12.14	4.74	0.31
1992	1	2	44	B	1	5,375	4,582	48.40	23.04	6.53	0.23
1992	1	2	50	T	0	7,789	7,789	32.55	10.85	4.32	0.11
1992	1	2	50	B	0	7,554	7,554	39.02	17.95	6.77	0.23
1992	1	2	56	T	0	6,446	6,446	23.70	8.00	3.06	0.18
1992	1	2	56	B	1	6,975	6,357	40.03	17.51	8.42	0.42
1992	1	2	62	T	0	8,276	8,276	31.51	11.09	3.83	0.11
1992	1	2	62	B	0	5,673	5,673	36.91	16.64	7.70	0.23

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
1992	1	2	68	T	1	6,568	5,994	31.89	12.10	3.93	0.21
1992	1	2	68	B	0	6,199	6,199	45.73	23.52	11.37	0.68
1992	1	2	74	T	0	7,394	7,394	28.87	12.68	4.43	0.14
1992	1	2	77	T	1	6,416	5,902	27.08	8.72	2.72	0.21
1992	1	2	77	B	1	6,987	5,664	39.92	19.65	7.40	0.21
1992	1	2	83	T	1	8,587	6,537	30.94	11.95	2.98	0.16
1992	1	2	89	T	1	5,718	3,916	8.67	2.78	0.85	0.04
1992	1	2	89	B	1	6,098	2,996	43.82	22.28	7.50	0.76
1992	1	2	95	T	1	14,100	7,765	35.15	18.25	5.31	0.35
1992	2	1	12	T	0	8,014	8,014	29.17	9.17	2.45	0.14
1992	2	1	12	B	0	8,915	8,915	35.07	13.96	5.14	0.39
1992	2	1	15	T	0	8,199	8,199	22.44	6.83	2.14	0.23
1992	2	1	15	B	0	9,147	9,147	41.61	16.39	7.94	0.86
1992	2	1	18	T	1	9,898	8,284	25.24	7.99	3.03	0.41
1992	2	1	18	B	0	7,300	7,300	39.77	16.94	4.48	0.45
1992	2	1	21	T	1	7,340	5,991	16.04	5.44	1.16	0.08
1992	2	1	21	B	1	7,457	6,879	37.64	17.70	3.20	0.37
1992	2	1	24	T	1	7,671	7,128	26.09	9.68	2.22	0.24
1992	2	1	24	B	0	7,376	7,376	39.64	20.19	4.53	0.18
1992	2	1	27	T	1	12,946	11,127	29.27	13.37	4.76	0.17
1992	2	1	48	T	0	5,721	5,721	26.81	12.13	4.25	0.05
1992	2	1	48	B	0	7,229	7,229	37.31	18.73	7.36	0.19
1992	2	1	51	T	0	10,256	10,256	27.78	12.63	5.14	0.13
1992	2	1	51	B	0	5,901	5,901	34.53	14.73	3.40	0.12
1992	2	1	54	T	1	8,242	7,655	55.86	49.69	23.35	0.24
1992	2	1	54	B	1	7,663	6,523	29.89	16.81	6.94	0.16
1992	2	1	57	T	0	7,059	7,059	7.35	2.10	0.74	0.05
1992	2	1	57	B	0	8,630	8,630	27.46	8.98	2.40	0.15
1992	2	1	60	T	0	7,618	7,618	19.62	9.72	3.38	0.03
1992	2	1	60	B	1	7,564	7,173	25.74	14.73	5.70	0.11
1992	2	1	63	T	1	7,479	6,907	16.46	5.75	1.62	1.10
1992	2	1	63	B	0	6,896	6,896	33.65	13.69	5.31	0.22
1992	2	1	66	T	0	8,708	8,708	36.44	25.80	13.78	0.04
1992	2	1	66	B	0	7,953	7,953	42.11	20.73	9.85	0.37
1992	2	1	69	T	0	7,250	7,250	26.20	12.01	4.22	0.07
1992	2	1	69	B	0	9,066	9,066	49.19	28.63	10.64	0.09
1992	2	1	72	T	0	7,482	7,482	23.43	10.66	5.83	0.04
1992	2	1	72	B	0	4,682	4,682	49.69	30.10	13.88	0.15
1992	2	2	12	T	0	5,843	5,843	9.99	1.29	0.26	0.02
1992	2	2	12	B	0	10,352	10,352	35.09	15.65	4.76	0.58
1992	2	2	15	T	0	8,619	8,619	30.38	11.34	3.64	0.33
