

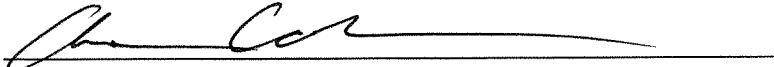
**An Archaeological Potential Model
for the Vanderhoof Forest District, B.C.**

TRACES *Archaeological Research and Consulting Ltd.*

888 Seymour Drive, Coquitlam, B.C., Canada, V3J 6V7

**An Archaeological Potential Model
for the Vanderhoof Forest District, B.C.**

Prepared by:



Arne K. Carlson (Principal)

TRACES Archaeological Research and Consulting Ltd.

888 Seymour Drive, Coquitlam, B.C.

V3J 6V7

December 20, 1996

Prepared for:

B.C. Ministry of Forests,

Vanderhoof District

1522 Highway 16 East, Box 190

Vanderhoof, B.C. V0J 3A0

TRACES *Archaeological Research and Consulting Ltd.*

888 Seymour Drive, Coquitlam, B.C., Canada, V3J 6V7

SUMMARY

At the request of Janine Elo (Operations Manager), Vanderhoof Forest District (V.F.D.), TRACES Archaeological Research and Consulting Ltd. has developed a revised archaeological potential model for the V.F.D. The model was designed for use in land-use planning and archaeological resource management, primarily in relation to logging development. It replaces an earlier, more general model of archaeological potential (Carlson 1996) used over the last year. This report presents the results of the study.

The new potential model presented here was loosely based on the earlier model in that it is a "buffer" model of archaeological potential that identifies areas (buffers) of varying archaeological potential around significant landscape features. However, it differs substantially from the earlier model by stratifying the District into five sub-zones. These sub-zones are: *Sub-Zone I* -- Trail Corridors; *Sub-Zone II* -- Glacial Lake Nechako; *Sub-Zone III* -- High Elevation Areas, Above 1,150 Metres; *Sub-Zone IV* -- Middle Elevation Areas, 790-1,150 Metres; and *Sub-Zone V* -- Low Elevations Areas, Below 790 Metres.

Within each sub-zone, areas of high, moderate, low and unproven archaeological potential were defined. Each of the sub-zones exhibits relatively unique distributions of archaeological sites in relation to a limited set of landscape features. To construct the potential model spatial patterning in known archaeological site locations was analyzed. Patterning in the spatial distribution (proximity) of all the known archaeological sites within each sub-zone in relation to primary streams, secondary streams, tertiary streams, big lakes, small lakes, ponds, wetlands, and trails was first identified and described. This information was employed to define critical buffer zone limits from each of these landscape features that collectively account for 90-100% of the known archaeological sites. The areas within these critical buffer zone limits have high archaeological potential. Any logging development (or portion) that falls within a high potential area would be recommended for archaeological impact assessment (AIA). Areas of moderate archaeological potential were also defined, within which, developments would be recommended for archaeological reconnaissance survey. Additionally, the magnitude of slope was incorporated into the model, with areas of greater than 45% slope (at 1:20,000 scale resolution) generally defined as having low archaeological potential. No further work would be recommended for developments in low potential areas. An example application of the model is provided.

This study was concerned with potential impacts to archaeological sites by proposed forestry operations. It did not address potential impacts to traditional use sites by these operations. Moreover, it was not the intent of this study to document First Nations interest in the land. The study was conducted without prejudice to First Nations Treaty Negotiations, aboriginal rights or aboriginal title.

CREDITS

RESEARCH AND DATA COLLECTION

Arne K. Carlson, M.A.
Felicia Epstein, B.A.
Craig Hooper (Trails -- Vanderhoof Forest District)
Lesley Mitchell, B.A.
Mike Robertson (Trails -- Cheslatta Carrier Nation)

DATA ENTRY

Lesley Mitchell
Felicia Epstein

ANALYSIS

Arne K. Carlson

REPORT AUTHORSHIP AND PRODUCTION

Arne K. Carlson

TABLE OF CONTENTS

SUMMARY	iii
CREDITS	iv
LIST OF FIGURES	vii
LIST OF TABLES	viii
INTRODUCTION AND BACKGROUND	1
GENERAL	1
SCOPE AND OBJECTIVES	2
Specific Tasks	3
STUDY AREA	4
PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS	5
Trails	5
METHODS, ANALYSIS, RESULTS -- Designing the Potential Model	8
GENERAL	8
ARCHAEOLOGICAL POTENTIAL	8
MODELLING ARCHAEOLOGICAL POTENTIAL	9
DESIGNING THE MODEL	11
Landscape Variables and Data Collection	12
Analytical Stage 1 -- Sub-Zone Stratification	15
Sub-Zone I: Trail Corridors	16
Sub-Zone II: Glacial Lake Nechako	20
Sub-Zone III: High Elevation Areas, 1,150 Metres Plus	22
Sub-Zone IV: Middle Elevation Areas, 790-1,150 Metres	23
Sub-Zone V: Low Elevation Areas, Below 790 Metres	25
Analytical Stage 2 -- Spatial Patterning of Sites within Sub-Zones	26
Sub-Zone I: Trail Corridors	30
Additional Variables and Considerations	68
Known Archaeological Sites	68
Slope	68
Eskers	71
Moderate Potential Areas	72
Informant Information	73

TABLE OF CONTENTS (Cont'd)

POTENTIAL MODEL SUMMARY AND APPLICATION	75
THE V.F.D. ARCHAEOLOGICAL POTENTIAL MODEL	75
APPLYING THE MODEL	80
Example Application of Model	81
CONCLUSION	87
DISCUSSION	87
RECOMMENDATIONS	89
REFERENCES CITED	91
APPENDIX 1 -- KNOWN SITES LOCATION DATA TABLE	93

LIST OF FIGURES

Figure 1: General Study Area, Vanderhoof Forest District	4
Figure 2: Frequency Distribution of Sites within Sub-Zones IV & V by Elevation	24
Figure 3: Frequency of Sites within <u>Sub-Zone I -- Trail Corridors</u> by 50m Distance Intervals to <i>Primary Streams</i>	31
Figure 4: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Secondary Streams</i>	32
Figure 5: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Tertiary Streams</i>	33
Figure 6: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Big Lakes</i>	34
Figure 7: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Small Lakes</i>	35
Figure 8: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Ponds</i> ..	36
Figure 9: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Trails</i> ..	37
Figure 10: Frequency of Sites within <u>Sub-Zone I</u> by 50m Distance Intervals to <i>Wetlands</i>	38
Figure 11: Frequency of Sites within <u>Sub-Zone II -- Glacial Lake Nechako</u> by 50m Distance Intervals to <i>Primary Streams</i>	41
Figure 12: Frequency of Sites within <u>Sub-Zone II -- Glacial Lake Nechako</u> by 50m Distance Intervals to <i>Secondary Streams</i>	42
Figure 13: Frequency of Sites within <u>Sub-Zone II -- Glacial Lake Nechako</u> by 50m Distance Intervals to <i>Tertiary Streams</i>	43
Figure 14: Frequency of Sites within <u>Sub-Zone II -- Glacial Lake Nechako</u> by 50m Distance Intervals to <i>Big Lakes</i>	44
Figure 15: Frequency of Sites within <u>Sub-Zone II -- Glacial Lake Nechako</u> by 50m Distance Intervals to <i>Small Lakes</i>	45
Figure 16: Frequency of Sites within <u>Sub-Zone II -- Glacial Lake Nechako</u> by 50m Distance Intervals to <i>Ponds</i>	46
Figure 17: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Primary Streams</i>	50
Figure 18: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Secondary Streams</i>	51
Figure 19: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Tertiary Streams</i>	52
Figure 20: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Big Lakes</i>	53

LIST OF FIGURES (Cont'd)

Figure 21: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Small Lakes</i>	54
Figure 22: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Ponds</i>	55
Figure 23: Frequency of Sites within <u>Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres</u> by 50m Distance Intervals to <i>Wetlands</i>	56
Figure 24: Frequency of Sites within <u>Sub-Zone V -- Low Elevation Areas, Below 790 Metres</u> by 50m Distance Intervals from <i>Primary Streams</i>	60
Figure 25: Frequency of Sites within <u>Sub-Zone V -- Low Elevation Areas, Below 790 Metres</u> by 50m Distance Intervals from <i>Secondary Streams</i>	61
Figure 26: Frequency of Sites within <u>Sub-Zone V -- Low Elevation Areas, Below 790 Metres</u> by 50m Distance Intervals from <i>Tertiary Streams</i>	62
Figure 27: Frequency of Sites within <u>Sub-Zone V -- Low Elevation Areas, Below 790 Metres</u> by 50m Distance Intervals from <i>Big Lakes</i>	63
Figure 28: Frequency of Sites within <u>Sub-Zone V -- Low Elevation Areas, Below 790 Metres</u> by 50m Distance Intervals from <i>Ponds</i>	64

LIST OF TABLES

Table 1: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone I -- Trail Corridors	39
Table 2: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone II -- Glacial Lake Nechako	47
Table 3: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone IV -- Middle Elevations Areas, 790-1,150 Metres	57
Table 4: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone V -- Low Elevation Areas, Below 790 Metres	66
Table 5: Summary of Reassessment of Archaeological Potential of 1996-2001 Logging Blocks on NTS Map 93 F/15	82

INTRODUCTION AND BACKGROUND

GENERAL

At the request of Janine Elo (Operations Manager) of the Vanderhoof Forest District (V.F.D.), *TRACES Archaeological Research and Consulting Ltd.* undertook a study to develop a detailed archaeological potential model for the V.F.D. This model is presented in this report and is intended to replace a more general potential model developed and used in the District over the last year (Carlson 1996).

Archaeological potential models are a basic tool in archaeological resource management. Within the forest industry, they are designed and used at the planning level to assist and guide the Forest Service and timber licensees in complying with the *Heritage Conservation Act (H.C.A.)* and the *Forest Practices Code (F.P.C.)* in regard to management of archaeological resources. The practical use of archaeological potential models is to determine where (in which particular development areas) archaeological impact assessments should be conducted so as to minimize the risk of adversely impacting known or unknown archaeological resources through timber harvesting and related developments. The existing potential model used over the past year in the V.F.D. (Carlson 1996), while recognized as being an effective decision-making tool, was also perceived by the Forest Service as being somewhat too general and was considered to over-estimate the potential risks of impacting unknown archaeological sites. As a result, the current study was commissioned with the goal of providing a model that was as equally effective as the earlier model in "predicting" where archaeological sites are found, but which was also more precise in its estimation of the potential risk that any given forest industry development would impact unknown archaeological resources.

This document comprises the final report on the study. It is organized into four sections: Introduction and Background; Methods, Analysis, Results -- Designing the Potential

Model; Summary and Application (the model); and Conclusion. The introductory section provides discussions of the scope and objectives of the study. It also defines the study area and presents limited background information on previous archaeological investigations and known archaeological sites in the Vanderhoof Forest District. The Methods, Analysis, Results section provides a discussion of how the new potential model was developed, and presents the detailed results of spatial analyses undertaken. The Summary section presents the model and how it should be applied, including an example of its application and a brief discussion of adapting it to a Geographical Information System (GIS). The Conclusion section provides a brief critical discussion of the model, and provides several recommendations stemming from completion of this study.

SCOPE AND OBJECTIVES

The 1995 *B.C. Archaeological Impact Assessment Guidelines* state that: "an archaeological resource overview is intended to identify and assess archaeological resource potential or sensitivity within a proposed study area," and is to provide "recommendations concerning the appropriate methodology and scope of work for subsequent inventory and/or impact assessment studies" (p. 8). This study comprised only the first stage in the overview process outlined in the statements above, having the overall goal of developing a means of identifying and assessing "archaeological resource potential and sensitivity" -- a goal met through development of the archaeological potential model. Examination of specific proposed development properties/areas in reference to the model (application of the model) comprises the second stage in an archaeological overview, during which management recommendations would be made. This study was not concerned with the second stage of the overview process, except to provide an example of application of the model for making management recommendations.

It is important to note that the potential model presented here is concerned primarily with archaeology and *archaeological sites* as opposed to aboriginal traditional land use and *traditional use sites*. Archaeological sites, on the one hand, are defined (following the *Heritage Conservation Act*) as any place containing material evidence of past human activity

earlier than A.D. 1846; such places are automatically protected under the *H.C.A.*. Although many places dating later than 1846 could be (and often are) considered to be archaeological sites, they are not automatically protected under the *H.C.A.* Traditional use sites, on the other hand, are places that have been/are used by one or more groups of people for some type of traditional activity. They may or may not contain physical evidence for the activities, but nevertheless the places are of economic, cultural, or spiritual value through a traditional historical connection to a living group or community. Oral history, personal knowledge, and contemporary usage are the primary evidence for traditional land use. The model defined below is designed around predicting the locations of archaeological sites, and attempts to be comprehensive in this regard. While the model probably has some fortuitous utility in predicting the locations of traditional use sites (e.g. historic period CMTs), and incorporates a certain amount of traditional use information (particularly trails), it does not specifically address traditional aboriginal land use patterns, and would not be used correctly if used as a tool in management of traditional use sites.

Specific Tasks

The following specific tasks were considered to constitute an adequate and appropriate scope of work for this study:

- 1) Conduct documentary research on the archaeology of the District to gather information on the distribution and nature of known archaeological sites. This research was to include: a review of extant archaeological site records held by the Archaeology Branch, Victoria in the B.C. Archaeological Site Inventory; and a review of all previous archaeological investigations in the District;
 - 2) Using the information acquired above, analyze and summarize the spatial distribution of the known archaeological sites in the District with the aim of identifying spatial patterning in site locations over the District;
 - 3) Develop an archaeological potential model which adequately "predicts" the locations of known archaeological sites in the District through definition of a series of spatial buffers around landscape variables;
 - 4) Present the background information, the methodology, its application, and results (including recommendations) in a final report.
-

STUDY AREA

The study area consists of the Vanderhoof Forest District (Fig. 1), located at the northern extent of the interior plateau of the province, and enclosing the approximate geographical centre of British Columbia. It encompasses most of the southern and eastern portions of the Nechako Plateau and all of the Nechako Plain -- a portion of the Fraser Basin (Holland 1964). Physiographically, the region is characterized by low to moderate relief, with large expanses of flat to rolling country dissected by rivers. Archaeological evidence suggests that this region of the province has been occupied and used by people since the early post-glacial period beginning around 8-9,000 years ago.

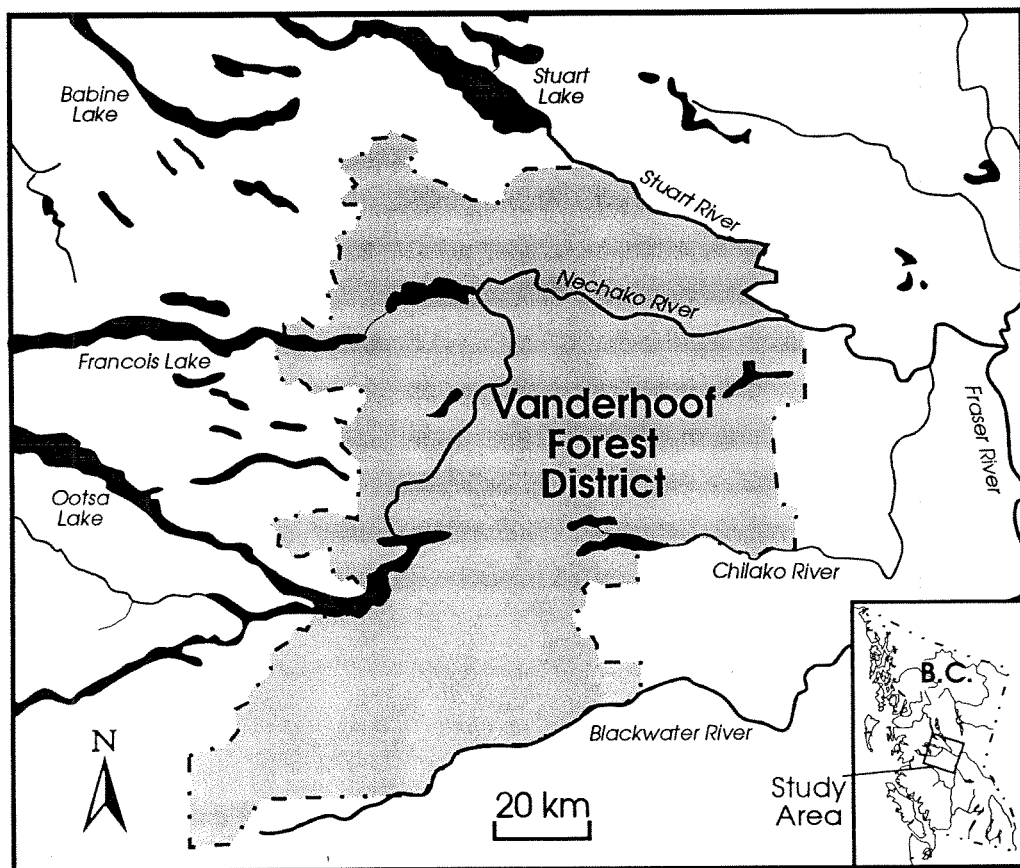


Figure 1: General Study Area, Vanderhoof Forest District

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

As of February 1996, all or portions of forty-two archaeological field projects had been carried out in the V.F.D. The earliest investigations were conducted in 1950 and the latest during the past 1996 field season¹. Of these forty-two projects, thirty (71%) were strictly resource management projects, eight (19%) were strictly research projects, and four (10%) were combination research/resource management projects. Two of the projects involved significant excavations, and three involved evaluative or limited controlled excavations. The remainder of the projects have been site survey/inventory projects, most of which were archaeological resource management studies in response to development. A complete list of references to these earlier archaeological studies can be found in the earlier archaeological overview assessment report prepared by TRACES (Carlson 1996).

These studies have provided the base-line archaeological data for this study. The potential model was developed directly from the currently known archaeological site location information. Although our knowledge of the archaeology of the V.F.D. is far from complete, it is relatively better in the V.F.D. than in other portions of the central interior. At present, a total of 540 archaeological sites have been recorded in the Vanderhoof Forest District. A summary of most of these sites can be found in the earlier archaeological overview assessment report prepared by TRACES (Carlson 1996). Background information on the archaeology of the region can be found in other reports (e.g. Carlson 1995). It was not within the scope of this study to describe and report on each individual site in the District. However, the records describing, and the mapped location of each site were inspected during research and construction of the archaeological potential model.

Trails

Aboriginal and historic trails as cultural resource features deserve particular comment here, because they are a significant and integral part of the potential model developed in this

¹ The field projects conducted during the 1996 season have for the most part, not been included in the current study because the final results of these projects are still forthcoming. However, some new site location information from the 1996 field work has been incorporated.

study. In the pre-contact and early historic periods, much travel in the District was conducted via an extensive network of trails. These trails connected to other trail networks and the lake and river systems that ultimately spanned the entire province. Most of these trails, however, went out of use over the last 100-150 years. Some have become our current road and highway right-of-ways. As a result of extensive documentary and traditional use research on trails, conducted independently by Mr. Craig Hooper (Recreation Resource Officer, V.F.D.) and Mr. Mike Robertson (researcher, Cheslatta Carrier Nation) we have a relatively comprehensive knowledge of the general trail routes throughout the V.F.D. Additionally, sections of several of these trails have been located on-the-ground (e.g. the Cheslatta Trail, the Nadleh-Sowchea Trail, and the Omineca Trail). Both Mr. Hooper and Mr. Robertson made their maps available to TRACES for the purposes of this study.

Documentation of aboriginal trails in the V.F.D. can be found in a variety of sources. Fr. Morice (1978) illustrates many of the trails that ran through the central interior. Most, if not all, of the trails Morice illustrates are trails that were used well back into the pre-contact period. Elders and other First Nations persons also possess a wealth of knowledge on the locations of trails they and their relations used in the past. The journals and records of the explorers and fur traders such as Mackenzie, Fraser, Harmon and Dawson also provide much documentary evidence of trails through the District. The early surveyors (late 1800s-early 1900s) such as Frank Swannell have provided some of the most useful information on trails in the District. The traverse notes and maps produced by these early surveyors often illustrate the exact routes of sections of various trails, tied into existing district lot boundaries, providing an excellent aid in locating particular trail sections on-the-ground.

The most famous of the trails in the District is the Nuxalk-Carrier Grease Trail (Alexander Mackenzie Heritage Trail) that winds its way back and forth along the southern boundary of the District. Of equal importance was the Cheslatta Trail from Fraser Lake to Cheslatta Lake, the Ulkatcho Trail from Cheslatta Lake and the Upper Nechako River Valley to Ulkatcho, The Nadleh-Sowchea Trail between Fraser Lake and Stuart Lake, the Omineca Gold Rush Trail (originally an aboriginal trail) from Tachick and Nulki lakes to the Stuart River and beyond, and the trail running east-west through the Lower Nechako River Valley between Fraser Lake and what is now Prince George. These are only a few of the mainlines

of the trail network that spread across the District. Numerous other shorter branch trails existed as well. Unfortunately, the trails we know of now, at the end of the Twentieth Century, are probably only a fraction of the trails that once existed and were regularly used by pre-contact peoples of the region.