1992	2	2	15	B	0	8,036	8,036	48.04	18.19	4.38	0.42
1992	2	2	18	T	0	6,479	6,479	10.98	1.55	0.39	0.12
1992	2	2	18	B	1	9,754	9,301	29.05	9.77	1.75	0.24
1992	2	2	21	T	1	5,818	5,329	9.11	1.84	0.30	0.02
1992	2	2	21	B	1	8,162	7,571	25.65	8.63	2.20	0.24
1992	2	2	24	T	1	8,918	7,811	14.87	3.12	0.52	0.06
1992	2	2	27	T	1	6,832	4,910	13.87	4.51	0.81	0.05
1992	2	2	27	B	0	7,490	7,490	37.44	14.86	3.63	0.17
1992	2	2	28.5	T	1	9,191	8,580	31.96	12.30	2.55	0.21

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
1992	2	2	28.5	B	0	6,896	6,896	41.46	20.36	7.24	0.30
1992	2	2	30	T	1	9,143	7,986	20.58	5.36	1.11	0.15
1992	2	2	30	B	0	7,551	7,551	37.97	16.56	5.65	0.48
1992	2	2	31.5	T	1	6,615	6,159	32.92	13.80	3.82	0.16
1992	2	2	31.5	B	1	7,887	7,300	36.62	15.97	5.14	0.29
1992	2	2	33	T	1	8,461	7,004	22.58	8.61	2.25	0.05
1992	2	2	33	B	0	8,452	8,452	31.08	14.27	6.57	0.35
1992	2	2	54	T	0	7,632	7,632	36.76	23.55	8.17	0.15
1992	2	2	54	B	0	8,542	8,542	33.96	20.52	9.57	0.21
1992	2	2	55.5	T	0	6,944	6,944	61.24	48.53	14.92	0.01
1992	2	2	55.5	B	0	8,146	8,146	27.91	18.45	6.53	0.15
1992	2	2	57	T	1	7,250	6,444	28.71	10.83	3.59	0.11
1992	2	2	57	B	1	9,336	8,493	29.84	18.14	7.22	0.19
1992	2	2	58.5	T	0	13,979	13,979	10.45	5.42	3.37	0.11
1992	2	2	60	T	0	5,743	5,743	9.38	0.66	0.24	0.03
1992	2	2	60	B	1	7,947	6,333	32.81	10.47	4.44	0.23
1992	2	2	61.5	T	0	8,432	8,432	23.22	10.90	5.35	0.09
1992	2	2	61.5	B	1	7,851	7,590	43.52	35.09	15.08	0.12
1992	2	2	63	T	0	10,416	10,416	30.36	10.65	4.21	0.12
1992	2	2	63	B	1	6,400	5,752	43.01	22.84	6.82	0.44
1992	2	2	64.5	T	0	8,671	8,671	17.80	6.77	2.87	0.07
1992	2	2	64.5	B	1	5,033	4,621	38.01	15.08	5.70	0.19
1992	2	2	66	T	0	8,490	8,490	19.41	6.50	2.53	0.06
1992	2	2	66	B	0	7,861	7,861	35.17	15.27	6.11	0.28
1992	2	2	69	T	1	7,458	6,946	3.89	0.27	0.04	0.00
1992	2	2	69	B	1	9,430	8,961	25.54	7.89	1.87	0.32
1992	2	2	72	T	0	9,059	9,059	32.09	10.71	4.37	0.25
1992	2	2	72	B	0	8,015	8,015	36.62	14.23	4.09	0.19
1992	3	1	0	T	1	11,213	8,940	14.95	4.26	1.28	0.14
1992	3	1	3	T	1	13,763	9,699	20.25	8.21	3.09	0.18
1992	3	1	6	T	1	6,860	5,636	5.75	0.61	0.08	0.01
1992	3	1	6	B	1	9,262	8,409	29.93	10.06	3.62	0.34
1992	3	1	7.5	T	1	7,927	6,459	12.47	3.57	1.39	1.10
1992	3	1	7.5	B	1	6,765	6,181	27.87	11.69	4.74	0.18
1992	3	1	9	T	0	8,062	8,062	11.46	2.59	1.32	0.05
1992	3	1	9	B	1	8,817	8,090	28.22	10.93	5.08	0.26
1992	3	1	10.5	T	1	9,870	8,983	18.13	5.35	2.16	0.05
1992	3	1	10.5	B	1	8,600	7,353	37.63	19.93	8.27	0.28