Based on the present level of documentation of these trails, they were incorporated into the archaeological potential model developed in this study. Although, as indicated, our knowledge of the trail network spanning the District is incomplete, we do know its main elements as they existed at contact, through the 19th Century, and into the early 20th Century. The antiquity of this particular transportation network, and how it may have changed over the 9,000 years of the pre-contact period remains unknown. Nevertheless, following analysis of archaeological site distributions in the District in relation to this transportation network, a significant pattern in site distributions emerged. Approximately 60% of the known archaeological sites in the V.F.D. are located within one kilometre of these trails. As a result of this finding, trails were incorporated as an integral part of the archaeological potential model. Trails and how they fit into the model are discussed further below.

METHODS, ANALYSIS, RESULTS – Designing the Potential Model

GENERAL

This section presents the methods, rationale, and results of the spatial analyses undertaken to design the potential model. It begins with a general discussion of archaeological potential and what it is, followed by general discussions of the ways in which archaeological potential can be modelled and the approach taken here. The section concludes with a presentation of the methods and results of data collection and analysis used in this study.

In sum, the approach taken here to designing the model is loosely based on the approach taken in designing the earlier potential model (Carlson 1996), based as it was around defining high potential buffers zones around landscape features. However, several additional elements have been added. These include in particular, a five part stratification of the District into sub-zones, and the incorporation of slope as an archaeological potential assessment criterion. Specific potential models have been designed for each of the five areal sub-zones within the V.F.D. These "mini-models" are based upon differing spatial patterning in the distribution of known archaeological sites within each Sub-zone. Analyses of the spatial patterning of known sites were employed to define critical distance intervals (buffers) from various landscape features which enclose all or most of the known archaeological sites in the sub-zone. These buffer zones in turn were defined as areas of high archaeological potential.

ARCHAEOLOGICAL POTENTIAL

Archaeological potential is effectively a means of describing the *relative probability* that archaeological sites exist in any given area. It is usually based on the currently known distribution of archaeological sites, and at least a general understanding of past human

settlement, subsistence, and cultural patterns in a region. Rather than a probabilistic or absolute measure of site frequencies or density, archaeological potential is better understood as a relative measure of *the cumulative intensity of human occupation* in any given area over the entire span of human occupation in the region. Thus, high potential would indicate a high intensity of cumulative use of an area or landscape zone over the last 9,000 years, whereas low potential would indicate the opposite. The higher the cumulative intensity of use of an area, the greater the absolute numbers of people that would have occupied and used the area over time, and the greater the number of archaeological sites that would have been created.

It is important to keep in mind that archaeological potential is a relative measure, and cannot be taken as a quantitative or probabilistic measure of actual archaeological site densities or locations in a region. Archaeologists can rarely predict the probability that an archaeological site will be in any one place (e.g. we cannot say there is a 75% chance that there is a site in a specific area). To a large degree site locations are unpredictable because of complex variations in temporal, cultural, geographic and other factors. Since we cannot know all these factors, there remains a high degree of unpredictability about exact site locations. However, based on what *is* known of site locations, relative statements about the chance of a site being in an area or type of area can be made -- e.g. it is more likely that sites will be located in river valleys (high potential) than on mountain slopes (low potential). Additionally, archaeologists generally do not define "no potential" zones. All parts of the landscape are considered to have some potential for the presence of sites; people go and have gone to many different places for many different reasons. These statements become more significant when considered in light of the length of time that humans have been occupying and exploiting the landscape (approximately 9,000 years in the Nechako Plateau). On the other end of this relative scale, however, is that areas identified as having high archaeological potential, do not necessarily contain identifiable archaeological remains.

MODELLING ARCHAEOLOGICAL POTENTIAL

There are two general ways in which archaeological potential can be assessed. The first of these (used in this and the earlier overview study) employs what is referred to here as

a "buffer model." The second employs what could be called a "predictive model." While both types of model are predictive, there are significant differences between them that deserve highlighting.

A "predictive model" would generally be more sophisticated than a "buffer model." Predictive models, as defined here, are predicated on assumption of knowledge, or demonstrated knowledge about *why* sites are located where they are. The researcher either explicitly or implicitly assumes understanding of the actual workings of pre-contact settlement, subsistence, and cultural systems and how they have changed over time. For example, in a predictive model the vicinity of river rapids would be considered to have high archaeological potential because in the past people would have gone to these places to catch fish. In a second example, archaeological sites are found at outcrops of chert or obsidian because people used such outcrops for obtaining lithic raw materials for tool manufacture. These assertions are intuitively correct, and have been demonstrated to be true in different regions. However, the problem with building an archaeological potential model based on such assertions or knowledge is that in order to be fully comprehensive, the full range of reasons people went to and used different places on the landscape must be outlined. Additionally, a full descriptive outline of the landscape must be assembled, and knowledge of the landscape's culturally significant resources/features must be gained. This would require a comprehensive understanding of cultural and natural systems over the entire span of the pre-contact history of a region; an understanding that we do not currently have. For a "buffer model" of archaeological potential, however, we need not assume any knowledge about *why* sites are where they are.

In its simplest sense, a buffer model outlines zones of archaeological potential based simply on where archaeological sites in the region are known to be located. It is this approach that was employed in developing the earlier model, and has again been employed for development of the current model. Several criteria can be readily defined that are spatial correlates (predictors) of the locations of known archaeological sites in the region under consideration. Basically, these criteria are defined by determining the kinds of places in the region at which archaeological sites are located. The inference is that other similar such places -- places with the same general landscape characteristics -- probably also have

archaeological remains. It is not implied, however, as in a predictive model, that it is *because* of the particular combination of landscape features that a site is where it is (while to some extent this may be the case, the model does not depend on this). The main advantage of a buffer model is that, by definition, it accounts for most, if not all, of the known archaeological sites in the region under consideration, using demonstrable and replicable empirical data. A buffer model also does not assume causality (avoids researcher bias and preconceptions, and accounts for site distributions that may not be currently explainable through any other means). It uses relatively few variables, significant landscape features are easily defined and identified using maps and airphotos. It is relatively easy to develop and to apply in any area, and a buffer model is flexible and adaptable to new data.

The primary criticism of a buffer model is that nowhere in the province do we know the full range of the different kinds of locations at which archaeological sites are found. This criticism applies equally to a predictive model in that nowhere in the province do we know the full range of, and variability in pre-contact cultural systems. There are large data gaps because of varying degrees of archaeological survey coverage given to different kinds of natural areas, and because of varying numbers of archaeological projects that have been undertaken in different parts of the province. The northern and central interior have large areas where no archaeologist has ever gone. Moreover, in areas where surveys have been undertaken, they have usually focused on only limited or select areas such as the shores of large lakes and rivers, and have more often than not, ignored other kinds of areas such as upland plateaus. Thus, basing predictive criteria on consideration of only the location of known archaeological sites biases the analysis -- usually to an unknown degree. The only real solution to this problem is more survey in more and different areas; this solution will only be reached over time.

DESIGNING THE MODEL

As indicated, the approach taken here was that of designing a buffer model of archaeological potential. The general framework for analysis and development of the model consisted of primary data collection and two subsequent stages of data analysis. Data

collection involved defining/selecting a series of archaeologically significant landscape variables and measuring the distances of known archaeological sites in the V.F.D. from these landscape variables. The first stage of analysis had the goal of developing a practical stratification of the V.F.D. into several sub-zones, each of which would possess a relatively homogenous yet unique distribution of sites (as compared to the other sub-zones) that would be demonstrable through consideration of the known site location data. The second stage of analysis involved describing the spatial patterning of sites within each sub-zone around the landscape features identified, and subsequently defining buffer zones around the landscape features within each sub-zone that collectively enclose (explain) all or most of the archaeological sites.

In addition to the sub-zone stratification of the District and definition of high archaeological potential buffers within each sub-zone, several other variables were considered to allow relatively greater refinement of the model. These other variables are, for the most part, independent of the sub-zone stratifications and the defined high potential buffer zones and include: known archaeological sites, slope, glacial eskers, and informant information. Additionally, moderate archaeological potential areas are defined for each sub-zone to provide a general indication of areas assumed to have a low to moderate density of archaeological sites.

Landscape Variables and Data Collection

A relatively wide variety of variables have been identified by researchers to be potentially significant in "predicting" the locations of archaeological sites including such environmental variables as water and fish resources, mammal and plant resources, terrain (landforms, slope, and aspect), lithic raw materials, and trails. The specific variables selected in this study include: *Big Lakes; Small Lakes; Ponds; Primary Streams; Secondary Streams; Tertiary Streams; Wetlands; and Trails*. These variables are natural landscape features except trails which are cultural landscape features. They have all been demonstrated to have some degree of significance in predicting archaeological sites in the V.F.D. (see Carlson 1996). Their value as predictors has been borne out in this study also. Slope has also been

incorporated into this model, but did not form part of the variable set used in data collection and analysis (see below for further discussion on slope).

Currently, definition of the lake and stream categories above has not been formalized; rather, they were defined on a subjective/pragmatic level. For the purposes of this overview, formal criteria defining what, for example, constitutes a big lake as opposed to a small lake, in terms of a measurement such as area were not necessary. Formal definition of the lake and stream categories would not add any significant predictive precision to the model at this time. The following lakes in the Vanderhoof Forest District were defined as "big lakes:" Francois, Fraser, Tachick, Nulki, Cluculz, Tatuk, Murray, Tatelkuz, Kuyakuz, Tsacha, and Entiako. Other lakes such as Hallett, Tahultzu, Lucas, Finger and several other "moderate" sized lakes in the District could also probably be considered big lakes, but for the purposes of this study were considered to be small lakes. All remaining named lakes were defined as "small lakes." "Ponds" were defined as any other standing body of water. The Nechako, Stuart, Chilako, Blackwater, Sutherland (below Duncan Ck.), Endako, Stellako, Cheslatta, and Entiako rivers as well as Knewstubb Lake (approx. centre line representing the original course of the Nechako River) were defined as "primary streams." The Euchiniko River could also possibly be considered a primary stream, but for the purposes of this study was considered to be a secondary stream. All other named streams were defined as "secondary streams," and all unnamed creeks, whether intermittent, ephemeral or permanent were defined as "tertiary streams."

For the purposes of this study, wetlands were defined as any wetland area which appears on the 1:50,000 scale NTS map series. No attempt to classify wetlands was made because the known site location data set in relation to wetlands is too small to allow meaningful investigation of the spatial patterning of sites around wetlands of different sizes or types.

Ultimately, it would be worthwhile to employ a more formal classification of the water bodies and waterways in the District for application of the model developed here. This would greatly assist in application of the model through a GIS, which are well equipped to classify lakes, for example, by size criteria. Re-analysis of the currently known site distributions could

also be undertaken to determine if a reclassification of the lakes and streams would alter the results achieved here. However, given the results of this study, and the general patterns in site distributions that it highlights, it is unlikely that further refinement of the model would be achieved through reanalysis of the data in light of a more formal water-body classification. Some of the specific frequencies of sites from specific landscape variables might change as a result of re-analysis of the data, but it is unlikely that the buffer zone limits defined here would change, and therefore the model itself would not change. Additionally, many of the lakes and rivers enumerated above as either big or small, or primary or secondary have no known sites in close proximity to them, and thus had no effect on the analyses conducted. Reclassifying these lakes and rivers would result in no change to the model, derived as it is from known site location information.

The primary data employed in this study consisted of the distance measurements of the 540 known archaeological sites from the above landscape variables. This information was collected from 1:50,000 scale maps illustrating site locations. The site location information was provided by the Archaeology Branch, Victoria, where the B.C. Archaeological Site Inventory records are housed. At the Archaeology Branch, primary site location information is plotted on the 1:50,000 scale National Topographic Series maps of the District (NAD 27). UTM grid coordinates and latitude and longitude locations of all the archaeological sites are also available. However, site locations in either of these coordinate systems, as recorded at the Branch, were derived from the 1:50,000 NTS maps, and thus offer no greater precision in site location data than the plotted locations of the sites on the maps themselves.

Currently, no finer scale of maps than the 1:50,000 scale NTS series illustrating site locations are available for all of the sites in the District. As such, the minimum meaningful distance interval for site locations in this model is 50 metres (1 mm map distance). In some cases, where personal knowledge of site locations existed, somewhat narrower distance measurements than 50 metres were recorded (either 0m or 25m). This was not done consistently, however, and cannot be taken to add any significance or precision to the results. The *only* feasible way of gaining more precise distance measurements of all the known sites to the various landscape features would be to re-visit and re-map the locations of all the sites using GPS and/or with the specific aim of gaining more precise distance measurements. The

most significant consequence of this limiting factor is that, given the quality of the currently available data set, *archaeological potential buffers narrower than 50 metres cannot be meaningfully defined using the available data and the methods employed in this study.*

The mapped location of each site was considered in reference to the above landscape variables. The distance of each site to each landscape variable was measured and recorded in a data table, with each site representing a record. Appendix I presents the entire data set. Maximum significant distance intervals for each landscape variable were defined. If a site was at a greater distance from the landscape variable than that variable's maximum value, "99999" was recorded in the data field. These maximum values represent what was considered to be the maximum significant distance of a site from a landscape variable at which a buffer zone could possibly be explanatory of the site location. The maximum values employed were: Big Lakes -- 1000m; Small Lakes -- 1000m; Ponds -- 500m; Primary Streams -- 1000m; Secondary Streams -- 1000m; Tertiary Streams -- 500m; Wetlands -- 250m; and Trails -- 1000m. Site elevation (+/-100 ft.) was also recorded, as was site type, and biogeoclimatic zone. Site type and biogeoclimatic zone were not subsequently employed in the final analysis. This information was collected for all known sites in the District, and comprises the primary data set. The information was stored in Exel 5 spreadsheet format. Data filtering functions in Exel 5 greatly facilitated analysis.

Analytical Stage 1 -- Sub-Zone Stratification

The goal of this stage of analysis was to develop a stratification of the District into sub-zones, each of which had a demonstrably different distribution of sites. Consequently, each sub-zone would have its own particular potential model, which collectively would provide a comprehensive model for the District as a whole. Archaeological site distributions reflect, to varying degrees, differing spatial and seasonal distributions and productivity of different resources exploited by humans across the landscape. Such environmental variations, observable across the region, combined with physiographic variation in the landscape and long-term historical development and change in human land-use throughout the Holocene, make it incorrect to assume archaeological site distributions would be the same in all areas

of the region. Stratification of the District into sub-zones attempted to factor out some of these differences by defining areas which were relatively more homogenous in their environmental, physiographic, and cultural characteristics. This process of stratification ultimately allows an analysis of the spatial patterning of sites to be undertaken that is generally meaningful in terms of broad human settlement and subsistence patterns.

Several different attempts were made at devising a stratification. Some of the original factors considered, but not subsequently used, included biogeoclimatic sub-zones, types of fish distributions and productivity, ungulate productivity, and latitude. It was found that these variables were too inconsistent spatially to highlight any unique patterns in site distributions. In the end, five sub-zones, based on three criteria were determined to provide a coherent stratification of the District: *Sub-Zone I: Trail Corridors* -- areas within 1 km of known trails; *Sub-Zone II: Glacial Lake Nechako* -- areas within the margins of Glacial Lake Nechako, but not within 1 km of trails; *Sub-Zone III: High Elevation Areas, 1,150 Metres Plus* -- areas above 1,150 metres elevation (3,800 ft.), but not within 1 km of trails; *Sub-Zone IV: Middle Elevation Areas, 790-1,150 Metres* -- areas between 790 and 1,150 metres elevation (2,600-3,800 ft.), but not within 1 km of trails; and *Sub-Zone V: Low Elevation Areas, Below 790 Metres* -- areas below 790 metres in elevation (2,600 ft.), but not within 1 km of trails, and not within the margins of Glacial Lake Nechako. Within each of these sub-zones, different distributions in archaeological sites were found to exist. Each of these sub-zones is an exclusive zone. Sub-Zone I -- Trail Corridors, cross-cuts all other zones and takes precedence over all other zones. Additionally, Sub-Zone II -- Glacial Lake Nechako, generally below 760 metres elevation, takes precedence over the low elevation Sub-Zone V.

Sub-Zone I: Trail Corridors

Trails were determined to be a significant factor in predicting archaeological site locations. They were chosen as the basis of an areal sub-zone on the rationale that if archaeological potential reflects the cumulative intensity of occupation of an area over time, then places known to have been habitually used by people in the past would contain relatively great numbers of archaeological sites. Aboriginal trails, being transportation corridors, by

definition were habitually used themselves, and moreover, connect areas of habitual use. This assumption was borne out by a simple analysis of the archaeological site location data. It was found that 323 (59.8%) of all the known sites in the V.F.D. are located within 1 km of currently documented trails. Thus, trails appear to be the best single predictor of site locations in the District. Rather than use trails as a cultural landscape variable within sub-zones defined on some other basis, it was decided to make trails the primary criteria defining a unique sub-zone (in this case 1 km either side of known or estimated actual trail beds). Moreover, patterning of archaeological sites in relation to landscape features within a two kilometre wide transportation corridor could be expected. This was explored in the second stage of analysis (below), and patterns were identified upon which buffers could be defined.

The specific trail routes forming the basis of this sub-zone as defined here are based primarily on a 1:250,000 scale map of the District illustrating the approximate routes of the main trails throughout the District provided by Mr. Craig Hooper of the V.F.D. A limited amount of additional information on trails in the west central portion of the District, provided by Mr. Mike Robertson, a researcher with the Cheslatta Carrier Nation, was also incorporated. Future application of the model designed here (whether through GIS or by hand) should employ these same basic maps, and incorporate any additional trail information that may have come to light in the mean time.

Over the last several years Mr. Hooper has conducted documentary and traditional use research on trails in the V.F.D. from a recreation resource/cultural heritage point-of-view, and has compiled a relatively comprehensive set of larger scale maps illustrating the exact and/or approximate routes of the trails. The level of precision in knowing the exact trail routes depends upon the level of historical and ethnographic documentation of the trails. This level of documentation is highly variable; the exact routes of some of the trails have been identified on-the-ground, while others are only vaguely known to have run through a particular area.

The trails employed in definition of Sub-Zone I run along many stream margins and lake shores of all sizes. Additionally, they cross many different kinds of areas from swamps to high elevation passes. As indicated above, the particular trails employed in defining Sub-

Zone I consist of a relatively large number of trails documented in the historical record. These trails were mapped onto the same set of 1:50,000 scale NTS maps of the District upon which the known archaeological sites were plotted. These, or other maps illustrating the same trail information would be necessary in future application of the model, whether by hand or by using a GIS.

The main trail elements in the southern portion of the District include six trails originating at Ulkatcho and heading in all directions. Three of these head south and west out of the District. The Nuxalk-Carrier Grease Trail heads eastward from Ulkatcho more-or less following the Blackwater River and in most sections is south of the District boundary. The last two trails originating at Ulkatcho head north to the Entiako River, join at Tschick Lake, and continue north to Nataalkuz Lake, following the west side of the Entiako River for the most part. Farther east, a trail originating at the Blackwater River, south of Kuyakuz Lake, runs northward to the west end of Kuyakuz Lake, along Chedakuz Creek, circles Tatelkuz Lake, and continues northwestward along Chedakuz Creek to Nataalkuz Lake (Chedakuz Arm). A second trail originating at the Blackwater River near Kluskus Lakes, heads north to the west end of Suscha Creek, continues north to the east end of Chutanli Lake, then onward along Tatuk Creek to Klunchatistli Lake north of the Jerry Boy Hills. Two trails run E-W between this last trail and Tatelkuz Lake -- one from the north end of Tatelkuz Lake to Chutanli Lake, and the other from the south end of Tatelkuz Lake to Suscha Lake. From Klunchatistli Lake, two trails continue to the north. One of these runs northwestward along the Euchiniko River, over the divide to Big Bend Creek, then westward along the north side of Big Bend Creek (Arm) to the vicinity of Kenney Dam. The other trail from Klunchatistli Lake heads northwards past the east side of Hay Lake, the east end of Lavoie Lake to the northwest side of Tatuk Lake. A small E-W branch trail connects the Big Bend Creek trail with Lavoie and Tatuk lakes. On the north shore of Nataalkuz Lake, opposite the mouth of the Euchiniko River, and west of Chedakuz Arm, a trail heads north past the east end of Yellow Moose Lake, winds northward to the east end of Lucas Lake, continues north to the east end of Bird Lake (Lakes District) and eventually to the east end of Cheslatta Lake.

In the central portion of the District, a main N-S trail begins at Tatuk Lake, and runs northward past the west end of Finger Lake, and along the west side of the Nulki Hills to

Nulki Lake. In the east, the Telegraph Trail enters the District at the north end of Naltesby Lake and winds roughly northwestward along the east side of Eulatazella Lake, crossing Cluculz Creek and veering more to the westward past the north shore of Hogsback Lake and eventually to the east end of Sinkut Lake. In the west, beginning at the present time at Kenney Dam, two trails run northward, one on either side of the Nechako Canyon, to the vicinity of Cheslatta Falls where they join. From this point another trail continues westward along the Cheslatta River and the north side of Murray Lake to the east end of Cheslatta Lake. Additionally, a trail runs northward from Big Bend Arm down the Cut-Off Creek valley to the Nechako River. From the east end of Cheslatta Lake, the Cheslatta Trail runs northeastward with two initial branches running around either side of Holy Cross Lake, and then joining and continuing northeastward. The Cheslatta Trail continues down Targe Creek to Bentzi Lake, along the north shore of Hallett Lake, at which point it turns northward over the height of land, crosses Smith Creek, runs along the east sides of Chowsunket and Klez lakes, and turns eastward along the south shore of Dry William Lake to the east end of Fraser Lake at Nautley. A main branch trail runs westward from the Cheslatta Trail, beginning southeast of Nithi Mountain, and runs westward to the east end of Francois Lake, and then turns southwestward past the west end of Anzus Lake and continuing on to Binta Lake. In the eastern portion of the District a trail runs westward along the north shore of Cluculz Lake and continues westward to the east end of Sinkut Lake. Three branch trails run northward to the Nechako River from this trail, one running down Cluculz Creek, the second running north to the vicinity of Hulatt, and the third running down the Sinkut River. In the area immediately south of Vanderhoof, between it and Sinkut, Tachick and Nulki lakes, several small branch trails interconnect these lakes and the Nechako River. From the east end of Sinkut Lake, the Telegraph Trail continues westward along the north side of Nulki Lake, runs south of Tachick Lake around its east end and westward to Fort Fraser.

In the northern portion of the District, north of the Nechako River, Fraser Lake, and the Endako River three main trails head northward. From the vicinity of Vanderhoof, the Omineca Trail begins at Noonla on the Nechako River and runs northward crossing Murray Creek, through the area east of Fountain, Wonder and Expected lakes and on to the Stuart River, where it crosses the river and continues northward. From the east end of Fraser Lake at Nautley, a trail runs northward over the divide to Sutherland Lake. From here it continues

northward, out of the District, eventually reaching Sowchea on Stuart Lake. From the vicinity of Endako, the third main trail runs northeastward to the east end of Stern Lake, and continues on to Peta and Top lakes. At this point, an E-W branch trail running along the north shores of Oona and Ormond lakes joins this trail with the Nautley-Sowchea trail. From Top Lake, a trail continues northward, down the Duncan Creek Valley to the Sutherland River, where it veers northwestward, running down the Sutherland Valley out of the District and eventually to Babine Lake.

As indicated above, these trails form the main elements of the transportation network used to define Sub-Zone I. Additionally, there are several small and/or incompletely known branch trails connected to these main trails. Knowledge of the exact routes of the trails throughout the District varies widely. Some of the trails have been located precisely on-the-ground (in particular the Nuxalk-Carrier Grease Trail, sections of the Cheslatta Trail, sections of the Telegraph Trail, the Omineca Trail, and the Nautley-Sowchea Trail). The routes of other trails are known relatively accurately based on existing historical maps, while still others are only vaguely known to have run through a general area. It is partly because of these considerations that the term "trail corridor" has been used for Sub-Zone I. Additionally, because of this level of imprecision, it can be expected that over time, the exact boundaries of Sub-Zone I will change, ultimately becoming more precise as more of the trails are identified on-the-ground. Currently, Sub-Zone I was defined on the basis of the "best estimate" of the precise location of the trails at 1:50,000 scale.

Sub-Zone II: Glacial Lake Nechako

Glacial Lake Nechako was formed in the late Pleistocene, probably by a large proglacial ice dam, or stagnant glacial remnant centred on the Nechako River near the eastern boundary of the V.F.D. (Tipper 1971). It drained by about 10,000 years ago creating the Nechako Plain and depositing the fine sediments of what is now the Nechako Valley around Vanderhoof, between Fraser Lake in the west and Cluculz Lake in the east. The western end of this lake is imprecisely known, as geomorphological studies are on-going (Plouffe 1991). It is estimated to have ran roughly N-S in the vicinity of Fort Fraser. It is unknown whether

or not Fraser Lake was directly connected to the glacial lake. The northern boundary of the glacial lake ran roughly E-W, north of the Nechako River, between the 760-790 metre (2,500-2,600 ft.) contours on the north side of the Nechako Valley. The eastern end of the glacial lake enclosed the eastern ends of what are now Cluculz and Cobb lakes. The southern boundary of the lake ran roughly E-W, again following the 760-790 metre (2,500-2,600 ft.) contours enclosing what are now Sob, Nulki, Tachick, Lily and Dorman lakes. All the extant lakes within this area are remnants of the glacial lake.

As an early Holocene environment, subsequent to draining of the lake, this zone was probably a relatively open grassland plain for some time (perhaps for as long as 2,000 years), and would have offered an excellent environment for early Holocene human and faunal occupation. It is hypothesized that this area was the first in the Nechako Plateau region to be occupied by humans. This interpretation is supported to a limited degree by surface finds of projectile points from the Nechako Valley which are typical of projectile point styles found on the plains between 10-8,000 years ago.

Several important lakes and streams are found within, or crossing Sub-Zone II. The only primary stream within this Sub-Zone is the Nechako River, running roughly E-W through the middle of the area. The most significant secondary streams within this Sub-Zone include: Stoney Creek, the lower reaches of Corkscrew Creek, the lower reaches of Sinkut River, Goldie Creek, Cluculz Creek between Cluculz Lake and the Nechako River, Khai Creek, Chilko Creek, Knight Creek, Murray Creek, Clear Creek, Moss Creek, Redmond Creek, Trankle Creek, Kluk Creek, Nine Mile Creek, Tatsutnai Creek, Smith Creek below Limit Lake, and Tahultzu Creek. It is primarily the lower reaches of these creeks that are included in this Sub-Zone, as they all drain roughly northward or southward from higher elevation areas into the glacial lake basin and ultimately the Nechako River. There are innumerable small intermittent and ephemeral tertiary streams within Sub-Zone II. The big lakes located within Sub-Zone II include: Tachick, Nulki, and Cluculz lakes. Sinkut Lake could also possibly be included as a big lake in this Sub-Zone, but for this study it was defined as a small lake. Some of the more notable other small lakes include: Dorman Lake, Lily Lake, Leg Lake, Rorison Lake, Sob Lake, and Cobb Lake. Additionally, there are numerous ponds scattered throughout Sub-Zone II.

In the previous archaeological potential model developed for the V.F.D. (Carlson 1996), 96% of the then known sites in the District were explained by the defined High-Moderate Potential buffer zones. It was noted at the time of the earlier analysis that, of the thirteen pre-contact period sites not explained, ten were located within the boundaries of Glacial Lake Nechako. Although a relatively small sample of sites, this pattern indicates that the distribution of sites within the glacial lake basin is different than in other portions of the District. Based on these considerations, and on the hypothesis that the Nechako Valley was the earliest occupied area in the District, the glacial lake basin was defined as its own unique sub-zone for the purposes of the current model. Excluded from the glacial lake sub-zone, however, are the trail corridors of Sub-Zone I, above. There are currently fifty known archaeological sites within the Glacial Lake Nechako sub-zone.

Sub-Zone III: High Elevation Areas, 1,150 Metres Plus

This sub-zone was defined to enclose all high elevation areas within the District, except those areas within 1 kilometre of a documented trail. It was assumed that in general, the high elevation areas were less intensively used in the past than the lower elevation areas surrounding major lakes and rivers of the District. This assumption is supported by the fact that no known archaeological sites have been found in the V.F.D. in areas above 1,180 metres elevation. However, very little archaeological survey has been conducted in such areas, and this pattern may simply be a consequence of sampling bias. Nevertheless, archaeological and ethnographic information from across the province suggests that, except for relatively specialized activities, high elevation areas were less intensively used than lower elevation areas. General exceptions to this pattern include trail corridors (accounted for by Sub-Zone I), and specialized resource exploitation such as hunting for caribou, grizzly bear, goats and sheep, and procurement of particular plant resources and of lithic resources such as obsidian.

In the V.F.D., this sub-zone encloses the Naglico Hills, the Fawnie Range, the Nechako Range, the Nulki Hills and Sinkut Mountain, much of the area in the northwest portion of the district forming the divide between the Nechako River, Sutherland River and Stuart Lake drainages, and several smaller, localized higher elevation areas such as Holy

Cross Mountain, areas to the east of the upper Nechako River around Mt. Greer, Mt. Hobson, and Paddle and Johnson lakes, and areas south and east of Francois Lake such as Nithi Mountain. In large part, these areas correspond to the ESSFmv1 and SBSmc2 Biogeoclimatic sub-zones.

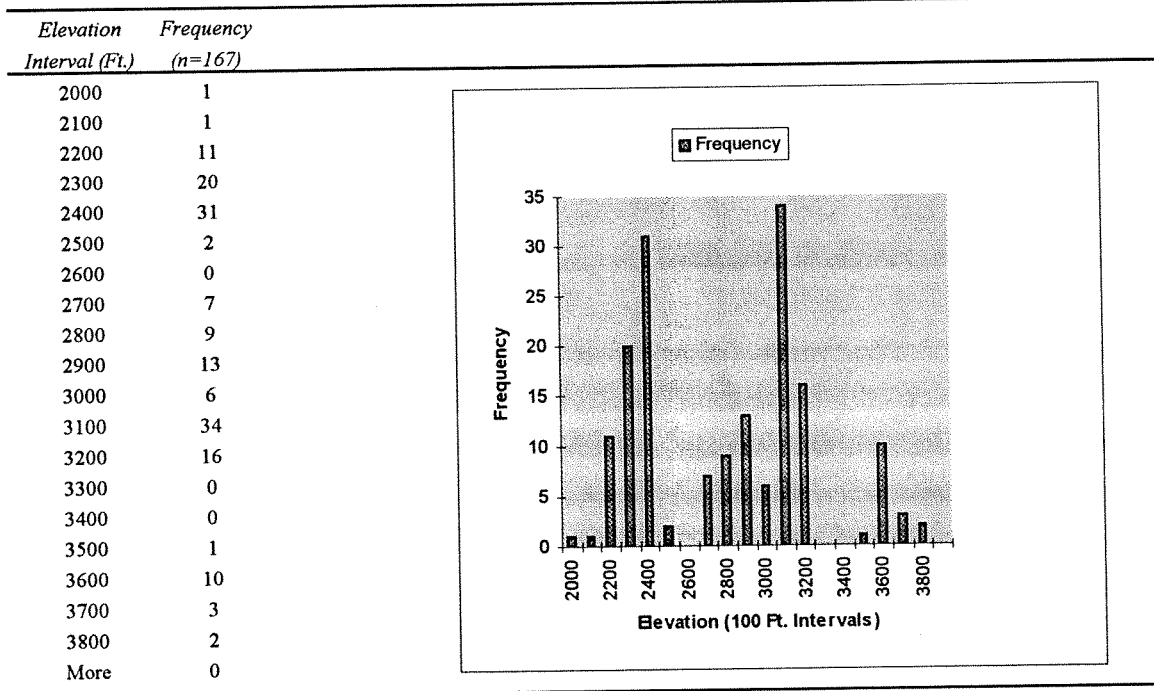
As indicated, no archaeological sites are known in these areas. Because of this pattern, but keeping in mind that the pattern may be a result of sampling bias, and that such areas were used in the past for specialized activities, *Sub-Zone III is defined as having Unproven archaeological potential.* For archaeological resource management purposes, it is recommended that either a sample of proposed logging developments in Sub-Zone III be surveyed on-the-ground over the next few years in order to gain survey coverage of the area to learn what the patterns of site distributions might be in this sub-zone, or alternatively, that an inventory survey be designed and carried out for Sub-Zone III with the explicit goal of determining archaeological site distribution patterns. As no archaeological sites are known in Sub-Zone III, it is not discussed further below in the subsequent analytical stages.

Sub-Zone IV: Middle Elevation Areas, 790-1,150 Metres

This sub-zone was defined to enclose all middle elevation areas within the District, except those areas within 1 kilometre of documented trails. In general, Sub-Zone IV was taken to represent the plateau areas outside the primary river valleys, throughout which many lakes and ponds are scattered. The lower end of this interval at 790 metres was selected because this elevation defines the top of most sections of the major river valleys in the District, and approximates the highest shore line of Glacial Lake Nechako. Additionally, plotting the frequencies of all the sites not within Sub-Zones I-III (giving n=167 sites) by elevation, highlights a tri-modal distribution of sites by elevation (Figure 2). The first peak on the frequency graph is centred on 730 metres (2,400 ft.) with thirty-one sites. The second peak on the frequency graph is centred on 940 metres (3,100 ft.) elevation with thirty-four sites, and the third, smallest peak is centred on 1,100 metres (3,600 ft.) elevation with ten sites. Between the first and second modal peaks, the value with the lowest frequency is 790 metres (2,600 ft.) elevation with no sites. It was based on this pattern that the critical

elevation value of 790 metres (2,600 ft.), separating the middle and lower elevation Sub-Zones IV and V was selected. The third modal peak on the frequency graph was not considered to be significant given the relatively small number of sites represented. This third peak is interpreted for the present as a product of sampling bias. Thus, the elevation value for the upper end of Sub-Zone IV was defined as 1,150 metres (3,800 ft.), the highest elevation of known sites in the District. A total of one hundred one known archaeological sites are located within Sub-Zone IV.

Figure 2: Frequency Distribution of Sites within Sub-Zones IV & V by Elevation



Several important lakes and streams are found within, or cross Sub-Zone IV. Sections of five primary streams run through this Sub-Zone: the upper reaches of the Chilako River from a point southwest of Naltesby Lake along the southern boundary of the District; the entire section of the upper reaches of the Blackwater River along the southwest boundary of the District, a small section of the upper Nechako River at the Nechako Canyon, and the Nechako River Valley now represented by Knewstubb Lake; a small section of the Sutherland River; and the Entiako River. There are numerous secondary streams running through Sub-

Zone IV, several of the more important of which include: Chedakuz Creek, Big Bend Creek, Suscha Creek, Euchiniko River, the upper reaches of Ormond Creek, Greer Creek, the middle and upper reaches of Corkscrew Creek, Cluculz Creek above Eulatazella Lake, and the middle reaches of Sinkut River. There are many other named streams classified here as secondary streams as well as innumerable small intermittent and ephemeral tertiary streams within Sub-Zone IV. The big lakes located within Sub-Zone IV include: Tatuk, Tatelkuz, Kuyakuz, Tsacha, and Entiako lakes. Some of the more notable small lakes (many of which could possibly be considered to be big lakes) include: Oona, Ormond, Hallett, Tahultzu, Lucas, Finger, Graveyard, Bobtail, Tatin, Justine, Stern, Anzus, Borel, Chowsunkut, Cabin, Bentzi, Holy Cross, Yellow Moose, Gatcho, Chutanli, Lavoie, Johnny, and Moose lakes. There are many other small lakes scattered through this Sub-Zone, as well as innumerable small ponds and wetlands.

Sub-Zone V: Low Elevation Areas, Below 790 Metres

Sub-Zone V was defined in much the same manner as Sub-Zone IV. However, it encloses the lower elevation areas within the District not located within trail corridors (Sub-Zone I) or within the Glacial Lake Nechako basin (Sub-Zone II). It effectively encloses all the major river valleys except the upper Chilako, Blackwater, and Entiako rivers and Knewstubb Lake (Nechako River above Kenney Dam). It also encloses Fraser Lake and Francois Lake. There is a high correlation between this sub-zone and salmon bearing waterways. As discussed above, of those sites not within Sub-Zones I-III, Sub-Zone V encloses the first modal peak on the frequency distribution of sites by elevation (Fig. 2). A total of sixty-six known archaeological sites are located within this sub-zone.

Several important lakes and streams are found within, or cross Sub-Zone V. All or sections of six primary streams run through this Sub-Zone: the Nechako River from the Nechako Canyon downstream to the vicinity of Lily Lake (edge of Glacial Lake Nechako); a section of the middle reaches of the Chilako River in the southeast corner of the District, the Stuart River along the northeast boundary of the District, the Stellako River, the Endako River, and the Nautley River. All of these rivers or sections have relatively high salmon

productivity. There are several sections of secondary streams running through Sub-Zone V. The sections of these streams represented are almost exclusively the lower reaches of the streams as they drain into the valleys of the primary streams and big lakes. Some of the more significant of these include: Cutoff Creek, Targe Creek, Greer Creek, Nithi River, Stern Creek, Ormond Creek, Dog Creek, and Kec Creek. There are many other named streams classified here as secondary streams as well as innumerable small intermittent and ephemeral tertiary streams within Sub-Zone V. The big lakes located within Sub-Zone V include Fraser and Francois Lakes. There are virtually no particularly significant small lakes within this Sub-Zone. Those of note are in the vicinity of Fraser Lake including Dry William, Seas and Deserters lakes. A few other small lakes are scattered through this Sub-Zone, as well as many smaller ponds.

Analytical Stage 2 -- Spatial Patterning of Sites within Sub-Zones

The objectives of this stage of analysis were two-fold: 1) to describe and highlight patterns in the spatial distribution of known archaeological sites in each sub-zone, in reference to landscape features; and 2) to define buffer zones around the landscape features that collectively enclose most, if not all, of the sites within each sub-zone. The data set(s)/samples used for this stage of analysis consisted of the data records for all sites within each sub-zone containing the measured distances of each site from big lakes, small lakes, ponds, primary streams, secondary streams, tertiary streams, wetlands, and trails.

Analyses were undertaken by sub-zone, within each of which separate analyses by landscape variable were completed. Only the sites within the sub-zone under consideration were employed in the analyses. For example, only the 323 sites within Sub-Zone I -- Trail Corridors were used in defining the buffer zones for this sub-zone. Moreover, these sites were not used in defining the buffer zones within other sub-zones. The means of analysis consisted of plotting the frequency distributions of sites by 50 metre distance interval (the smallest meaningful interval given the nature of the data) from each landscape variable up to the maximum significant distance established for each variable. The maximum distance values for each variable are: Big Lakes -- 1000m; Small Lakes -- 1000m; Ponds -- 500m; Primary

Streams -- 1000m; Secondary Streams -- 1000m; Tertiary Streams -- 500m; Wetlands -- 250m; and Trails -- 1000m.

Subsequent to highlighting spatial patterning of sites in relation to the landscape variables through plotting the frequency distributions, a critical distance value for each landscape variable was identified which would define the high potential buffer zone limits for that variable. The general process adopted to define the buffer zone limit was first to take the median distance interval, and second to add one distance interval value (50 metres). The median distance interval is that interval in which the median frequency value falls, and which, by definition, accounts for at least 50% of the sites located within the maximum distance value for that particular landscape variable. For example, if the median distance interval defined in the frequency distribution were 50-100 metres, then the critical buffer zone value would be defined as 150 metres from that landscape variable. Adding 50 metres to the median interval value accounts for the potentially high level of measurement error inherent in the 1:50,000 scale site location maps which served as the primary raw data set. The mean distance value was not employed in defining the buffer zone limits as it often misrepresents the frequency distributions because of their usually highly skewed nature.

While the above process was devised as a consistent means of defining the critical buffer zone values, it was not always possible to follow it rigidly for a variety of reasons. Primary among these reasons were irregular or poorly defined frequency distributions and misleading results, usually attributable to insufficient archaeological site information about the zones defined (insufficient or biased samples). The cases where such problems occurred are discussed individually, and the rationale for definition of the critical buffer zone value in each case is presented.

It is important to note here that stratification of the district into sub-zones, while facilitating a better understanding of varying site distribution patterns across the landscape, also creates problems in terms of sample sizes; the effective sample sizes used in analysis become relatively small. Although there are 540 known sites in the District providing the overall sample, each sub-zone has a significantly smaller actual number of sites. During analysis, these sub-zone samples are effectively reduced even further into sub-samples of

known sites in relation to particular landscape variables. This pattern is best illustrated with an example. Beginning with $n=540$ known sites in the District, stratification reduces the sample of known sites to $n=101$ for Sub-Zone IV (Middle Elevation Areas). Determination of the number of sites within 500 metres of ponds in Sub-Zone IV, reduces the sample size to $n=11$. It is this last sample that is used to define the buffer widths for ponds in Sub-Zone IV. As can be appreciated, such a small sample size is probably not representative. One of the incidental more positive results of this sample size issue, however, was to highlight instances where samples of known sites in particular circumstances are lacking or non-representative.

This kind of pattern in sample size reduction, although highly variable in magnitude, is apparent for all sub-zones and all landscape variables and, as indicated, often creates interpretive problems. In some cases the reduction of sample size was so great as effectively, to reduce it to $n=0$. In such cases, it is obvious that a field sampling bias and large data-gap are present. Definition of an appropriate high potential buffer in such cases was accomplished by analogy and/or by making assumptions. In cases where the samples sizes were small, but where patterning in site locations were suggested by the data, it was usually assumed that the general pattern indicated would hold given further data collection. For example, most archaeologists would agree that knowing of only one archaeological site 0-50 metres from a wetland, but greater than a kilometre from any other significant landscape variable, still provides good evidence to assume that many similar such sites are located on such marshes throughout the area under consideration.

The above discussion recognizes and makes explicit the general limitations in the available data set. Continuing field research will eventually increase our known site data set, and allow more confident definition of high archaeological potential zones (whether by decreasing or increasing the buffer widths remains to be determined). The model is intended as the current best estimate of archaeological potential zones for the V.F.D., and has much utility for archaeological resource management decision making. This is all it is, however, a tool, and cannot be interpreted as a full representation of the distribution of all the archaeological sites in the District. The model has been designed to be flexible and can and should be reconsidered and modified regularly or as necessary in light of new information.

The results of the analyses are presented below in combined tabular and graphical form by sub-zone (Figures 3-28) with accompanying textual annotations for each separate analysis. Note that in the frequency distribution figures, the 50 metre distance intervals are labelled using only the maximum value of the interval; thus, the distance interval 0-50 metres is labelled 50, the interval 51-100 metres is labelled 100, and so on.