1992	3	1	12	T	0	8,672	8,672	14.54	5.28	1.70	0.07
1992	3	1	12	B	1	8,171	6,946	36.68	15.68	5.03	0.44
1992	3	1	15	T	0	8,047	8,047	20.49	5.39	2.16	0.11
1992	3	1	15	B	0	6,184	6,184	31.19	10.76	2.99	0.20
1992	3	1	18	T	1	9,715	9,067	26.70	9.23	3.24	0.12
1992	3	1	18	B	1	8,392	7,741	38.12	20.12	5.81	0.19
1992	3	1	21	T	0	10,454	10,454	25.59	8.52	3.16	0.13
1992	3	1	21	B	0	6,577	6,577	35.43	18.46	5.33	0.02
1992	3	1	24	T	0	10,015	10,015	29.04	10.82	3.32	0.12
1992	3	1	24	B	0	6,857	6,857	38.30	20.43	6.38	0.08
1992	3	1	27	T	0	10,790	10,790	30.36	10.96	4.05	0.06
1992	3	1	27	B	0	6,607	6,607	45.17	22.05	7.93	0.35

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
1992	3	1	30	T	0	9,263	9,263	25.10	8.09	3.18	0.09
1992	3	1	30	B	0	7,636	7,636	44.23	21.84	8.72	0.16
1992	3	1	33	T	0	10,772	10,772	28.69	11.51	4.62	0.02
1992	3	1	33	B	0	6,831	6,831	40.87	21.06	10.00	0.22
1992	3	1	36	T	1	8,767	8,110	23.74	8.68	2.58	0.05
1992	3	1	36	B	0	7,865	7,865	44.14	21.33	7.84	0.11
1992	3	1	39	T	0	8,362	8,362	36.84	15.89	4.04	0.04
1992	3	1	39	B	0	7,345	7,345	44.14	21.03	6.97	0.06
1992	3	1	42	T	0	9,721	9,721	27.63	10.23	3.43	0.14
1992	3	1	42	B	0	6,725	6,725	40.73	21.01	9.15	0.35
1992	3	1	45	T	0	7,357	7,357	26.93	4.06	0.74	0.02
1992	3	1	45	B	1	9,316	6,022	44.18	17.48	5.69	0.23
1992	3	1	48	T	0	9,350	9,350	11.27	1.96	1.10	0.14
1992	3	1	48	B	1	6,803	6,393	33.15	23.89	6.29	0.37
1992	3	1	51	T	0	10,073	10,073	28.84	7.32	3.72	0.07
1992	3	1	51	B	1	7,014	5,217	43.79	21.31	10.66	0.30
1992	3	2	16	T	0	9,203	9,203	32.35	10.25	1.36	0.19
1992	3	2	16	B	0	7,131	7,131	39.93	17.09	7.82	0.22
1992	3	2	19	T	0	8,830	8,830	35.70	12.69	3.32	0.01
1992	3	2	19	B	0	5,682	5,682	38.31	8.42	2.71	0.19
1992	3	2	22	T	0	8,542	8,542	26.66	10.54	4.39	0.11
1992	3	2	22	B	0	8,059	8,059	39.60	17.67	5.50	0.22
1992	3	2	25	T	0	8,346	8,346	32.27	13.75	5.71	0.25
1992	3	2	25	B	0	8,245	8,245	44.19	25.96	10.23	0.14
1992	3	2	28	T	0	8,942	8,942	29.82	12.07	3.79	0.14
1992	3	2	28	B	0	6,647	6,647	40.96	23.28	9.77	0.39
1992	3	2	31	T	0	10,392	10,392	30.76	11.45	4.25	0.06
1992	3	2	31	B	0	6,516	6,516	44.94	23.80	10.41	0.28
1992	3	2	34	T	0	10,286	10,286	21.87	8.86	2.24	0.18
1992	3	2	34	B	0	7,376	7,376	41.14	23.01	9.27	0.13
1992	3	2	37	T	0	10,761	10,761	26.92	11.35	3.16	0.07
1992	3	2	37	B	0	8,617	8,617	47.84	24.24	10.41	0.14
1992	3	2	40	T	0	7,946	7,946	27.02	11.86	4.53	0.15
1992	3	2	40	B	1	10,181	8,906	43.14	19.81	7.92	0.15
1992	3	2	43	T	0	8,921	8,921	19.42	5.82	2.03	0.06
1992	3	2	43	B	1	8,067	6,809	42.82	18.67	6.63	0.24