Sub-Zone I: Trail Corridors

As indicated above, 323 (59.8%) of the known archaeological sites in the V.F.D. fall within this sub-zone (within 1 kilometre of documented trails). Figures 3-10 (below) illustrate the frequency of sites within this sub-zone by 50 metre intervals from Primary Streams; Secondary Streams; Tertiary Streams; Big Lakes; Small Lakes; Ponds; Trails (approximated actual location of trail beds), and Wetlands respectively.

Figure 3: Frequency of Sites within Sub-Zone I -- Trail Corridors by 50m Distance Intervals to Primary Streams (specified intervals include only sites within 1 kilometre of primary streams)

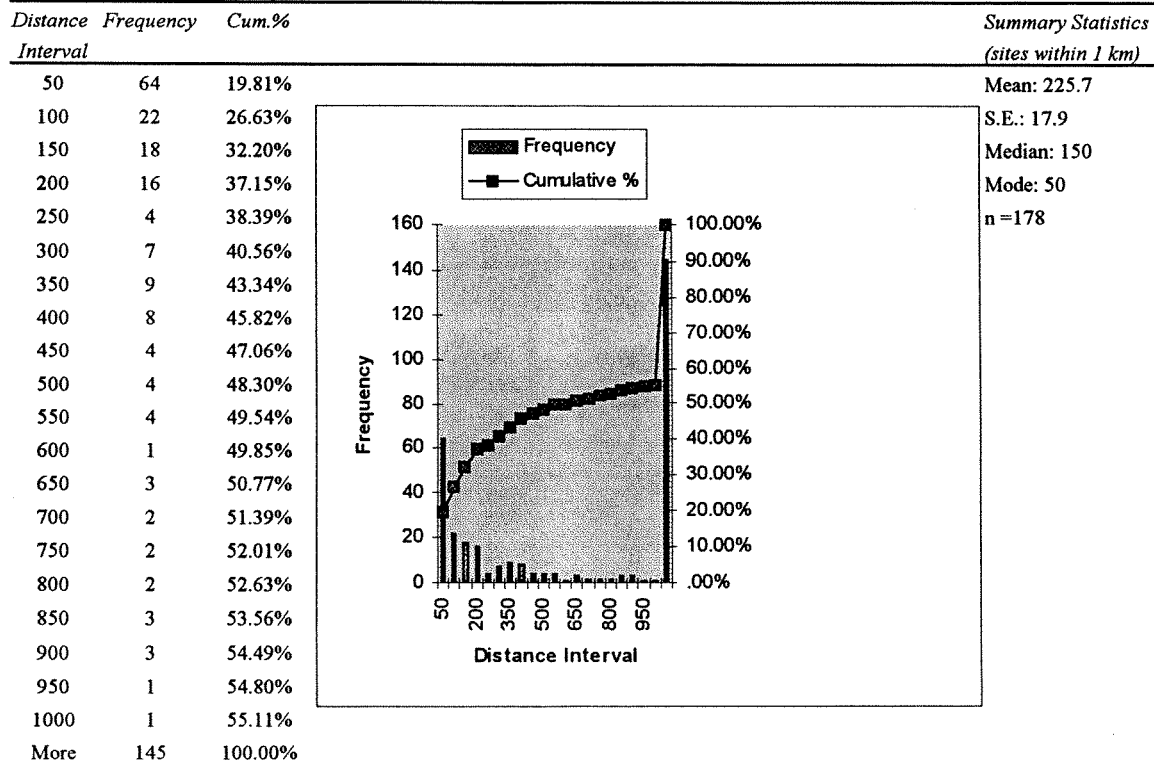


Figure 3 illustrates the distribution of archaeological sites within one kilometre of primary streams in Sub-Zone I. It is clear from this diagram that as distance from primary streams increases, the number, and therefore density of archaeological sites decreases. The median distance interval value is 150 metres accounting for 104 (58.4%) of the sites in Sub-Zone I within one kilometre of a primary stream. Adding 50 metres to this value gives 200 metres and defines an acceptable high potential buffer zone limit for primary streams in Sub-Zone I. This buffer zone limit accounts for 120 sites representing 37.15% of all the sites in Sub-Zone I, and 67.4% of the 178 known sites within one kilometre of primary streams.

Figure 4: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to Secondary Streams (specified intervals include only sites within 1 kilometre of secondary streams)

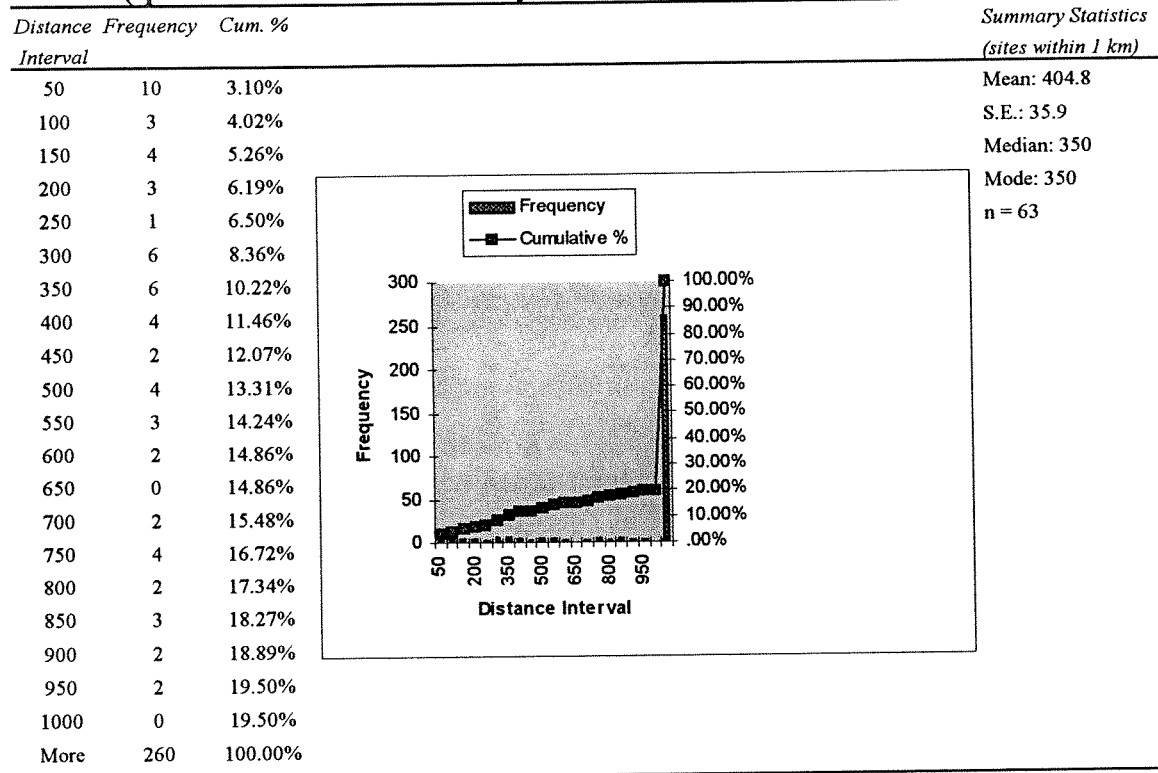


Figure 4 illustrates the distribution of archaeological sites within one kilometre of secondary streams in Sub-Zone I. No clear pattern of site distributions is visible, and it appears that as distance from secondary streams increases, the number of archaeological sites remains relatively constant. It would seem from this distribution that secondary streams are a weak predictor of site locations. However, a significant, yet small number of sites are closely associated with secondary streams; the greatest frequency of sites in this distribution (n=10) are within 50 metres. This association is probably greater in reality than indicated by this frequency distribution. There appears to be a sampling bias represented in the distribution, and it is probable that little survey attention has been given secondary streams in Sub-Zone I. Therefore, it is assumed that the median interval for secondary streams would be 50 metres if representative sampling were achieved. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for secondary streams in Sub-Zone I. This buffer zone accounts for 13 sites representing 4.0% of all the sites in Sub-Zone I, and 20.6% of the 63 known sites within one kilometre of secondary streams.

Figure 5: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to Tertiary Streams (specified intervals include only sites within 500 metres of tertiary streams)

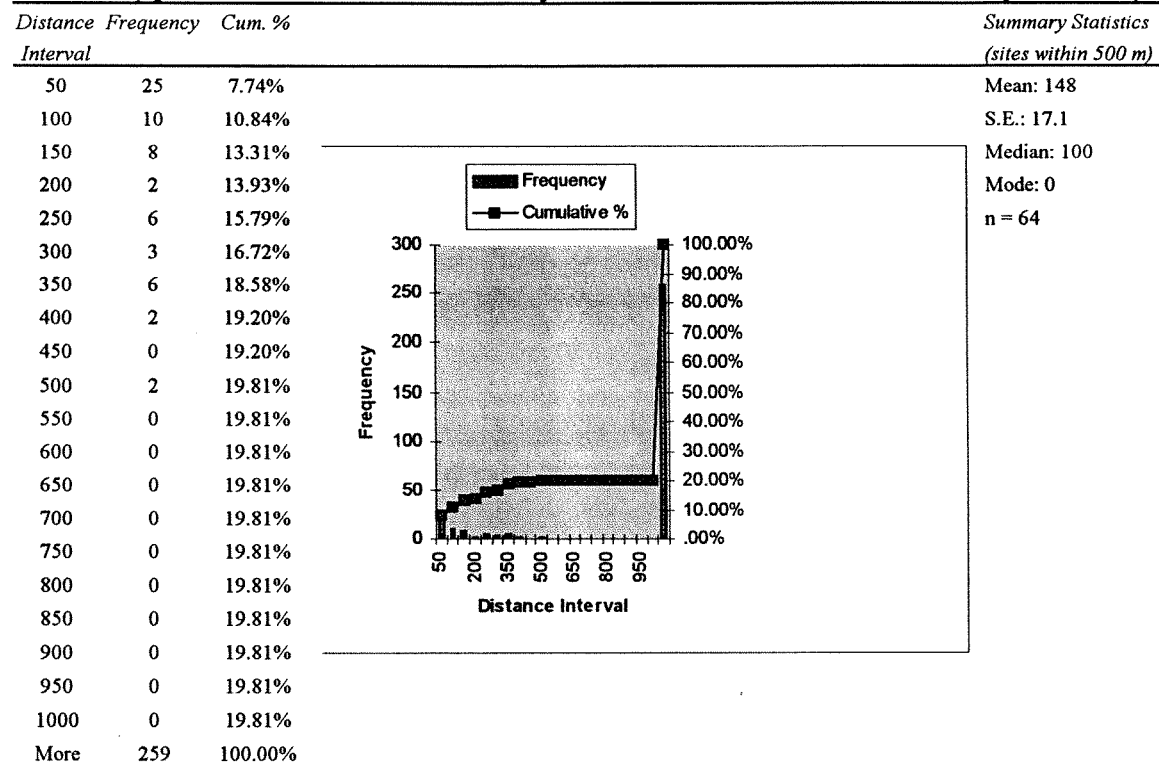


Figure 5 illustrates the distribution of archaeological sites within 500 metres of tertiary streams in Sub-Zone I. A relatively regular pattern of site distributions is apparent, with decreasing site frequencies as distance increases from tertiary streams. The median distance interval is 50-100 metres. However, if this value were used to define a buffer zone limit, it would over-emphasize the significance of tertiary streams as site predictors, and would give a 150 metre buffer value, and thus greater significance to tertiary streams than to secondary streams. Such a pattern is counter-intuitive. Consideration of the modal value of the frequency distribution, indicates that the greatest frequency of sites in relation to tertiary streams, is 0-50 metres from tertiary streams. Such a value makes more sense in relation to what one would perceive as the cultural significance of small and/or ephemeral streams. Moreover, after filtering the site location data based on all the defined high potential buffer zones (see below, Summary of Sub-Zone I Analyses), 0-50 metres from tertiary streams accounts for only one site not already accounted for by other landscape variables. Overall, this pattern suggests that tertiary streams are more important in determining specific site

locations (secondary predictors), than in being primary, general site location predictors. Given these considerations, a high potential buffer limit of 50 metres is defined for tertiary streams. This buffer zone limit accounts for 25 sites representing 7.7% of all the sites in Sub-Zone I, and 39.1% of the 64 known sites within 500 metres of tertiary streams.

Figure 6: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to Big Lakes (specified intervals include only sites within 1 kilometre of big lakes)

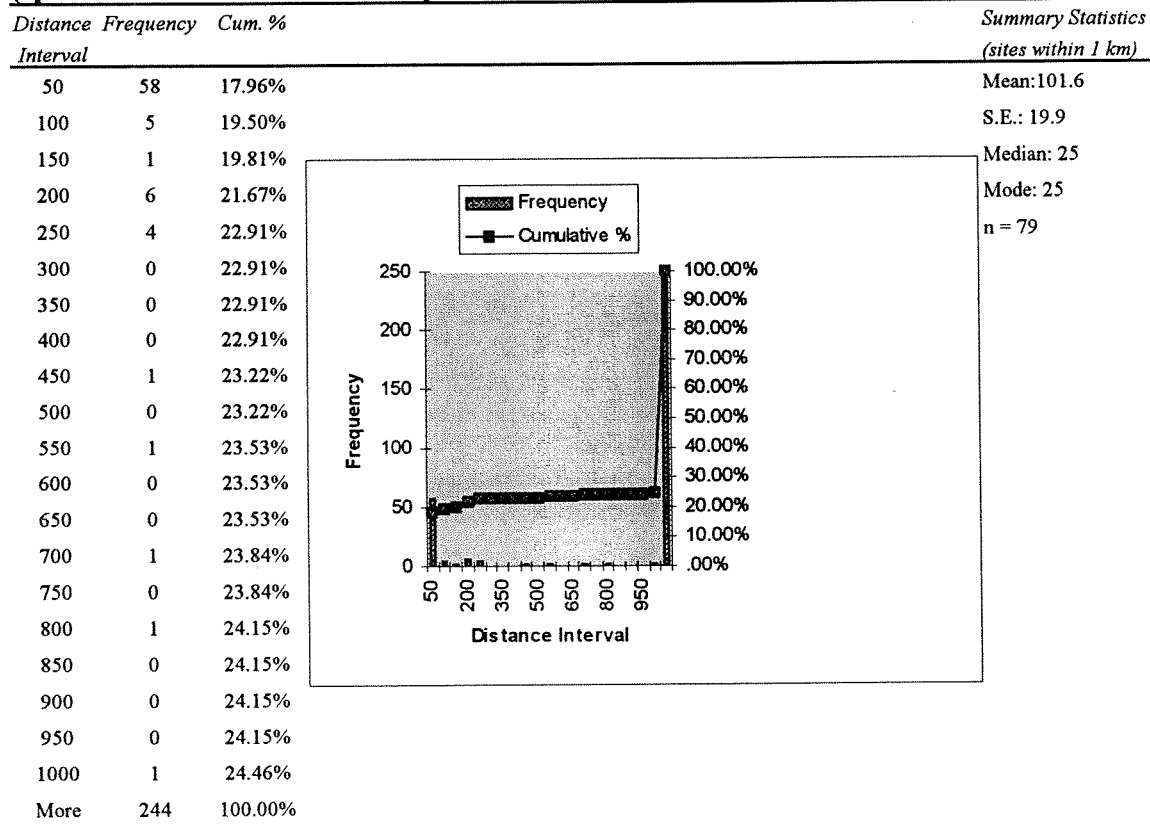


Figure 6 illustrates the distribution of archaeological sites within one kilometre of big lakes in Sub-Zone I. This distribution indicates that there is a close association between site locations and big lakes. Beyond 50 metres from a big lake, the number of sites drops sharply. The median distance interval value is 50 metres which accounts for 58 (73.4%) of the sites in Sub-Zone I within one kilometre of big lakes. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for big lakes in Sub-Zone I. This buffer zone limit accounts for 63 sites representing 19.5% of all the sites in Sub-Zone I, and 79.7% of the 79 known sites within one kilometre of big lakes.

Figure 7: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to *Small Lakes* (specified intervals include only sites within 1 kilometre of small lakes)

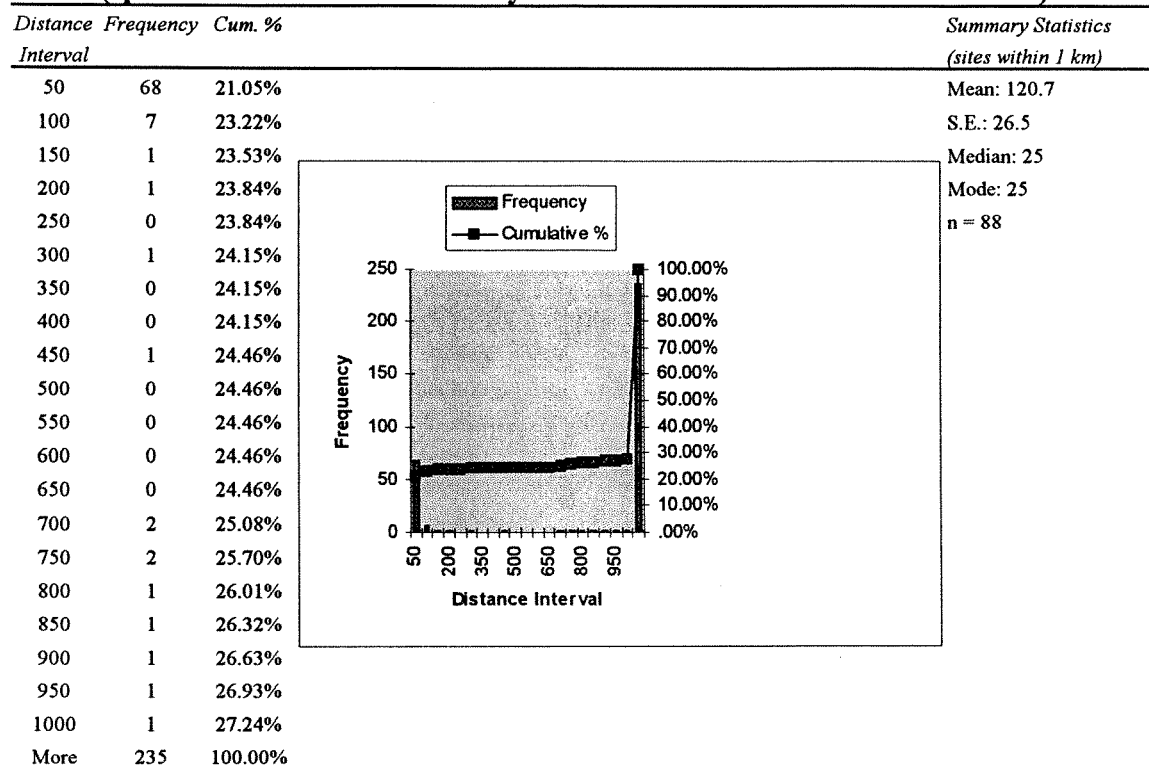


Figure 7 illustrates the distribution of archaeological sites within one kilometre of small lakes in Sub-Zone I. This distribution is very similar in form to that of Big Lakes, and suggests that lake size may not be particularly significant in terms of site densities, or alternatively may indicate that the definitions of big lakes and small lakes employed in this study are not fully appropriate. The distribution indicates that there is a close association between site locations and small lakes. Beyond 50 metres from a small lake, the number of sites drops sharply. The median distance interval value is 50 metres which accounts for 68 (77.3%) of the sites in Sub-Zone I within one kilometre of small lakes. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for small lakes in Sub-Zone I. This buffer zone limit accounts for 75 sites representing 23.2% of all the sites in Sub-Zone I, and 85.2% of the 88 known sites within one kilometre of small lakes.