1992	3	2	46	T	1	8,999	8,417	22.64	6.72	2.37	0.07
1992	3	2	46	B	1	7,519	6,271	35.32	17.25	5.56	0.26
1992	3	2	49	T	0	9,682	9,682	25.83	9.30	3.36	0.10
1992	3	2	49	B	1	9,322	8,544	38.77	18.81	6.84	0.33
1992	3	2	52	T	0	6,877	6,877	26.22	6.70	1.81	0.04
1992	3	2	52	B	0	8,222	8,222	39.26	17.52	5.54	0.27
1992	3	2	55	T	1	9,501	8,879	12.91	2.36	0.60	0.06
1992	3	2	55	B	1	7,253	5,372	34.73	13.23	3.42	0.18
1992	3	2	58	T	1	5,629	4,954	10.71	2.08	0.54	0.07
1992	3	2	58	B	1	6,693	6,325	33.61	14.11	4.01	0.30
1992	3	2	61	T	0	8,305	8,305	21.41	3.86	0.50	0.02
1992	3	2	61	B	0	8,075	8,075	30.67	10.24	2.07	0.16

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
2000	1	1	25	T	1	6,564	5,432	31.99	13.27	6.46	0.14
2000	1	1	25	B	1	7,168	4,904	52.63	24.79	10.34	0.23
2000	1	1	28	T	1	9,762	3,395	16.57	2.88	0.73	0.20
2000	1	1	34	T	1	13,828	12,859	33.51	11.87	4.41	0.00
2000	1	1	40	T	1	12,913	11,531	35.64	13.18	4.41	0.07
2000	1	1	43	T	1	8,111	7,357	16.80	3.49	1.21	0.03
2000	1	1	46	T	1	8,666	8,265	23.14	8.59	3.40	0.07
2000	1	1	46	B	0	7,669	7,669	29.03	13.07	3.89	0.12
2000	1	1	49	T	1	7,901	7,227	23.81	8.54	3.80	0.06
2000	1	1	49	B	1	9,098	7,990	43.11	20.59	5.96	0.17
2000	1	1	52	T	1	5,762	5,380	21.06	6.43	3.25	0.05
2000	1	1	52	B	0	8,674	8,674	36.00	15.67	8.77	0.30
2000	1	1	55	T	0	6,639	6,639	24.01	7.84	2.80	0.05
2000	1	1	55	B	0	9,735	9,735	40.37	17.64	6.57	0.21
2000	1	1	58	T	0	9,532	9,532	17.06	5.39	2.94	0.16
2000	1	1	58	B	0	7,694	7,694	33.55	14.41	7.63	0.33
2000	1	1	61	T	0	5,117	5,117	19.33	7.51	3.88	0.07
2000	1	1	61	B	1	8,144	6,463	37.99	17.05	8.10	0.13
2000	1	1	64	T	0	3,449	3,449	12.70	2.46	0.67	0.02
2000	1	1	64	B	0	7,543	7,543	37.49	16.10	6.98	0.21
2000	1	1	67	T	0	6,645	6,645	22.02	7.05	2.03	0.04
2000	1	1	67	B	1	4,722	3,724	44.11	18.55	6.68	0.30
2000	1	1	70	T	0	5,208	5,208	10.22	0.49	0.24	0.02
2000	1	1	70	B	1	8,337	6,509	34.22	16.34	5.82	0.28
2000	1	1	73	T	0	6,554	6,554	16.98	0.41	0.00	0.00
2000	1	1	73	B	1	7,220	5,242	32.98	16.83	8.96	0.55
2000	1	1	76	T	0	6,002	6,002	30.04	10.90	3.32	0.06
2000	1	1	76	B	1	9,312	8,495	38.64	17.05	5.02	0.26
2000	1	1	79	T	1	12,438	9,010	25.37	9.88	3.02	0.13
2000	1	1	82	T	0	4,975	4,975	29.14	10.64	2.35	0.10
2000	1	1	82	B	1	8,402	7,735	36.03	17.98	5.28	0.18
2000	1	1	85	T	0	5,145	5,145	23.49	7.05	1.53	0.05
2000	1	1	85	B	1	8,069	4,689	42.84	21.54	6.25	0.24
2000	1	1	88	T	0	4,171	4,171	17.97	6.57	1.97	0.28
2000	1	1	88	B	1	8,482	5,392	31.72	14.27	4.32	0.29
2000	1	1	91	T	1	3,947	2,236	41.55	23.25	8.74	0.23
2000	1	1	91	B	1	6,435	4,941	24.07	10.81	5.40	0.23
2000	1	1	94	T	1	9,834	5,985	32.40	13.90	4.49	0.15
2000	1	1	97	T	1	3,883	1,964	49.29	19.92	5.37	0.13
2000	1	1	97	B	1	7,392	5,852	37.70	19.25	4.95	0.23
2000	1	2	34	T	1	9,233	8,277	38.82	13.96	6.71	0.18
2000	1	2	37	T	0	6,275	6,275	28.17	7.83	3.81	0.12
2000	1	2	37	B	1	7,055	5,467	44.25	16.42	5.86	0.17
2000	1	2	40	T	0	8,809	8,809	40.04	18.08	8.29	0.33
2000	1	2	43	T	1	8,037	7,575	27.05	9.57	3.74	0.10
2000	1	2	46	T	1	5,389	4,161	15.23	5.28	2.36	0.11
2000	1	2	46	B	1	6,865	6,480	34.90	14.21	5.31	0.20
2000	1	2	49	T	1	6,529	6,029	20.44	6.43	3.33	0.07
2000	1	2	49	B	0	6,491	6,491	35.28	14.21	6.61	0.20
2000	1	2	52	T	0	6,190	6,190	35.43	12.53	6.09	0.16

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
2000	1	2	52	B	1	8,577	8,196	34.16	14.43	5.29	0.23
2000	1	2	55	T	0	8,006	8,006	25.67	9.04	4.35	1.10
2000	1	2	55	B	1	6,892	4,802	41.46	17.05	8.20	0.33
2000	1	2	58	T	0	5,967	5,967	23.69	9.59	4.03	0.06
2000	1	2	58	B	1	7,386	6,701	40.65	19.60	5.68	0.16
2000	1	2	61	T	1	10,732	10,003	32.40	13.31	4.65	0.10
2000	1	2	61	B	0	9,039	9,039	40.88	19.86	10.79	0.41
2000	1	2	64	T	0	8,648	8,648	33.91	13.54	5.44	0.14
2000	1	2	64	B	1	8,139	7,748	42.05	20.19	10.80	0.58
2000	1	2	67	T	0	8,697	8,697	33.73	14.18	5.32	0.13
2000	1	2	67	B	0	5,290	5,290	50.21	22.94	13.79	0.45
2000	1	2	70	T	1	7,512	6,973	16.88	6.20	1.86	0.06
2000	1	2	70	B	1	6,498	5,252	32.63	15.84	6.18	0.25
2000	1	2	73	T	0	5,306	5,306	15.14	3.16	1.18	0.07
2000	1	2	73	B	1	7,300	4,382	38.35	14.92	6.28	0.26
2000	1	2	76	T	0	6,334	6,334	21.28	7.76	2.91	0.16
2000	1	2	76	B	1	6,833	6,271	33.13	13.74	4.74	0.24
2000	1	2	85	T	0	6,021	6,021	20.30	8.08	2.69	0.09
2000	1	2	91	T	0	4,379	4,379	23.24	9.12	2.93	0.10
2000	1	2	91	B	1	9,806	8,784	38.26	18.80	5.37	0.20
2000	1	2	97	T	0	4,264	4,264	27.91	15.39	7.08	0.13
2000	1	2	97	B	1	7,055	6,221	62.98	39.85	15.70	0.17
2000	2	1	9	T	0	8,535	8,535	26.11	8.55	2.48	0.10
2000	2	1	9	B	0	7,090	7,090	20.63	3.77	0.74	0.04
2000	2	1	10.5	T	1	6,323	5,823	20.43	6.16	1.78	0.12
2000	2	1	10.5	B	1	6,424	5,869	38.51	16.13	7.55	0.39
2000	2	1	12	T	1	8,758	7,895	25.25	9.33	4.40	0.09
2000	2	1	12	B	0	7,221	7,221	42.23	19.16	8.75	0.36
2000	2	1	13.5	T	0	7,894	7,894	25.95	10.66	3.31	0.07
2000	2	1	13.5	B	0	7,227	7,227	34.36	19.39	9.56	0.20
2000	2	1	15	T	1	9,715	8,312	23.02	10.50	3.47	0.09
2000	2	1	15	B	0	8,447	8,447	36.36	16.08	4.57	0.24
2000	2	1	16.5	T	1	8,891	7,631	26.68	9.45	2.00	0.10