Figure 8: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to Ponds (specified intervals include only sites within 500 metres of ponds)

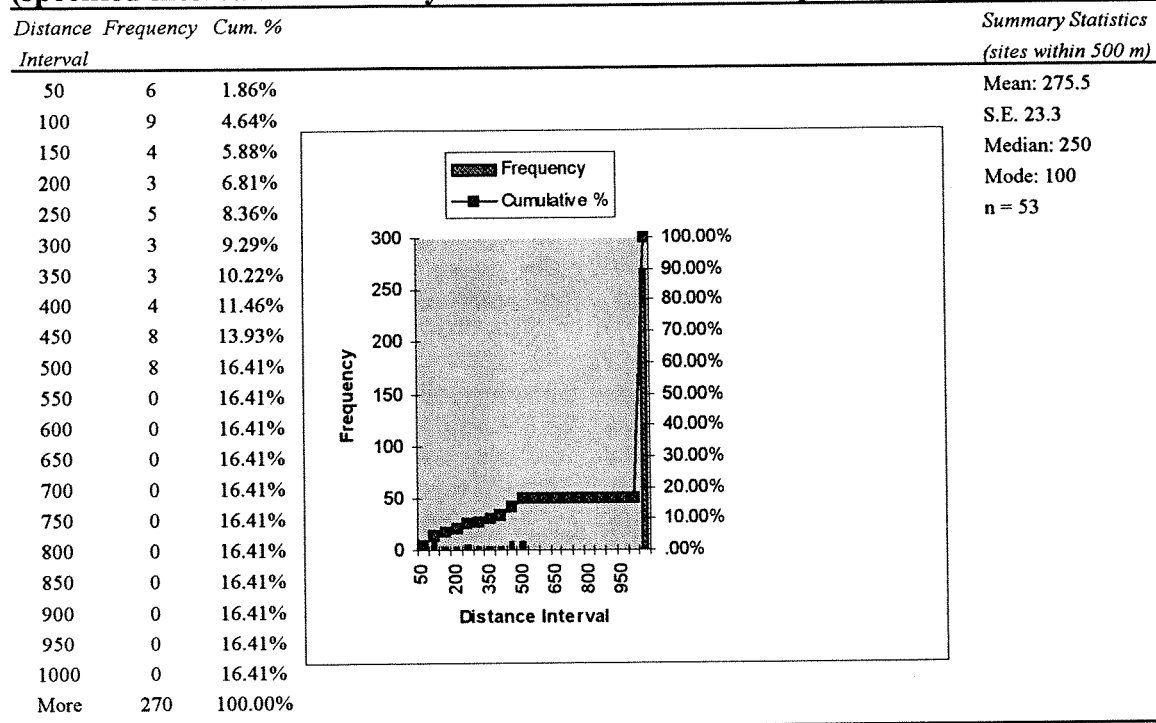


Figure 8 illustrates the distribution of archaeological sites within 500 metres of ponds within Sub-Zone I. No clear pattern of site distributions is visible, and it appears that as distance from secondary streams increases, the number of archaeological sites remains relatively constant. The median distance interval is 200-250 metres. However, if this value were used to define a high potential buffer zone limit, it would over-emphasize the significance of ponds as site predictors, and would give a 300 metre buffer value, and thus greater significance to ponds than to any other landscape variable. Such a pattern is erroneous. Consideration of the modal value of the frequency distribution, indicates that the greatest frequency of sites in relation to ponds is within 50-100 metres of ponds. Such a value makes more sense in relation to what one would perceive as the cultural significance of ponds and is consistent with the patterns identified above for bigger bodies of water. Given these considerations, a high potential buffer limit of 100 metres is defined for ponds. Subsequent field sampling may indicate this buffer limit could be reduced. This buffer zone limit accounts for 15 sites representing 4.6% of all the sites in Sub-Zone I, and 28.3% of the 53 known sites within 500 metres of ponds.

Figure 9: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to Trails (specified intervals include only sites within 1 kilometre of trails)

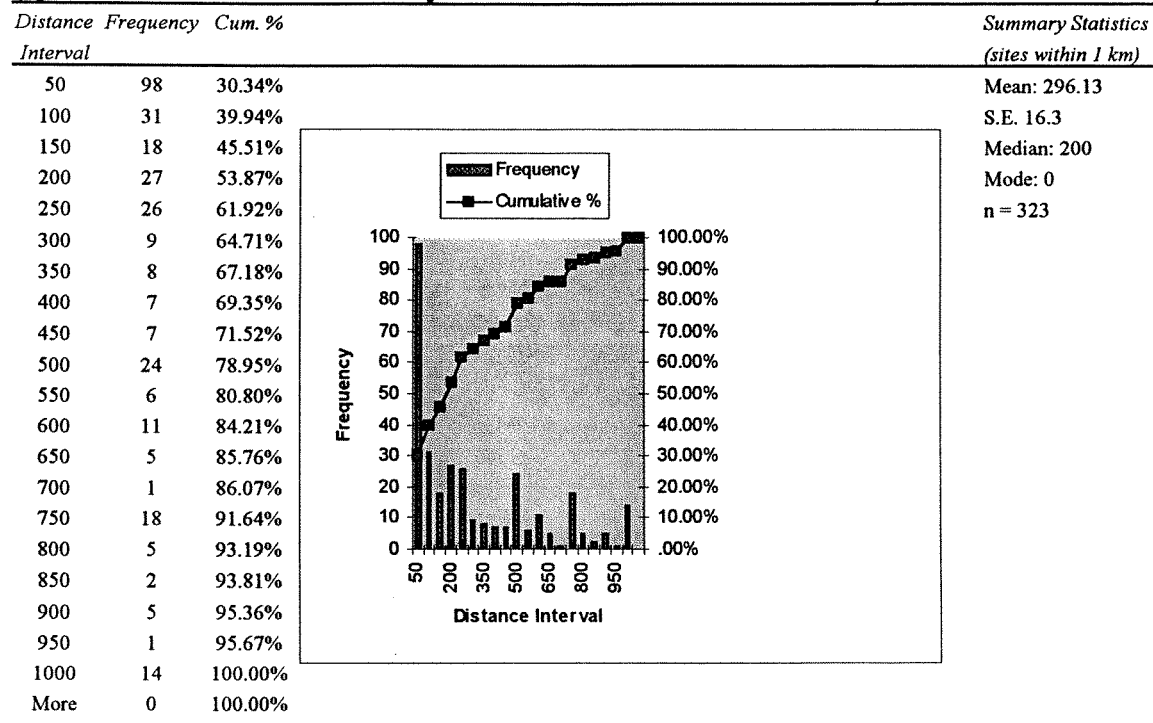


Figure 9 illustrates the distribution of archaeological sites within one kilometre of trails in Sub-Zone I. This distribution includes all the sites in Sub-Zone I, as the sub-zone is defined as areas within one kilometre of trails. There is a strong, relatively regular pattern of site distributions in relation to trails. As distance from trails increases, the number and, therefore densities of sites decreases. The median distance interval value is 200 metres which accounts for 174 (53.9%) of the 323 sites in Sub-Zone I within one kilometre of trails. Adding 50 metres to this value gives 250 metres and defines an acceptable high potential buffer zone limit for trails in Sub-Zone I. This buffer zone limit accounts for 200 sites representing 61.9% of all the sites in Sub-Zone I. Note that this is the same high potential buffer zone limit value defined for trails in the earlier potential model (Carlson 1996).

Figure 10: Frequency of Sites within Sub-Zone I by 50m Distance Intervals to Wetlands (specified intervals include only sites within 250 metres of wetlands)

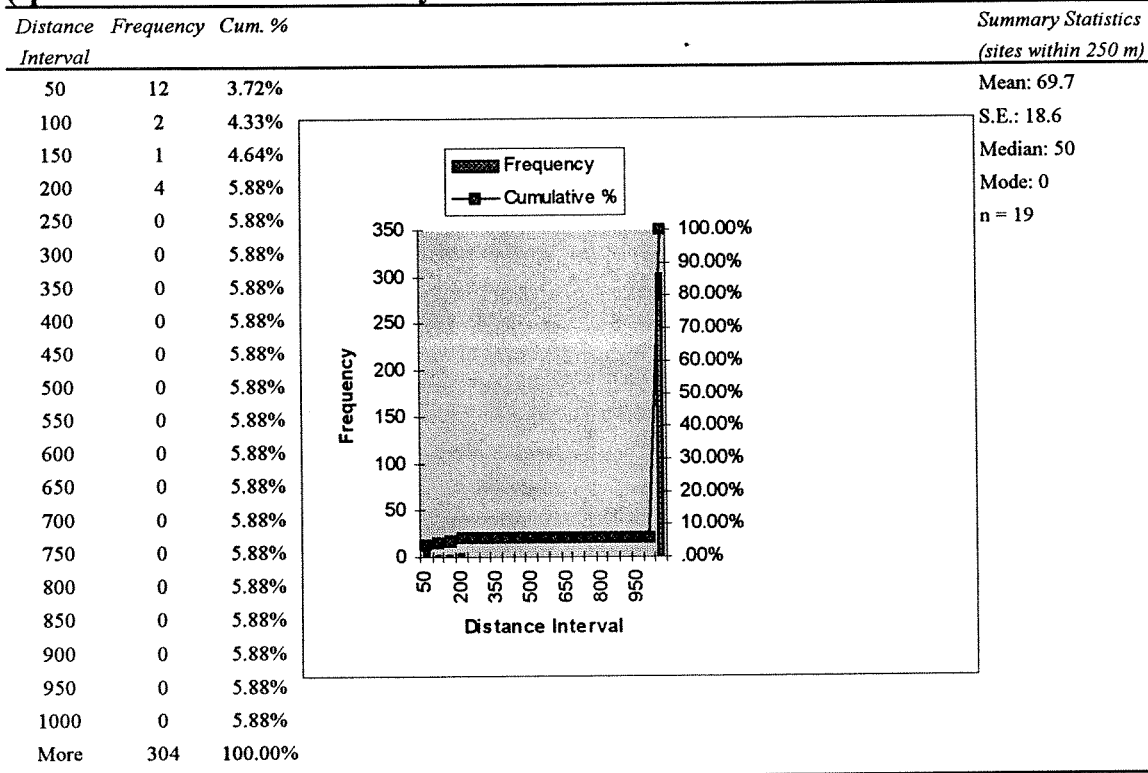


Figure 10 illustrates the distribution of archaeological sites within 250 metres of wetlands in Sub-Zone I. A relatively regular pattern of site distributions is apparent, with decreasing site frequencies as distance increases from wetlands, dropping to zero at distances farther than 200 metres. This pattern is very similar to that for tertiary streams. The median distance interval is 0-50 metres. Consideration of the modal value of the frequency distribution, indicates that the greatest frequency of sites in relation to wetlands is also between 0-50 metres. Such a value makes sense in relation to what one would perceive as the cultural significance of wetlands. Overall, this pattern, like that for tertiary streams, suggests that wetlands are more important in determining specific site locations, than in being primary general site location predictors. Given these considerations, a high potential buffer limit of 50 metres is defined for wetlands. This buffer zone limit accounts for 12 sites representing 3.7% of all the sites in Sub-Zone I, and 63.2% of the 19 known sites within 250 metres of wetlands.

Summary of Sub-Zone I Analyses

Table 1 summarizes the high potential buffers, the actual number of sites explained by each high potential buffer as a single variable, and the cumulative proportion of sites explained by successive application of each buffer on sites in Sub-Zone I. Table 1 effectively defines the potential model for Sub-Zone I. Any logging development within the high potential buffer zone limits should be preceded by archaeological impact assessments because there is a relatively great risk of impacting unknown archaeological sites in these areas.

Table 1: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone I -- Trail Corridors

Landscape Variable	High Potential Buffer Limit (metres)	No. of sites Explained by Single Variable High Potential Buffer Zone	Cumulative No. of Sites Explained by High Potential Buffer Limits*
Trail	250	200/323 (61.9%)	200/323 (61.9%)
Primary Stream	200	120/323 (37.2%)	229/323 (70.9%)
Big Lake	100	63/323 (19.5%)	253/323 (78.3%)
Small Lake	100	75/323 (22.2%)	293/323 (90.7%)
Secondary Stream	100	13/323 (4.0%)	296/323 (91.6%)
Pond	100	15/323 (4.6%)	297/323 (92.0%)
Tertiary Stream	50	25/323 (7.7%)	298/323 (92.3%)
Wetland	50	12/323 (3.7%)	300/323 (92.9%)
Total no. of sites in Sub-Zone I explained by High Potential Zones			300/323 (92.9%)

*This column illustrates the cumulative effectiveness of each variable's high potential buffer for explaining or accounting for sites within the Sub-Zone. It illustrates a cumulative progression with ever increasing numbers of sites explained. Note that in this progression, sites are only explained once, even though more than one variable buffer may account for any one site.

Because of the high proportion of known sites in the District located in Sub-Zone I (59.8%), all areas outside the high potential areas defined above, but within 1 kilometre of documented trails are defined as having moderate archaeological potential. It is recommended that archaeological reconnaissance surveys and/or partial AIAs be conducted on development properties falling in these moderate potential areas.

Sub-Zone II: Glacial Lake Nechako

Fifty (9.3%) of the 540 known archaeological sites in the V.F.D. fall within Sub-Zone II (within the margins of Glacial Lake Nechako, but not within 1 km of trails crossing the glacial lake basin). Figures 11-16 illustrate the frequency of sites within this Sub-Zone by 50 metre intervals from Primary Streams, Secondary Streams, Tertiary Streams, Big Lakes, Small Lakes, and Ponds respectively. The proximity of sites to trails cross-cutting this Sub-Zone have been accounted for in Sub-Zone I, and are therefore, not a part of the data set used in the analyses presented here for Sub-Zone II, and not used in definition of the high potential buffer zone limits for this Sub-Zone.

Figure 11: Frequency of Sites within Sub-Zone II -- Glacial Lake Nechako by 50m Distance Intervals to Primary Streams (specified intervals include only sites within 1 kilometre of primary streams)

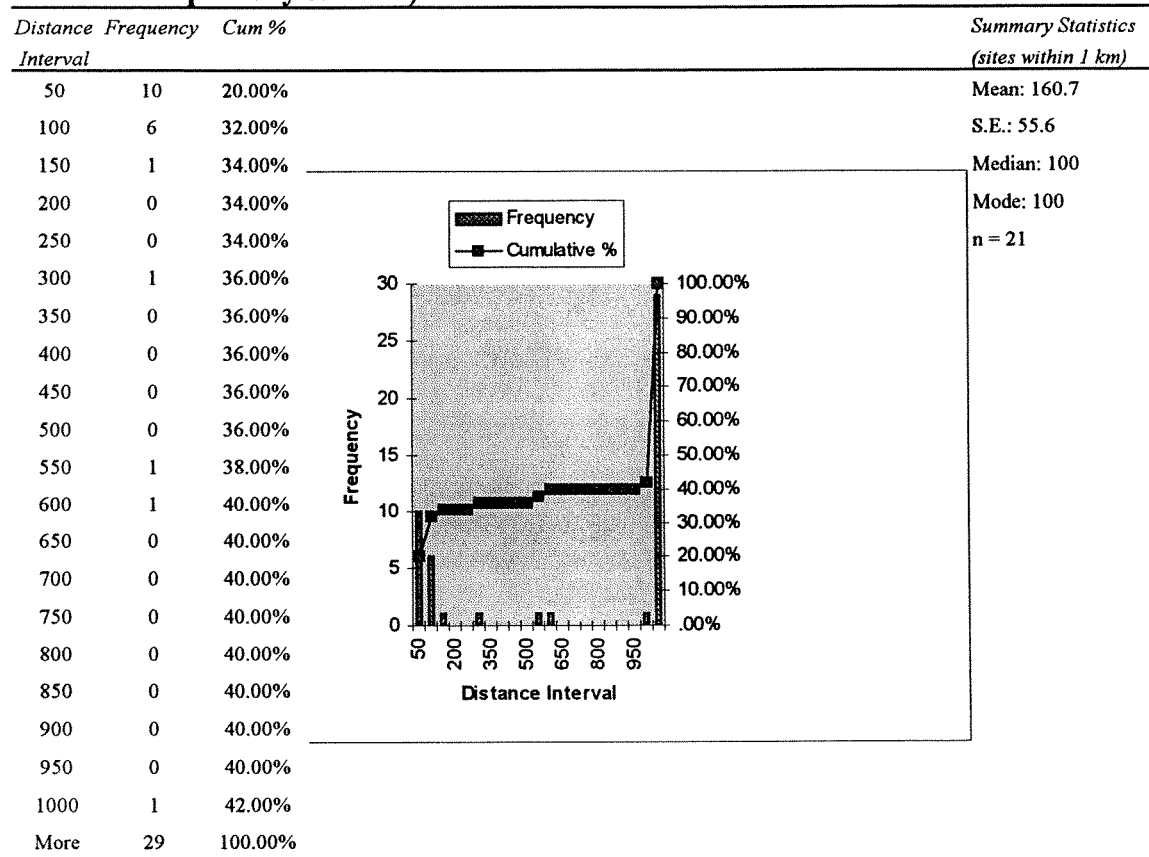


Figure 11 illustrates the distribution of known archaeological sites within one kilometre of primary streams in Sub-Zone II. It is clear from this distribution that within a short distance of primary streams within the Glacial Lake Nechako basin, there is a relatively high density of archaeological sites. The median distance interval value is 100 metres which accounts for 16 (76.2%) of the 21 sites in Sub-Zone II within one kilometre of a primary stream. Adding 50 metres to this value gives 150 metres and defines an acceptable high potential buffer zone limit for primary streams in Sub-Zone II. This buffer zone limit accounts for 17 sites representing 34.0% of all the sites in Sub-Zone II, and 81.0% of the 21 known sites within one kilometre of primary streams.

Figure 12: Frequency of Sites within Sub-Zone II -- Glacial Lake Nechako by 50m Distance Intervals to Secondary Streams (specified intervals include only sites within 1 kilometre of secondary streams)

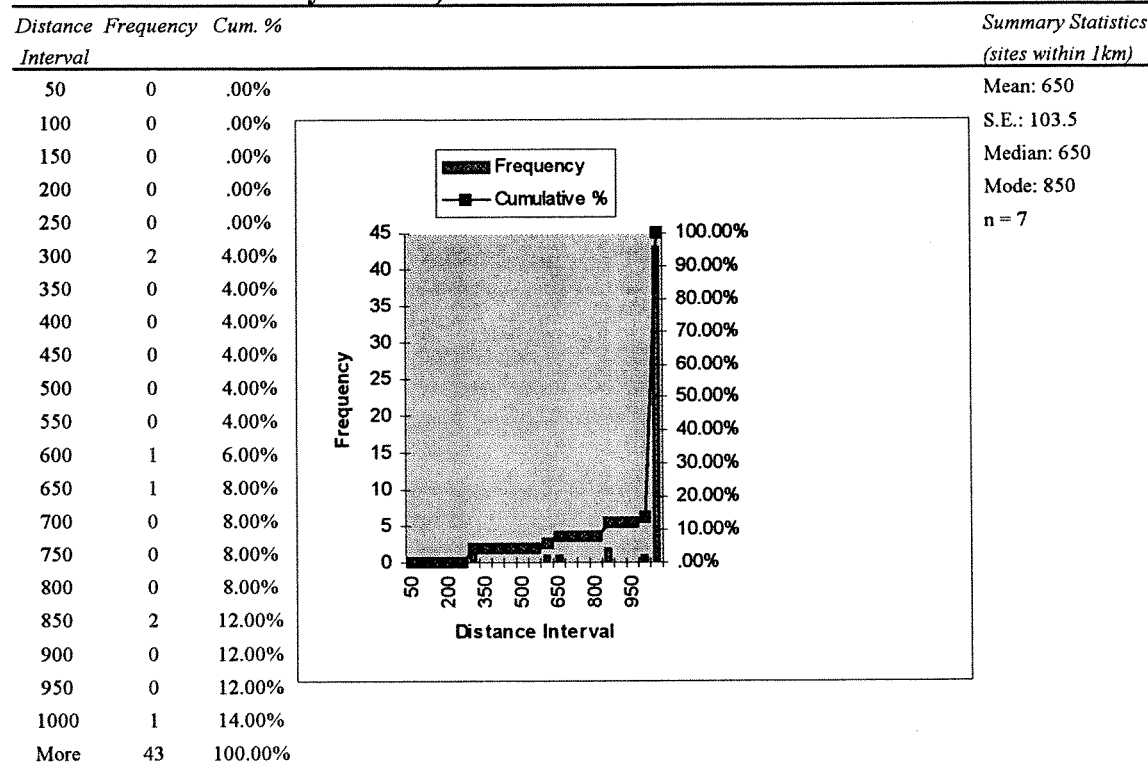


Figure 12 illustrates the distribution of known archaeological sites within one kilometre of secondary streams in Sub-Zone II. This distribution offers little information on the locations of archaeological sites in relation to secondary streams in Sub-Zone II. The closest known sites to secondary streams are between 250-300 metres, all of which are explained by other landscape variables. It appears that a large data-gap is illustrated in the distribution. Very little survey attention has been given secondary streams, as indicated in a brief review of archaeological projects to date, and the attention that has been given consists almost solely of surveys of linear development corridor crossings of secondary streams (e.g. pipelines and transmission lines). It is assumed that the median interval for secondary streams in Sub-Zone II would be 50 metres if a representative sample of sites were known. This interval would provide a high potential buffer zone limit of 100 meters and is consistent with the high potential buffer zone limit defined for tertiary streams in this Sub-Zone. Currently, this buffer zone for secondary streams in Sub-Zone II accounts for no archaeological sites.

Figure 13: Frequency of Sites within Sub-Zone II -- Glacial Lake Nechako by 50m Distance Intervals to Tertiary Streams (specified intervals include only sites within 500 metres of tertiary streams)

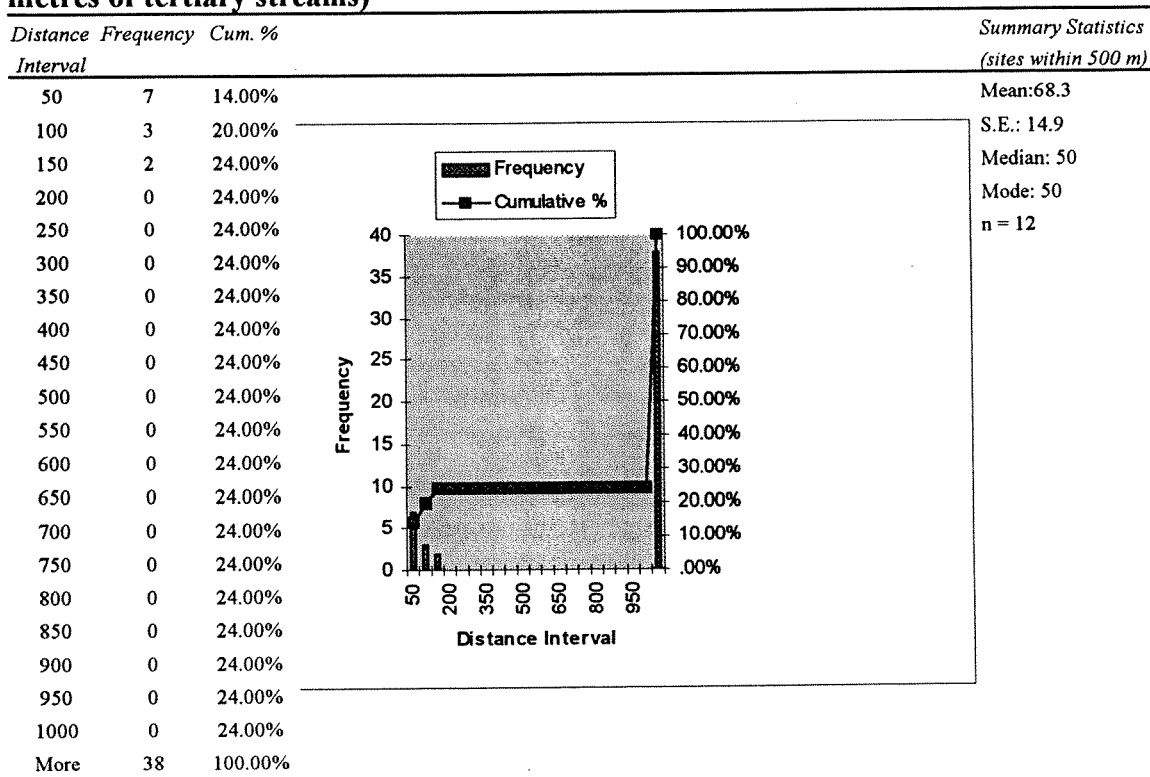


Figure 13 illustrates the distribution of known archaeological sites within 500 metres of tertiary streams in Sub-Zone II. A relatively regular pattern of site distributions is apparent, with site frequencies dropping to zero between 150-200 metres. The median distance interval is 50 metres. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for tertiary streams in Sub-Zone II. This buffer zone limit accounts for 10 sites representing 20.0% of all the sites in Sub-Zone II, and 83.3% of the 12 known sites within 500 metres of tertiary streams. It is pointed out here, however, that the remaining 2 sites within 500 metres of tertiary streams between 100 and 150 metres, are not explained by any other variable. Thus, it is possible that the 100 metre high potential buffer zone limit for tertiary streams is too narrow. If so, this would probably indicate that the assumed high potential buffer zone limit for secondary streams is also too narrow. Only further field investigations would resolve this uncertainty.

Figure 14: Frequency of Sites within Sub-Zone II -- Glacial Lake Nechako by 50m Distance Intervals to Big Lakes (specified intervals include only sites within 1 kilometre of big lakes)

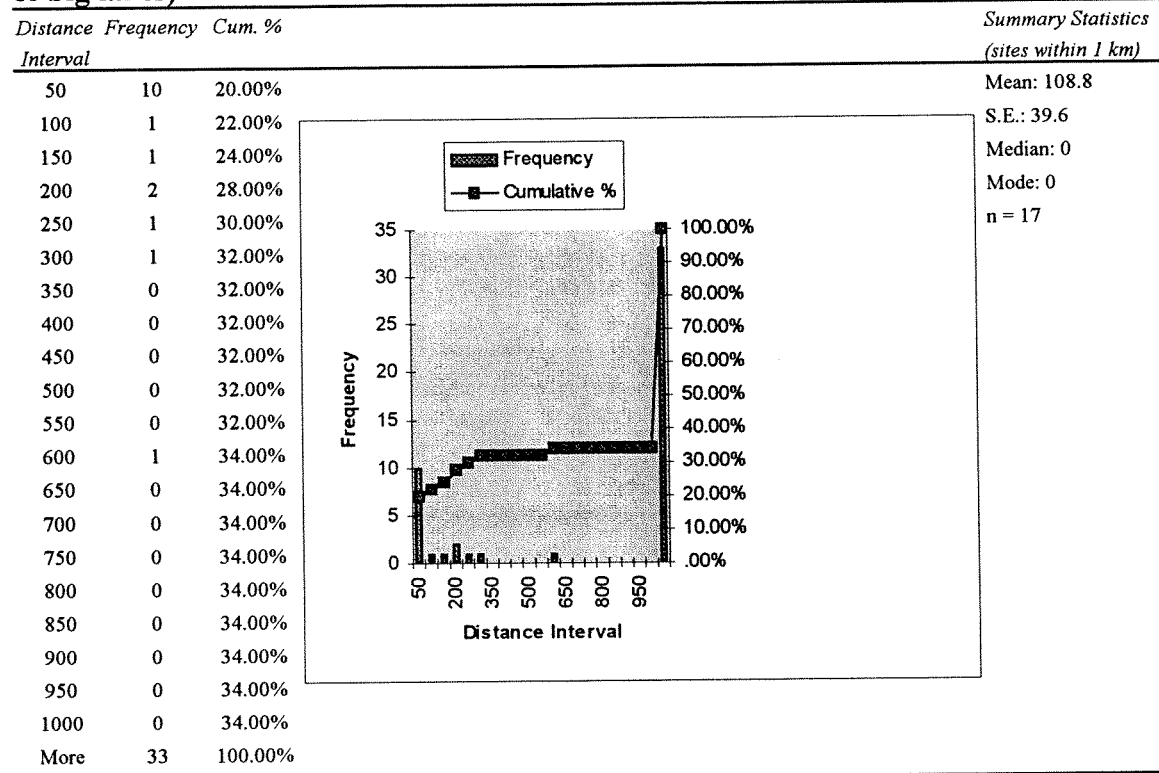


Figure 14 illustrates the distribution of known archaeological sites within one kilometre of big lakes in Sub-Zone II. A relatively regular pattern of site distributions is apparent, with site frequencies dropping quickly more than 50 metres from the lake shore, and dropping to zero further than 300 metres from the lake shore. The median distance interval is 50 metres. Using the procedures defined above for determining the high potential buffer limit value by adding 50 metres would give 100 metres as the buffer limit. However, on filtering of the data it was found that none of the additional five sites at distances further than 100 metres from big lakes are explained by any other variable. This suggests that our sample of sites in relation to big lakes in Sub-Zone II is not representative. As a consequence, the high potential buffer zone limit for big lakes was defined as 300 metres so as to enclose these additional sites. This buffer zone limit accounts for 16 sites representing 32.0% of all the sites in Sub-Zone II, and 94.1% of the 17 known sites within 1 kilometre of big lakes in Sub-Zone II.

Figure 15: Frequency of Sites within Sub-Zone II -- Glacial Lake Nechako by 50m Distance Intervals to Small Lakes (specified intervals include only sites within 1 kilometre of small lakes)

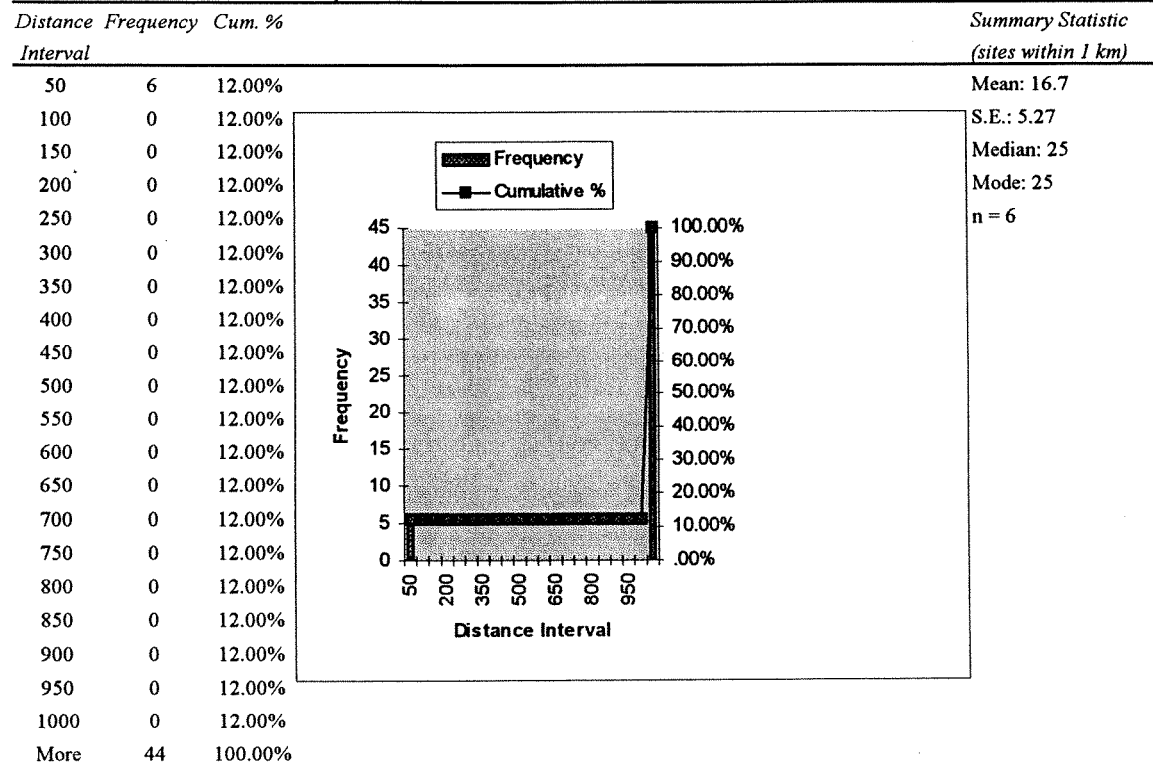


Figure 15 illustrates the distribution of known archaeological sites within 1 kilometre of small lakes in Sub-Zone II. A relatively regular pattern of site distributions is apparent, with known site frequencies dropping to zero at distances further than 50 metres. The median distance interval is 50 metres. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for small lakes in Sub-Zone II. This buffer zone limit accounts for 6 sites representing 12.0% of all the sites in Sub-Zone II, and 100% of the 6 known sites within 1 kilometre of small lakes in Sub-Zone II.

Figure 16: Frequency of Sites within Sub-Zone II -- Glacial Lake Nechako by 50m Distance Intervals to Ponds (specified intervals include only sites within 500 metres of ponds)

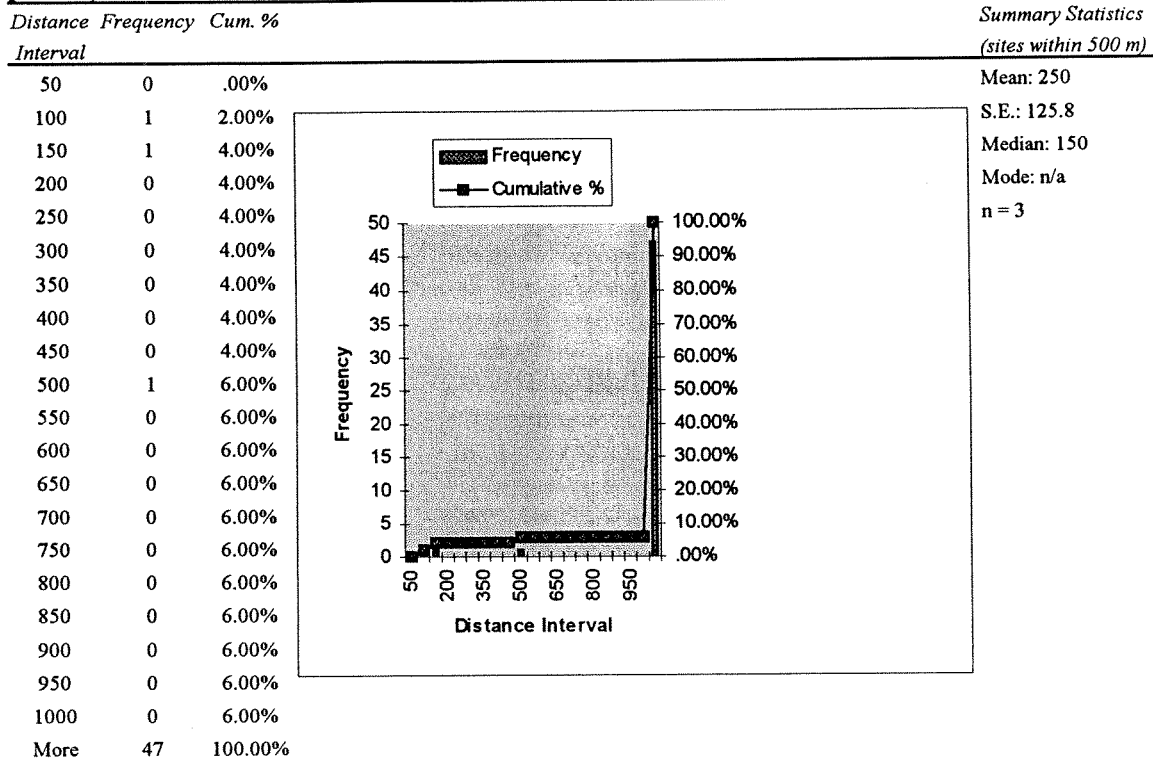


Figure 16 illustrates the distribution of known archaeological sites within 500 metres of ponds in Sub-Zone II. Because of the small sample size ($n=3$), this distribution offers virtually no useful information on the locations of archaeological sites in relation to ponds. The closest site to a pond in Sub-Zone II is between 50-100 metres. This site, and the other two more distant sites are all explained by other landscape variables. It appears that, again, a sampling bias is illustrated. For the purposes of this model, the high potential buffer zone limit for ponds was defined as 50 metres. This value would account for any sites in clear and direct association with small water bodies. Currently, it accounts for no known archaeological sites.

Summary of Sub-Zone II Analyses

Table 2 summarizes the high potential buffer limits, the actual number of sites explained by each high potential buffer as a single variable, and the cumulative proportion of sites explained by successive application of each buffer on sites in Sub-Zone II -- Glacial Lake Nechako. Table 2 effectively defines the potential model for Sub-Zone II. Any logging development within these high potential buffer zone limits should be preceded by archaeological impact assessments because there is a relatively great risk of impacting unknown archaeological sites in these areas.

Table 2: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone II -- Glacial Lake Nechako

Landscape Variable	High Potential Buffer Limit (metres)	No. of Sites Explained by Single Variable High Potential Buffer Zone	Cumulative No. of Sites Explained by High Potential Buffer Limits*
Primary Stream	150	17/50 (34.0%)	17/50 (34.0%)
Big Lake	300	16/50 (32.0%)	33/50 (66.0%)
Small Lake	100	6/50 (12.0%)	39/50 (78.0%)
Secondary Stream	100	0/50 (0.0%)	39/50 (78.0%)
Pond	50	0/50 (0.0%)	39/50 (78.0%)
Tertiary Stream	100	10/50 (20.0%)	44/50 (88.0%)
Total no. of sites in Sub-Zone II explained by High Potential Zones			44/50 (88.0%)

*This column illustrates the cumulative effectiveness of each variable's high potential buffer for explaining or accounting for sites within the Sub-Zone. It illustrates a cumulative progression with ever increasing numbers of sites explained. Note that in this progression, sites are only explained once, even though more than one variable buffer may account for any one site.

Wetlands were found, somewhat surprisingly, to have little or no predictive significance in Sub-Zone II. This pattern is also observed in Sub-Zone V. Two sites in Sub-Zone II are relatively near wetlands, but both of these sites are closer still to a big lake and the Nechako River respectively. This pattern, although based on a very small sample, suggests that it was wetlands relatively close to more significant landscape features that were most commonly visited and exploited. The primary implication of this hypothesized pattern, if valid, is that a large proportion of the total number of sites in association with wetlands will

be accounted for by the high potential buffer zones around other landscape features. As a consequence, wetlands are not included as a significant landscape variable for Sub-Zones II or V. Only further field investigation could address the level of validity of this pattern, but the current evidence is considered to be strong enough to eliminate wetlands as a *primary* landscape variable for predicting the locations of archaeological sites in Sub-Zones II and V. Wetlands remain *secondary* predictors of archaeological sites in these Sub-Zones, however, and are employed in the other Sub-Zones as primary landscape variables.

Of all the Sub-Zones, Sub-Zone II exhibits the least redundancy between the variables and their associated buffers in accounting for site locations; of the fifty known sites within Sub-Zone II, only four are accounted for by more than one of the defined landscape variable buffers. As a consequence, the relative significance of the defined high potential buffer zones for each individual landscape variable in Sub-Zone II is relatively greater than that in the other Sub-Zones. This is illustrated by the relatively wide high potential buffer zone (300 m) defined for big lakes in Sub-Zone II. The future implication of this pattern is that, as more surveys are completed in Sub-Zone II, it is very possible that the buffer limits would need to be widened and/or the landscape variables redefined.

These considerations, combined with the high probability that the glacial lake basin was the first area in the Nechako Plateau intensively occupied by humans, indicate that regardless of proximity to identified landscape variables, the entire area of Sub-Zone II should be considered to have moderate archaeological potential. It is also pointed out that of all the Sub-Zone potential models, the Sub-Zone II model accounts for the lowest proportion of known sites (88.0%) within the Sub-Zone, even though it has the single largest high potential buffer zone limit (300m from big lakes) defined within any of the models. It is recommended, therefore, that in addition to conducting AIAs on development properties falling in high potential areas, archaeological reconnaissance surveys and/or partial AIAs be conducted on development properties in all remaining areas (moderate potential) within Sub-Zone II.

Sub-Zone IV: Middle Elevation Areas, 790-1,150 Metres

One hundred one (18.7%) of the 540 known archaeological sites in the V.F.D. fall within Sub-Zone IV (between the elevations of 790 and 1,150 metres, but not within 1 km of trails crossing these areas). Figures 17-23 illustrate the frequency of known sites within this Sub-Zone by 50 metre intervals from Primary Streams; Secondary Streams; Tertiary Streams; Big Lakes; Small Lakes; Ponds, and Wetlands respectively. The proximity of sites to trails cross-cutting this Sub-Zone have been accounted for in Sub-Zone I, and are therefore, not a part of the data set used in the analyses presented here for Sub-Zone IV, and not used in definition of the buffer model for this Sub-Zone.

Figure 17: Frequency of Sites within Sub-Zone IV – Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to Primary Streams (specified intervals include only sites within 1 kilometre of primary streams)

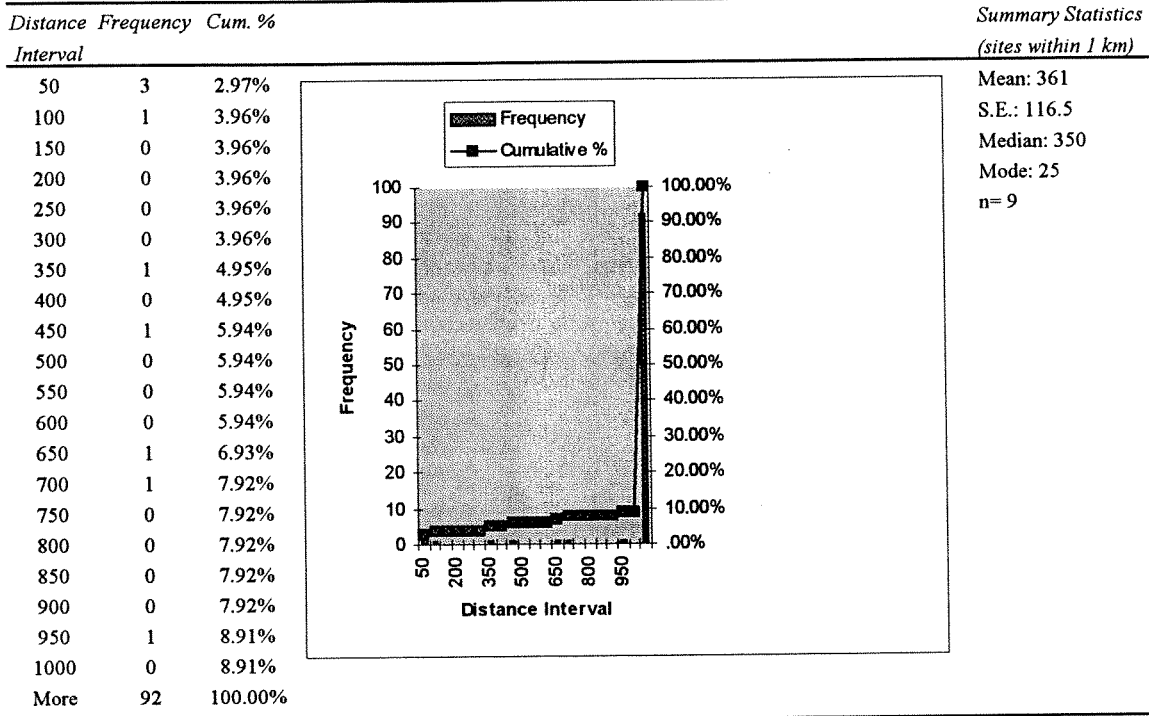


Figure 17 illustrates the distribution of known archaeological sites within 1 kilometre of primary streams in Sub-Zone IV. A weak pattern of site distributions is apparent, with known sites spread relatively evenly between 50 and 1000 metres from primary streams. The small sample size (n=9 sites) is thought to be the primary factor creating this distribution pattern. It is assumed that the modal distance interval (0-50 metres) defines an acceptable high potential buffer zone limit for Primary Streams. This buffer zone limit accounts for 3 sites representing 3.0% of all the sites in Sub-Zone IV, and 33.3% of the 9 known sites within 1 kilometre of primary streams. This narrow buffer zone is thought to be adequate for two basic reasons. First, Sub-Zone IV was designed primarily to account for upland plateau areas with lakes. The primary streams that are within this zone consist of the upper reaches of the streams, and hence are expected to have lower site densities in their vicinity. Secondly, of the 9 sites within 1000 metres of primary streams in Sub-Zone IV, all but one of them is accounted for by high potential buffers around other landscape variables, and the one site that is not accounted for in this manner, is within 50 metres of a primary stream.