2000	2	1	16.5	B	0	6,598	6,598	36.51	14.81	3.75	0.13
2000	2	1	18	T	0	7,826	7,826	18.01	6.72	1.70	0.04
2000	2	1	18	B	0	8,036	8,036	36.73	16.03	4.82	0.10
2000	2	1	19.5	T	1	8,148	7,238	28.61	11.56	2.28	0.09
2000	2	1	19.5	B	0	6,323	6,323	35.52	16.21	4.71	0.12
2000	2	1	21	T	1	8,270	5,177	16.30	6.81	2.20	0.08
2000	2	1	21	B	1	7,090	6,515	25.74	13.11	5.07	0.16
2000	2	1	51	T	1	6,484	5,725	21.52	7.31	3.90	0.14
2000	2	1	51	B	1	6,970	6,563	27.90	12.26	4.63	0.13
2000	2	1	54	T	1	6,146	5,684	17.39	4.27	1.19	0.04
2000	2	1	54	B	0	6,347	6,347	25.87	11.03	2.30	0.04
2000	2	1	55.5	T	0	6,413	6,413	27.89	15.27	6.13	0.06
2000	2	1	55.5	B	0	8,832	8,832	28.28	15.87	8.80	0.11
2000	2	1	57	T	0	7,866	7,866	18.89	6.58	2.98	0.03
2000	2	1	57	B	1	7,628	5,986	23.75	6.44	2.09	0.06
2000	2	1	60	T	1	6,138	5,762	20.98	6.12	2.16	0.04
2000	2	1	60	B	0	7,708	7,708	32.29	13.62	6.45	0.13

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
2000	2	1	61.5	T	0	7,866	7,866	22.64	7.29	2.68	0.06
2000	2	1	61.5	B	1	7,228	6,354	37.99	14.82	6.37	0.15
2000	2	1	63	T	0	4,841	4,841	65.82	51.01	41.38	0.22
2000	2	1	63	B	0	4,369	4,369	42.05	34.54	23.77	0.33
2000	2	1	66	T	0	5,835	5,835	35.62	20.94	13.76	0.28
2000	2	1	66	B	0	5,478	5,478	72.12	60.21	43.89	0.36
2000	2	1	67.5	T	0	6,139	6,139	45.66	30.76	21.61	0.37
2000	2	1	67.5	B	0	5,452	5,452	49.96	41.42	23.37	0.19
2000	2	1	69	T	0	6,899	6,899	30.78	17.50	13.88	0.34
2000	2	1	69	B	0	6,562	6,562	64.31	36.43	21.61	0.36
2000	2	1	72	T	0	9,409	9,409	35.19	15.09	7.44	0.27
2000	2	1	72	B	0	10,740	10,740	34.79	23.13	9.44	0.09
2000	2	2	12	T	0	8,561	8,561	33.59	12.64	3.38	0.10
2000	2	2	12	B	1	7,477	7,036	28.03	12.52	3.65	0.29
2000	2	2	15	T	0	7,972	7,972	29.66	11.16	3.31	0.14
2000	2	2	15	B	0	8,529	8,529	38.51	16.91	5.31	0.28
2000	2	2	18	T	0	7,008	7,008	19.69	3.58	0.49	0.03
2000	2	2	18	B	0	6,615	6,615	30.26	9.04	1.77	0.08
2000	2	2	21	T	1	6,188	5,314	21.23	6.66	1.52	0.07
2000	2	2	21	B	1	8,295	5,639	31.62	14.44	3.66	0.13
2000	2	2	24	T	1	7,797	6,354	22.57	5.83	1.22	0.08
2000	2	2	24	B	0	7,059	7,059	32.61	12.18	2.43	0.08
2000	2	2	27	T	0	8,122	8,122	24.23	8.45	2.14	0.07
2000	2	2	27	B	1	8,754	7,350	38.18	17.10	4.79	0.21
2000	2	2	28.5	T	1	8,466	7,464	22.66	7.74	2.62	0.06
2000	2	2	28.5	B	0	6,812	6,812	31.31	15.27	5.66	0.13
2000	2	2	60	T	0	8,227	8,227	33.55	14.63	6.23	0.20
2000	2	2	60	B	0	7,230	7,230	43.57	20.37	6.87	0.16
2000	2	2	61.5	T	1	7,010	6,635	36.93	16.13	7.15	0.09
2000	2	2	61.5	B	0	10,460	10,460	35.31	17.81	6.06	0.15
2000	2	2	63	T	0	7,917	7,917	31.96	20.06	6.56	0.13