Figure 18: Frequency of Sites within Sub-Zone IV – Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to Secondary Streams (specified intervals include only sites within 1 kilometre of secondary streams)

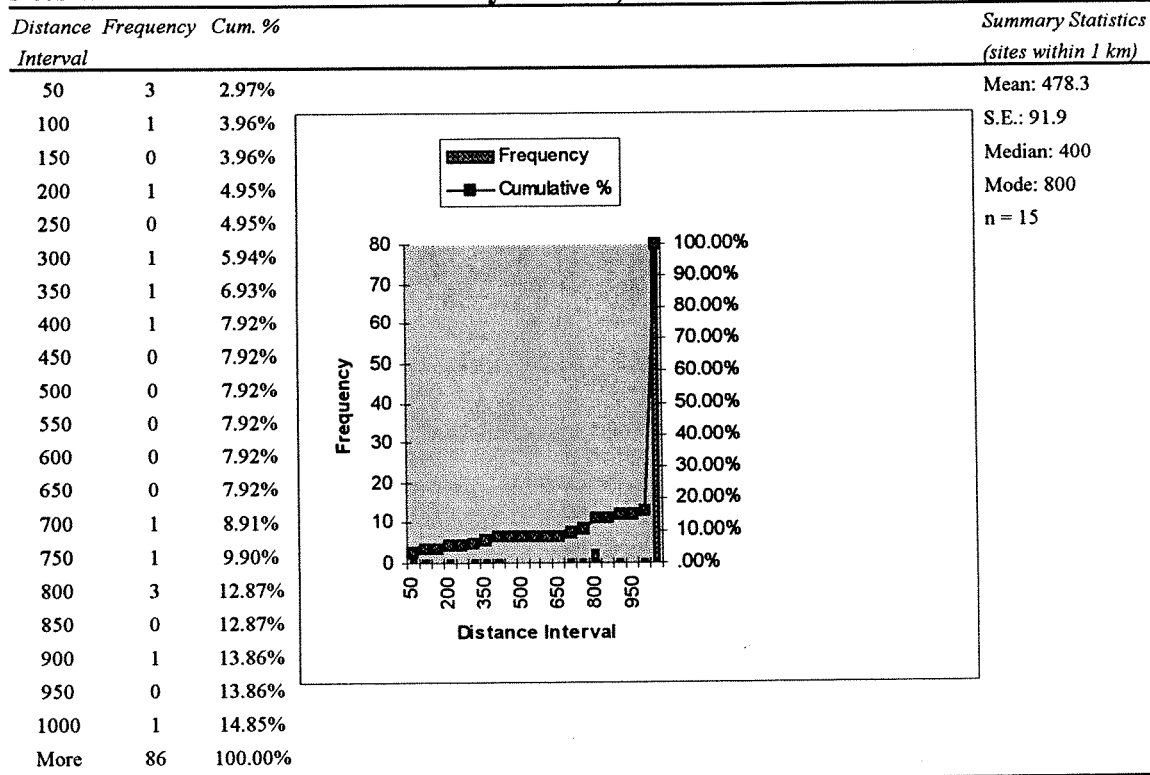


Figure 18 illustrates the distribution of known archaeological sites within 1 kilometre of secondary streams in Sub-Zone IV. Virtually the same weak pattern of site distributions as that for primary streams is apparent. Again, the small sample size ($n = 15$ sites) is thought to be the primary factor involved. As with primary streams, it is assumed that the 0-50 metre distance interval defines an acceptable high potential buffer zone limit for secondary streams. This buffer zone limit accounts for 3 sites representing 3.0% of all the sites in Sub-Zone IV, and 20% of the 15 known sites within 1 kilometre of secondary streams. This narrow buffer zone considered adequate for the same reasons as for primary streams. In the case of secondary streams, however, of the 15 sites within 1000 metres of secondary streams, two of them are accounted for by only the 0-50 metres high potential buffer zone limit around secondary streams.

Figure 19: Frequency of Sites within Sub-Zone IV – Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to Tertiary Streams (specified intervals include only sites within 500 metres of tertiary streams)

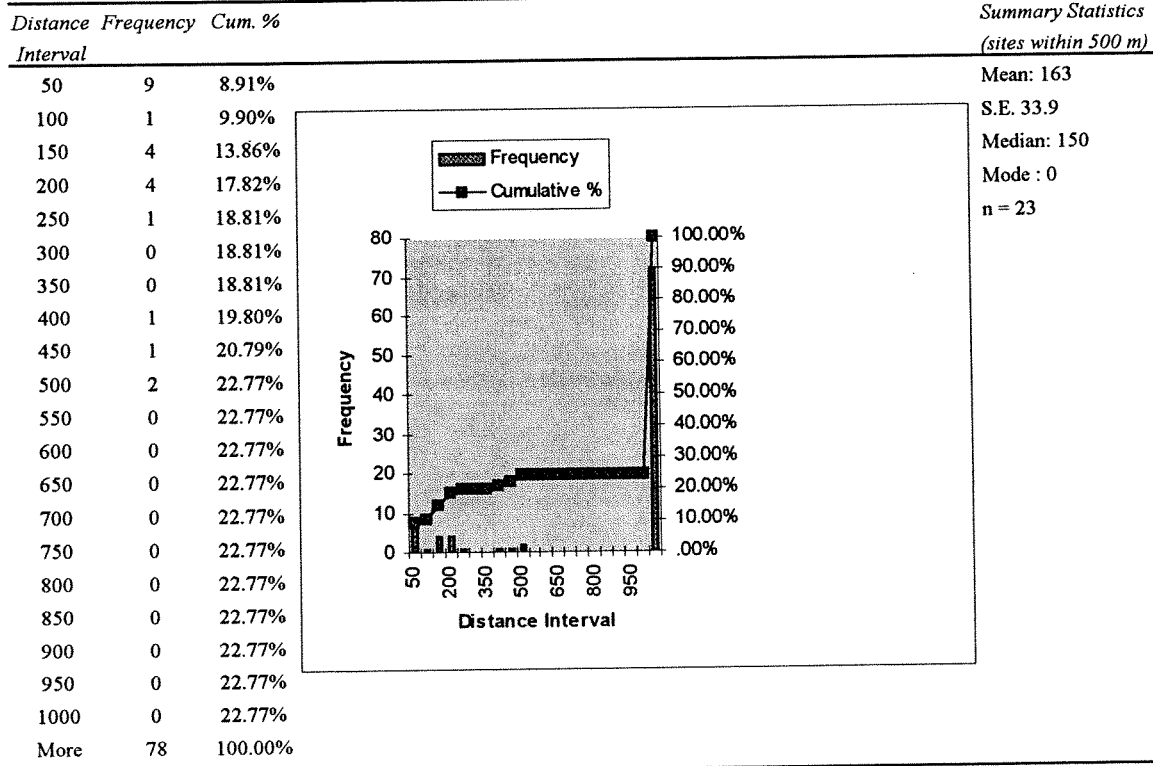


Figure 19 illustrates the distribution of known archaeological sites within 500 metres of tertiary streams in Sub-Zone IV. A relatively strong distribution pattern is apparent with the greatest number of sites falling between 0 and 50 metres from tertiary streams. It is interesting to note that this pattern is better defined than that for either primary and secondary streams in Sub-Zone IV. This is probably because a large number of sites near primary and secondary streams, that would otherwise have appeared in the respective distributions of sites above, are accounted for by Sub-Zone I -- Trail Corridors, which frequently follow primary and secondary stream valleys. For tertiary streams, it is thought that 50 metres defines an adequate high potential buffer zone limit, as again, virtually all of the sites within 500 metres of tertiary streams are accounted for by other landscape variable buffers for this Sub-Zone. This buffer zone limit accounts for 9 sites representing 8.9% of all the sites in Sub-Zone IV, and 39.1% of the 23 known sites within 500 metres of tertiary streams.

Figure 20: Frequency of Sites within Sub-Zone IV – Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to *Big Lakes* (specified intervals include only sites within 1 kilometre of big lakes)

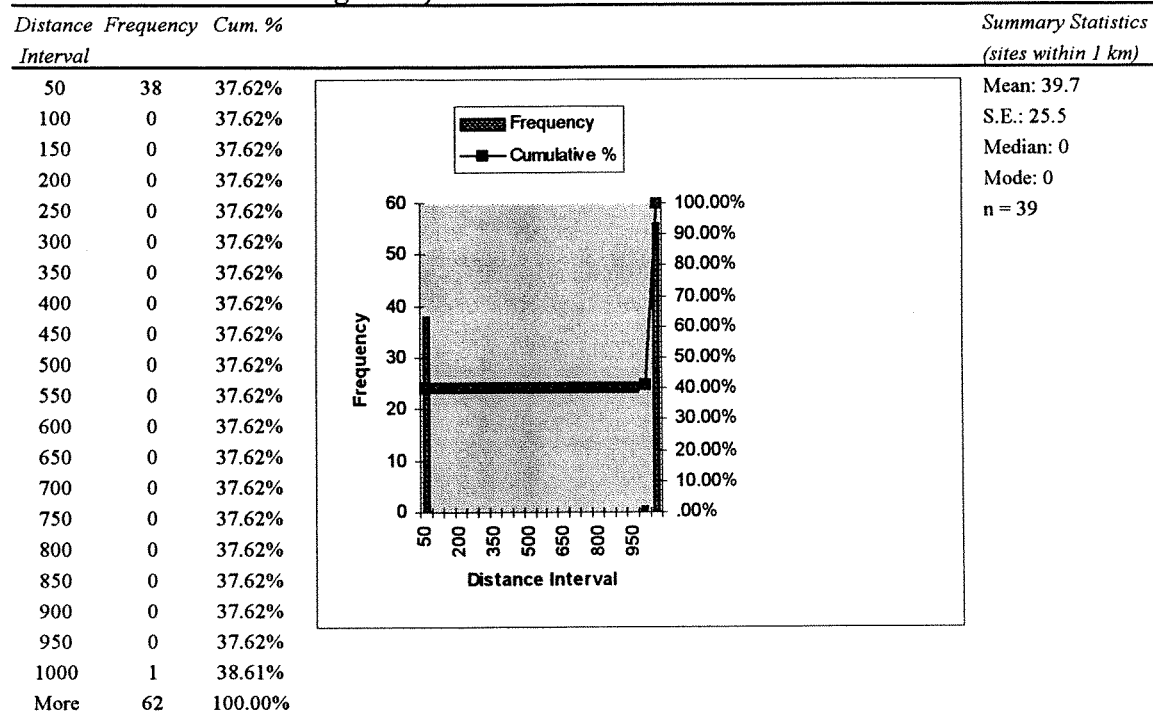


Figure 20 illustrates the distribution of known archaeological sites within one kilometre of big lakes in Sub-Zone IV. A very clear distribution pattern is evident, with all but one of the 39 sites within 1 kilometre of big lakes, being between 0 and 50 metres from the big lakes. It is clear from this distribution that within a short distance of big lakes within Sub-Zone IV, there is a high density of archaeological sites. The median distance interval value is 50 metres which accounts for 38 (97.4%) of the 39 sites in Sub-Zone IV within one kilometre of a big lake. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for big lakes in Sub-Zone IV. This buffer zone limit accounts for 38 sites representing 37.6% of all the sites in Sub-Zone IV, and 97.4% of the 39 known sites within one kilometre of big lakes.

Figure 21: Frequency of Sites within Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to *Small Lakes* (specified intervals include only sites within 1 kilometre of small lakes)

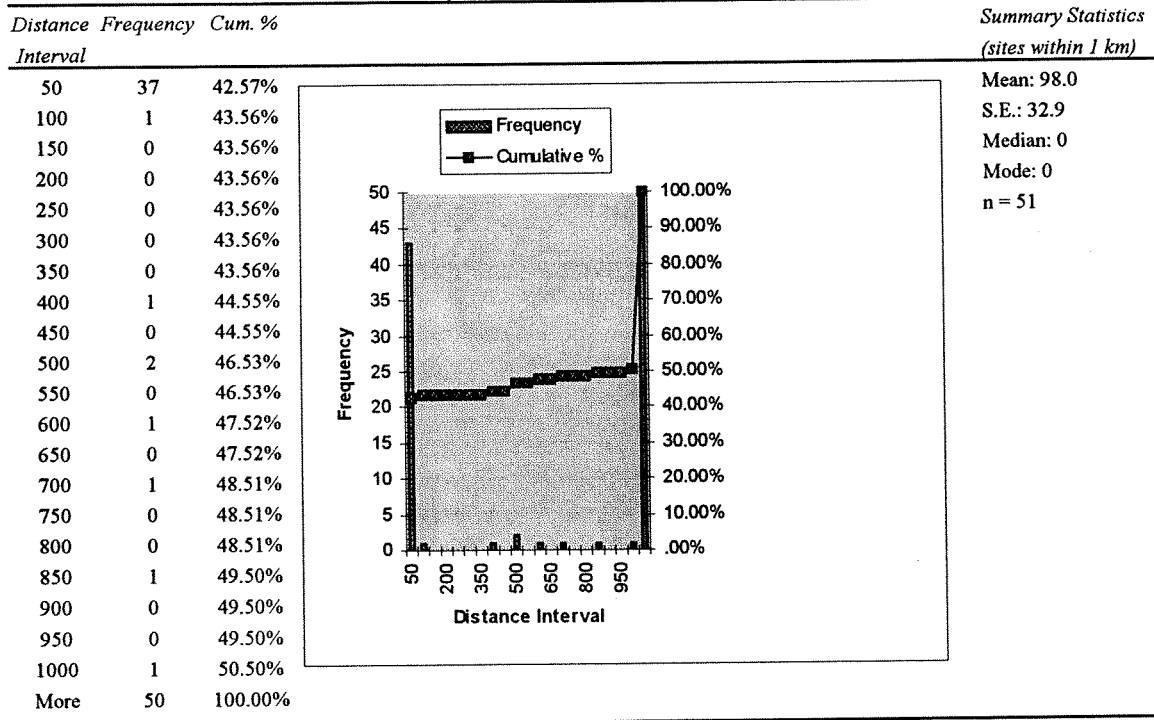


Figure 21 illustrates the distribution of known archaeological sites within one kilometre of small lakes in Sub-Zone IV. As is the case with site densities around big lakes, a very clear distribution pattern is evident. It is clear from this distribution that within a short distance of small lakes within Sub-Zone IV, there is a high density of archaeological sites. The median distance interval value is 50 metres, which accounts for 43 (84.3%) of the 51 sites in Sub-Zone IV within one kilometre of a small lake. Adding 50 metres to this value gives 100 metres and defines an acceptable high potential buffer zone limit for big lakes in Sub-Zone IV. This buffer zone limit accounts for 44 sites representing 43.5% of all the sites in Sub-Zone IV, and 86.3% of the 51 known sites within one kilometre of small lakes.

Figure 22: Frequency of Sites within Sub-Zone IV – Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to Ponds (specified intervals include only sites within 500 metres of ponds)

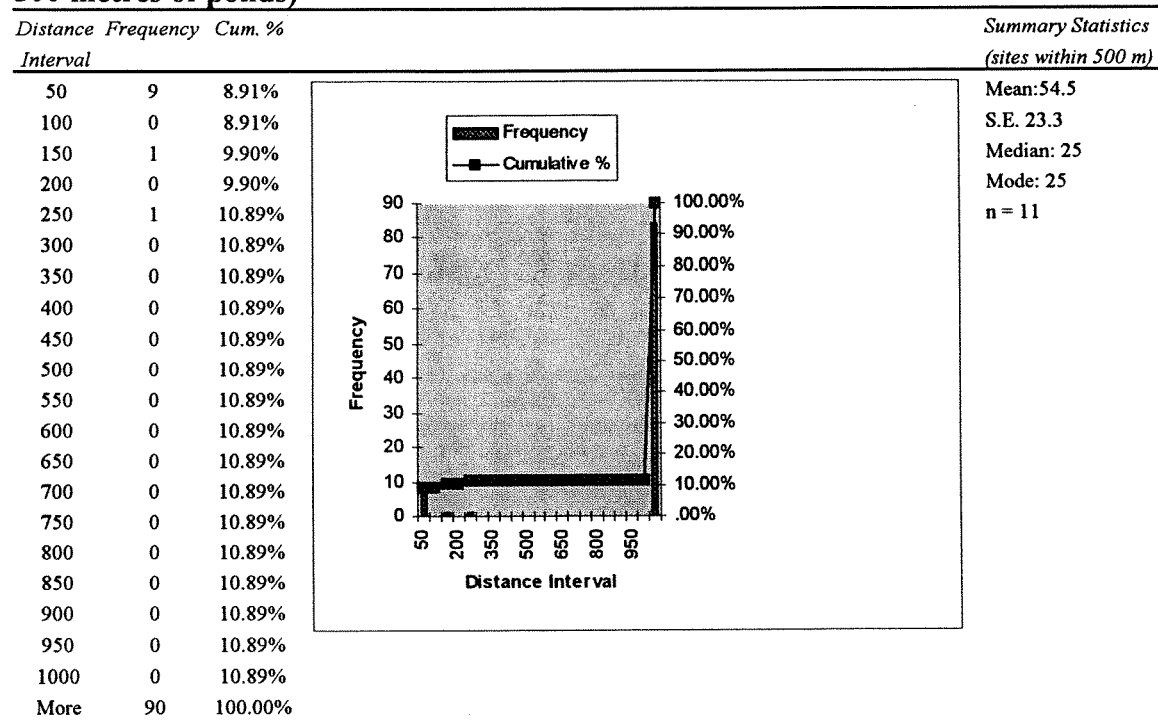


Figure 22 illustrates the distribution of known archaeological sites within 500 metres of ponds in Sub-Zone IV. As is the case with site densities around big and small lakes, a clear distribution pattern is evident, with most sites being located within 50 metres of the ponds. The median distance interval value is 50 metres which accounts for 9 (81.8%) of the 11 sites in Sub-Zone IV within 500 metres of a pond. It is thought that adding 50 metres to this value to define a high potential buffer zone limit would over-emphasize the importance of ponds. Thus, 50 metres defines an acceptable high potential buffer zone limit for ponds in Sub-Zone IV. This buffer zone limit accounts for 9 sites representing 8.9% of all the sites in Sub-Zone IV, and 81.8% of the 11 known sites within 500 metres of ponds. It is pointed out that all of the sites at greater than 50 metres from ponds are accounted for by other landscape feature buffers within Sub-Zone IV, and that seven of the nine sites within fifty metres of ponds are accounted for by only the pond buffer of 50 metres.

Figure 23: Frequency of Sites within Sub-Zone IV – Middle Elevation Areas, 790-1,150 Metres by 50m Distance Intervals to Wetlands (specified intervals include only sites within 250 metres of wetlands)

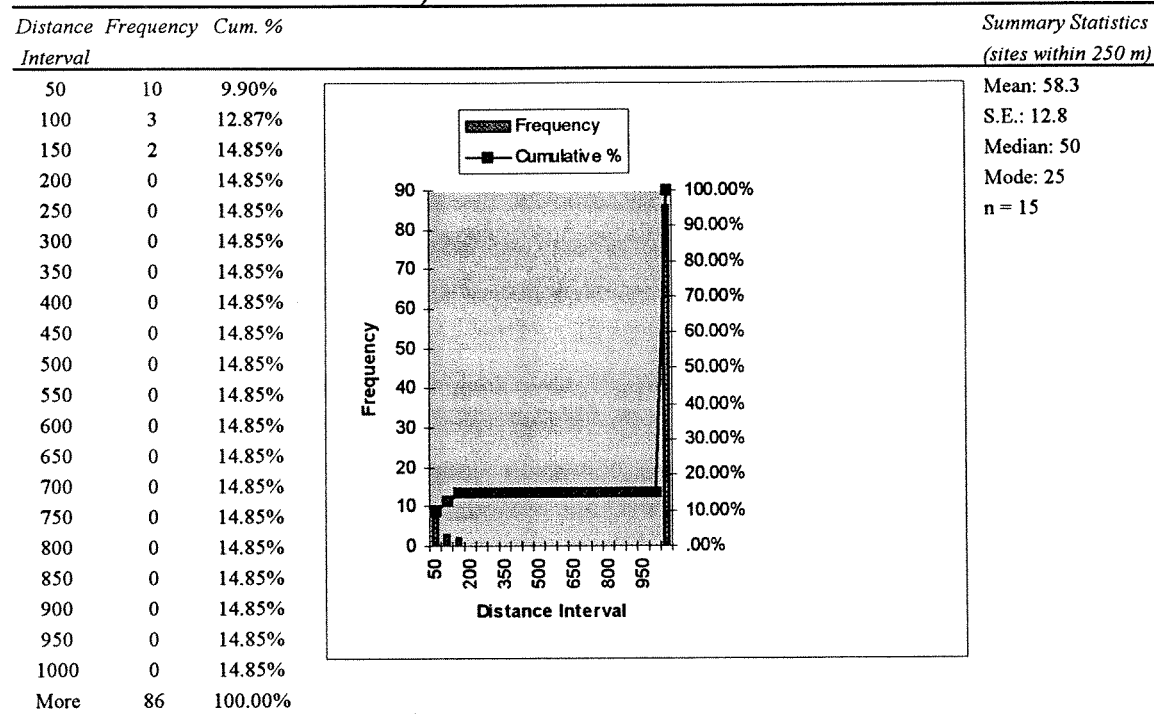


Figure 23 illustrates the distribution of archaeological sites within 500 metres of wetlands in Sub-Zone IV. A relatively regular pattern of site distributions is apparent. This pattern is very similar to that for tertiary streams. The median distance interval is 0-50 metres. Consideration of the modal value of the frequency distribution, indicates that the greatest frequency of sites in relation to wetlands is also 0-50 metres. Such a value makes sense in relation to what one would perceive as the cultural significance of wetlands. Overall, this pattern, like that for tertiary streams, suggests that wetlands are more important in determining specific site locations, than in being primary general site location predictors. Given these considerations, a high potential buffer limit of 50 metres is defined for wetlands. This buffer zone limit accounts for 10 sites representing 9.9% of all the sites in Sub-Zone I, and 66.6% of the 15 known sites within 250 metres of wetlands.