2000	2	2	63	B	1	7,357	6,217	32.15	24.66	10.71	0.20
2000	2	2	64.5	T	1	8,865	8,452	30.44	10.86	4.43	0.10
2000	2	2	64.5	B	0	7,686	7,686	35.30	17.00	6.98	0.16
2000	2	2	66	T	1	7,143	5,689	24.61	8.37	3.16	0.05
2000	2	2	66	B	0	7,351	7,351	31.66	13.27	5.24	0.13
2000	2	2	67.5	T	0	8,134	8,134	28.49	8.82	3.16	0.07
2000	2	2	67.5	B	1	9,245	8,477	36.42	16.19	7.08	0.15
2000	2	2	69	T	1	8,465	7,860	9.88	2.97	0.56	0.04
2000	2	2	69	B	0	7,624	7,624	33.26	14.44	4.83	0.12
2000	2	2	70.5	T	0	8,824	8,824	18.95	2.32	0.26	0.02
2000	2	2	70.5	B	0	7,844	7,844	32.75	11.44	4.10	0.10
2000	2	2	72	T	0	8,196	8,196	16.77	2.89	0.72	0.03
2000	2	2	72	B	0	7,520	7,520	13.29	2.12	0.63	0.07
2000	3	1	3	T	0	4,954	4,954	9.55	3.19	1.83	0.05
2000	3	1	3	B	1	6,341	5,947	22.93	9.65	4.87	0.10
2000	3	1	6	T	1	5,851	5,363	14.12	4.50	1.95	0.08
2000	3	1	6	B	1	6,904	5,880	27.06	9.83	3.99	0.15
2000	3	1	7.5	T	1	8,084	7,448	16.99	5.54	2.34	0.08
2000	3	1	7.5	B	1	7,030	6,589	28.84	13.01	5.83	0.26

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
2000	3	1	9	T	1	6,716	5,120	14.70	3.85	1.52	0.05
2000	3	1	9	B	1	6,783	6,467	27.10	10.72	4.32	0.10
2000	3	1	10.5	T	1	9,345	7,715	20.43	7.22	2.75	0.08
2000	3	1	10.5	B	1	9,030	8,160	32.99	14.70	5.62	0.15
2000	3	1	12	T	0	7,236	7,236	35.45	12.00	3.23	0.02
2000	3	1	12	B	1	7,855	6,995	41.96	18.62	6.81	0.15
2000	3	1	15	T	0	7,401	7,401	19.70	6.58	2.67	0.09
2000	3	1	15	B	0	8,191	8,191	36.26	17.84	7.05	0.17
2000	3	1	18	T	1	8,189	7,613	23.94	7.78	3.24	0.05
2000	3	1	18	B	0	9,469	9,469	39.95	18.27	7.47	0.14
2000	3	1	21	T	1	9,973	9,473	24.30	7.91	3.32	0.08
2000	3	1	21	B	0	8,729	8,729	40.88	19.22	7.64	0.17
2000	3	1	24	T	0	8,556	8,556	21.54	6.15	3.00	0.03
2000	3	1	24	B	0	7,411	7,411	39.43	18.40	8.34	0.13
2000	3	1	27	T	0	6,393	6,393	28.00	10.28	4.53	0.03
2000	3	1	27	B	0	6,929	6,929	39.10	18.93	8.09	0.10
2000	3	1	30	T	0	7,482	7,482	31.77	11.56	4.44	0.03
2000	3	1	30	B	0	5,942	5,942	43.83	21.35	9.57	0.12
2000	3	1	33	T	0	7,648	7,648	38.27	16.14	5.61	0.03
2000	3	1	33	B	0	7,563	7,563	37.46	18.80	7.50	0.13
2000	3	1	36	T	0	6,068	6,068	29.47	12.20	4.57	0.04
2000	3	1	36	B	0	7,908	7,908	48.62	25.12	9.40	0.11
2000	3	1	39	T	0	7,410	7,410	31.79	14.20	4.78	0.02
2000	3	1	39	B	0	7,593	7,593	36.95	19.08	7.34	0.09
2000	3	1	42	T	0	7,006	7,006	28.98	12.11	4.15	0.05
2000	3	1	42	B	0	6,313	6,313	34.68	19.38	6.28	0.07
2000	3	1	45	T	1	7,187	6,661	22.17	10.69	4.97	0.04
2000	3	1	45	B	1	7,145	6,117	32.50	19.50	8.82	0.19
2000	3	1	48	T	1	8,690	7,810	30.98	11.74	5.29	0.09
2000	3	1	48	B	0	6,160	6,160	39.83	13.89	3.43	0.10
2000	3	1	51	T	0	7,367	7,367	29.51	8.65	3.15	0.04
2000	3	1	51	B	0	6,690	6,690	24.09	11.77	4.55	0.15
2000	3	1	54	T	0	6,450	6,450	24.33	5.90	1.61	0.03
2000	3	1	54	B	1	6,817	6,435	36.98	13.36	2.31	0.08
2000	3	1	57	T	1	6,947	6,574	17.98	4.84	2.26	0.07
2000	3	1	57	B	1	7,118	6,563	23.09	5.39	1.81	0.07
2000	3	2	10	T	1	7,396	6,942	29.52	10.93	4.95	0.07
2000	3	2	10	B	1	6,540	5,845	31.70	14.76	8.76	0.14
2000	3	2	13	T	0	7,862	7,862	26.99	10.58	3.95	0.08
2000	3	2	13	B	0	7,441	7,441	23.63	10.62	5.88	0.17
2000	3	2	16	T	0	7,402	7,402	23.99	3.98	1.85	0.03
2000	3	2	16	B	0	7,882	7,882	24.84	9.45	4.74	0.09
2000	3	2	19	T	0	6,673	6,673	41.32	14.17	4.41	0.01
2000	3	2	19	B	0	7,393	7,393	51.95	17.43	5.99	0.04
2000	3	2	22	T	0	7,894	7,894	19.16	4.08	1.83	0.03
2000	3	2	22	B	0	7,324	7,324	20.43	4.73	2.18	0.13
2000	3	2	25	T	0	6,886	6,886	34.82	17.16	7.32	0.04
2000	3	2	25	B	0	7,512	7,512	33.55	16.74	8.37	0.16
2000	3	2	28	T	0	7,434	7,434	33.53	13.94	4.60	0.02
2000	3	2	28	B	0	7,393	7,393	39.47	21.08	7.93	0.13

APPENDIX C (continued)
Nechako River Substrate Sample Data

Sample ID					Any	Sample Mass (g)		Percent finer than: (truncated at 64 mm)			
Year	Sample				> 64 mm?	Total	Truncated	8 mm	2 mm	0.5 mm	0.063 mm
2000	3	2	31	T	0	7,408	7,408	36.35	11.48	3.02	0.02
2000	3	2	31	B	0	8,181	8,181	43.07	19.61	8.31	0.11
2000	3	2	34	T	1	6,385	5,218	12.45	4.02	1.68	0.06
2000	3	2	34	B	0	7,185	7,185	41.08	17.87	5.89	0.08
2000	3	2	37	T	0	7,898	7,898	23.06	7.42	2.56	0.04
2000	3	2	37	B	0	8,193	8,193	36.43	17.09	6.53	0.20
2000	3	2	40	T	0	7,328	7,328	30.09	12.76	5.06	0.04
2000	3	2	40	B	0	8,626	8,626	42.61	18.65	7.08	0.08
2000	3	2	43	T	0	7,850	7,850	25.36	8.48	3.36	0.04
2000	3	2	43	B	1	9,018	7,952	45.13	20.96	8.74	0.15
2000	3	2	46	T	0	9,342	9,342	16.57	5.47	2.26	0.03
2000	3	2	46	B	0	7,607	7,607	31.96	14.38	6.21	0.11
2000	3	2	49	T	1	8,036	7,059	27.07	8.97	3.95	0.10
2000	3	2	49	B	0	6,824	6,824	37.26	16.17	6.04	0.17
2000	3	2	52	T	1	7,599	6,437	23.61	7.17	2.84	0.07
2000	3	2	52	B	0	7,693	7,693	41.11	14.11	3.68	0.09
2000	3	2	55	T	1	8,412	7,687	24.05	8.78	4.00	0.11
2000	3	2	55	B	1	8,301	7,562	32.97	13.99	5.19	0.15
2000	3	2	58	T	1	8,822	7,785	11.29	3.49	2.04	0.12
2000	3	2	58	B	0	8,110	8,110	30.71	11.95	4.90	0.27
2000	3	2	61	T	0	5,990	5,990	7.55	2.63	1.02	0.03
2000	3	2	61	B	1	9,103	8,088	28.65	13.77	6.35	0.20
			Totals -- 1992			1,565,707	1,459,881				
			Totals -- 2000			1,659,432	1,550,737				