Summary of Sub-Zone IV Analyses

Table 3 summarizes the high potential buffer limits, the actual numbers of sites explained by each high potential buffer as a single variable, and the cumulative proportion of sites explained by successive application of each buffer on known sites in Sub-Zone IV -- Middle Elevation Areas, 790-1,150 Metres. Table 3 effectively defines the potential model for Sub-Zone IV. Any logging development within these buffer zone limits should be preceded by archaeological impact assessments because there is a relatively great risk of impacting unknown archaeological sites in these areas.

Table 3: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone IV -- Middle Elevations Areas, 790-1,150 Metres

Landscape Variable	High Potential Buffer Limit (metres)	No. of sites Explained by Single Variable High Potential Buffer Zone	Cumulative No. of Sites Explained by High Potential Buffer Limits*
Primary Stream	50	3/101 (3.0%)	3/101 (3.0%)
Big Lake	100	38/101 (37.6%)	41/101 (41.0%)
Small Lake	100	44/101 (43.5%)	84/101 (83.0%)
Secondary Stream	50	3/101 (3.0%)	87/101 (86.0%)
Pond	50	9/101 (8.9%)	93/101 (92.0%)
Tertiary Stream	50	9/101 (8.9%)	95/101 (94.0%)
Wetlands	50	10/95 (9.9%)	97/101 (96.0%)
Total no. of sites in Sub-Zone IV explained by High Potential Zones			97/101 (96.0%)

*This column illustrates the cumulative effectiveness of each variable's high potential buffer for explaining or accounting for sites within the Sub-Zone. It illustrates a cumulative progression with ever increasing numbers of sites explained. Note that in this progression, sites are only explained once, even though more than one variable buffer may account for any one site.

General patterns of site distributions within Sub-Zone IV that would be expected given the definition of Sub-Zone IV as middle elevation plateau areas outside major river valleys, were observed subsequent to analysis. In these areas, the primary areas of occupation were expected to be lakes. Both the analyses of big and small lakes indicate high archaeological site densities along relatively narrow bands around lakes in this Sub-Zone. The surprising degree of correspondence in the proportions of sites explained by the defined high

potential buffer zones for big and small lakes, suggests that there may not be any real difference in the relative cultural importance of big versus small lakes for past human occupation of Sub-Zone IV as defined here.

As indicated above, the apparent, relatively poor predictive ability of primary and secondary streams in Sub-Zone IV, is explained by two factors. The first of these is that the sections of these rivers that are found in Sub-Zone IV are these rivers' upper reaches, which are relatively small in actual size. Thus, in many respects they are like secondary streams. There may be no appreciable difference in the relative importance of secondary versus primary streams for human occupation in Sub-Zone IV, other than the direct transportation connection the upper reaches of these streams offer to the lower reaches of these streams. The second factor is partly a product of the Sub-Zone stratification adopted for the District, creating an apparent rather than real pattern of low site densities in proximity to primary and secondary streams. Many sites between 790 and 1,150 metres elevation, including many sites actually on primary and secondary streams, are located within 1 kilometre of documented trails, particularly along the Blackwater River on the southern boundary of the District. Thus, it is further seen that transportation is perhaps one of the most important aspects of primary and secondary streams in Sub-Zone IV. The sites along the rivers and trails are included in Sub-Zone I and therefore were not included in the site location data set employed for the analyses of site distributions in Sub-Zone IV. This effectively results in an apparent under-representation of sites in proximity to primary and secondary streams in Sub-Zone IV. This is not a problem in reference to the predictive ability of the model, however, because all the sites are still accounted for in either Sub-Zone I or Sub-Zone IV. It may be that in the future, subsequent to further field surveys, the high potential buffer zone limits would deserve to be widened for primary and secondary streams in Sub-Zone IV.

Sub-Zone V: Low Elevation Areas, Below 790 Metres

Sixty-six (12.2%) of the 540 known archaeological sites in the V.F.D. fall within Sub-Zone V (below 790 metres elevation, but not within 1 km of trails, and not within the Glacial Lake Nechako basin). Figures 24-28 illustrate the frequency of sites within this Sub-Zone by 50 metre intervals from Primary Streams; Secondary Streams; Tertiary Streams; Big Lakes; and Ponds respectively. Sites within 1 kilometre of trails cross-cutting this Sub-Zone have been accounted for in Sub-Zone I, as have all the sites below 790 metres within the Glacial Lake Nechako basin. These sites are therefore, not a part of the data set used in the analyses presented here for Sub-Zone V, and were not used in definition of the buffer model for this Sub-Zone.

Figure 24: Frequency of Sites within Sub-Zone V -- Low Elevation Areas, Below 790 Metres by 50m Distance Intervals from *Primary Streams* (specified intervals include only sites within 1 kilometre of primary streams)

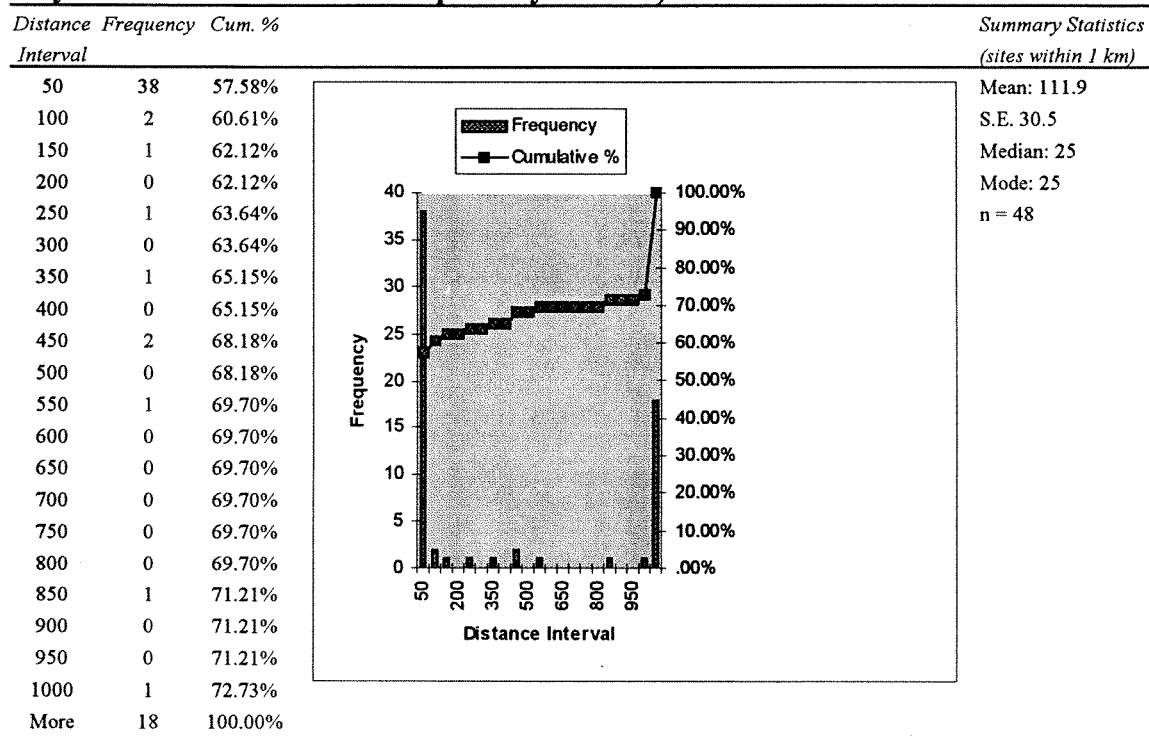


Figure 24 illustrates the distribution of known archaeological sites within one kilometre of primary streams in Sub-Zone V. A clear distribution pattern is evident, with a high density of sites located between 0 and 50 metres from the primary streams. The median distance interval value is 50 metres which would give a 100 metre high potential buffer zone limit for primary streams. However, it is thought that the above distribution is highly biased towards survey of areas close to/directly bordering the rivers. The author recorded most of the sites represented. However, coverage during these surveys rarely extended beyond 50 metres from the river edges; virtually no areas at greater distances than 50 metres from the river edges have been surveyed. As such, it is thought that 50-100 metres is probably a better estimate of the actual median distance interval. This median interval would provide an acceptable high potential buffer zone limit of 150 metres from primary streams in Sub-Zone V. This buffer zone limit is consistent with the high potential buffer defined for primary streams in Sub-Zone II, and accounts for 41 sites representing 62.1% of all the sites in Sub-Zone V, and 85.4% of the 66 known sites within one kilometre of primary streams.

Figure 25: Frequency of Sites within Sub-Zone V -- Low Elevation Areas, Below 790 Metres by 50m Distance Intervals from *Secondary Streams* (specified intervals include only sites within 1 kilometre of secondary streams)

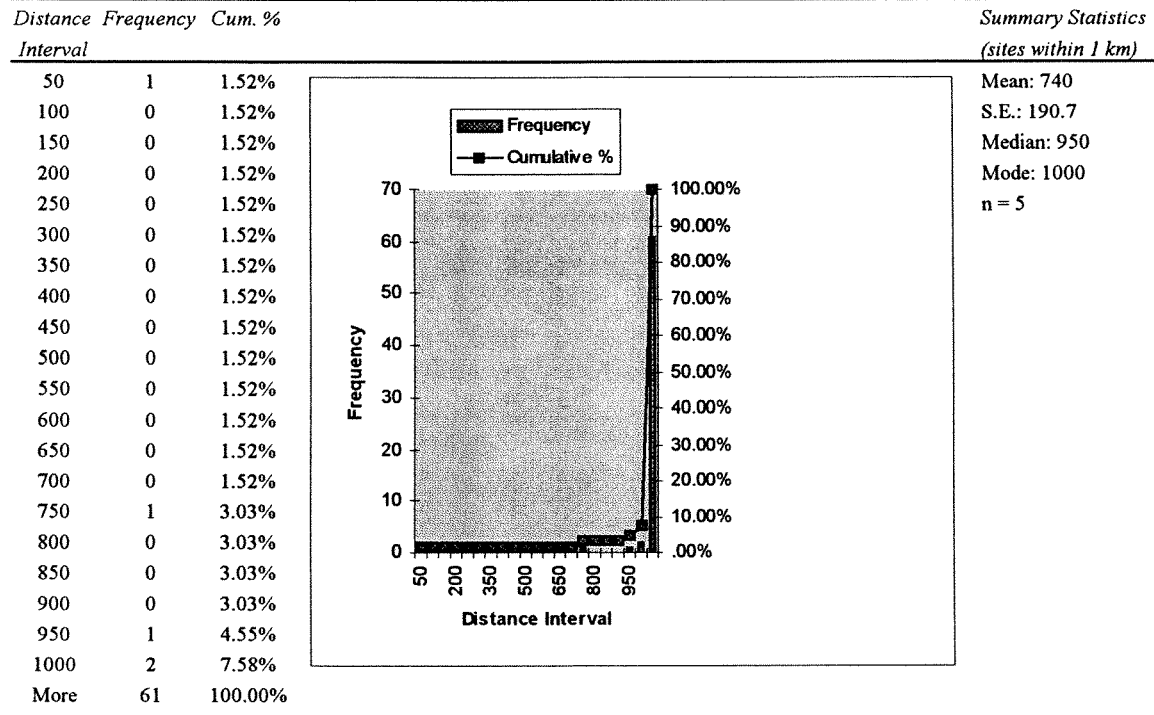


Figure 25 illustrates the distribution of known archaeological sites within one kilometre of secondary streams in Sub-Zone V. This distribution offers no useful information about the distribution of archaeological sites in Sub-Zone V in relation to secondary streams. There is clearly a significant data-gap represented. As such, it is assumed that a 50 metre high potential buffer zone limit would be appropriate. This is thought to be adequate because, the main focus of occupation and use of Sub-Zone V is clearly the primary streams and big lakes, which in turn, is probably directly correlated with salmon exploitation. Nevertheless, some use of areas in close proximity to secondary streams, particularly streams such as Nithi River and Ormond Creek, could be expected. The 50 metre buffer zone limit for secondary streams in Sub-Zone V accounts for 1 site representing 1.5% of all the sites in Sub-Zone V, and 20.0% of the 5 known sites within one kilometre of secondary streams.

Figure 26: Frequency of Sites within Sub-Zone V -- Low Elevation Areas, Below 790 Metres by 50m Distance Intervals from Tertiary Streams (specified intervals include only sites within 500 metres of tertiary streams)

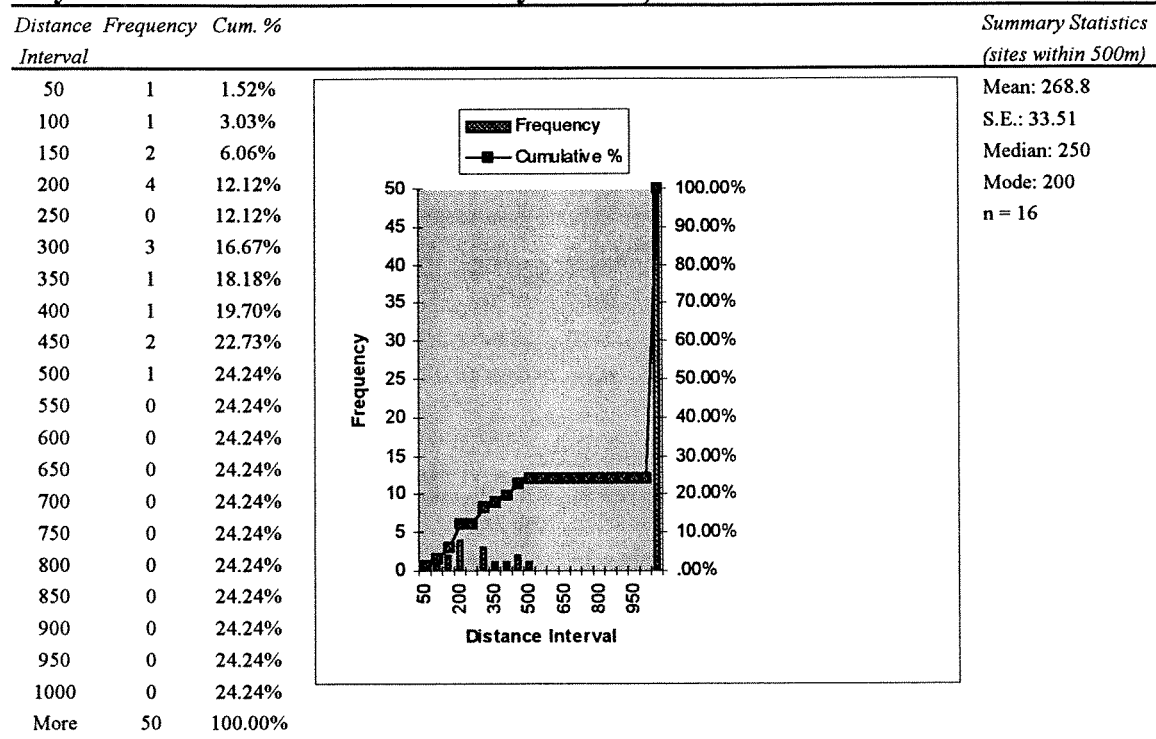


Figure 26 illustrates the distribution of known archaeological sites within one kilometre of tertiary streams in Sub-Zone V. As with the distribution of sites around secondary streams, this distribution offers little useful information about the distribution of archaeological sites in Sub-Zone V in relation to tertiary streams. There again appears to be a significant sampling bias represented. As such, it is assumed that a 50 metre high potential buffer zone limit would be appropriate. This is thought to be adequate for the same reasons outlined for secondary streams. This buffer zone limit accounts for 1 site representing 1.5% of all the sites in Sub-Zone V, and 6.3% of the 16 known sites within 500 metres of tertiary streams.

Figure 27: Frequency of Sites within Sub-Zone V -- Low Elevation Areas, Below 790 Metres by 50m Distance Intervals from Big Lakes (specified intervals include only sites within 1 kilometre of big lakes)

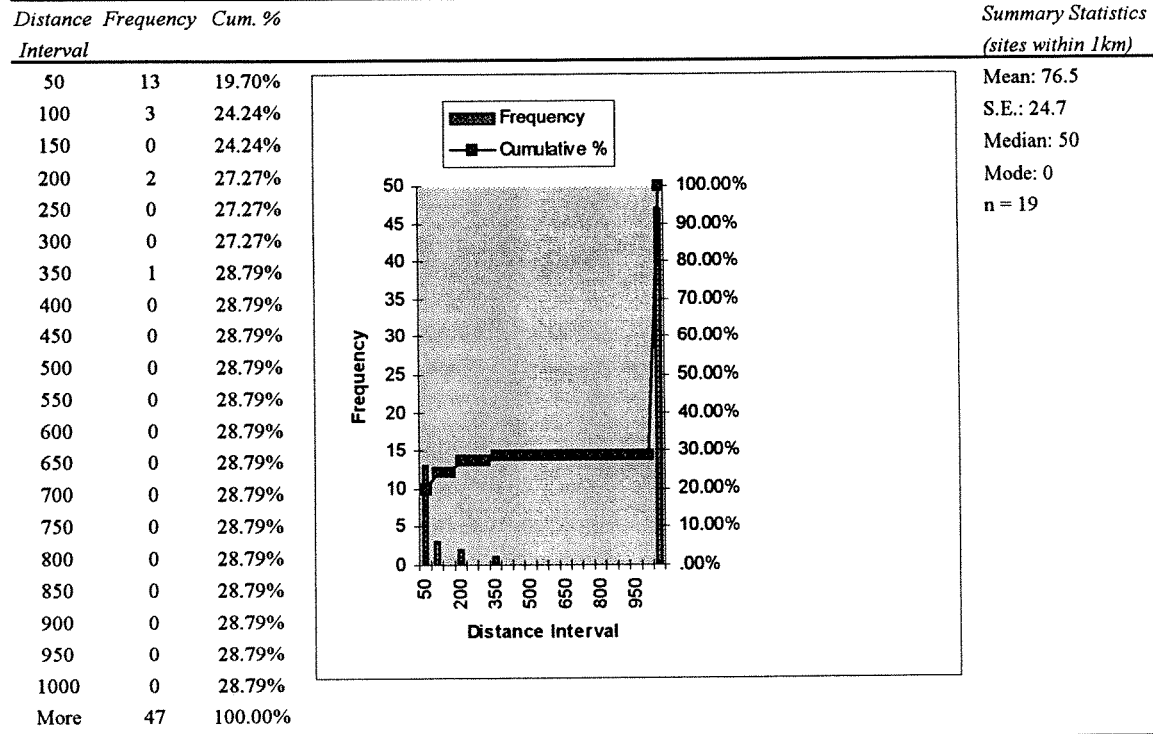


Figure 27 illustrates the distribution of known archaeological sites within one kilometre of Big Lakes in Sub-Zone V. A clear distribution pattern is evident, with a high density of sites located between 0 and 50 metres from big lakes. The median distance interval value is 50 metres which would give a 100 metre high potential buffer zone limit for big lakes. However, as is the case with primary streams, the above distribution is probably biased towards survey of areas close to/directly bordering the lakes. During past surveys, coverage rarely extended beyond 50 metres from the shore. Moreover, no systematic surveys of Francois and Fraser lakes have ever been conducted. The 19 known sites within 1 kilometre of these lakes have been recorded during several small and limited surveys. As such, 50-100 metres is a better estimate of the actual median distance interval for big lakes. This median interval provides an acceptable high potential buffer zone limit of 150 metres from big lakes in Sub-Zone V. Additionally, this buffer limit maintains consistency with the high potential buffer limit defined for primary streams. Both primary streams and big lakes in Sub-Zone V (Fraser Lake, Francois Lake, Nechako River, Nautley River, Stellako River, and Endako

River in particular reference to a lake-stream system) make up the greater part of the interconnected salmon bearing waterways of the District. The areas surrounding these waterways are clearly of High archaeological potential. This buffer zone limit accounts for 16 sites representing 24.2% of all the sites in Sub-Zone V, and 84.2% of the 66 known sites within one kilometre of big lakes.

Figure 28: Frequency of Sites within Sub-Zone V -- Low Elevation Areas, Below 790 Metres by 50m Distance Intervals from Ponds (specified intervals include only sites within 500 metres of ponds)

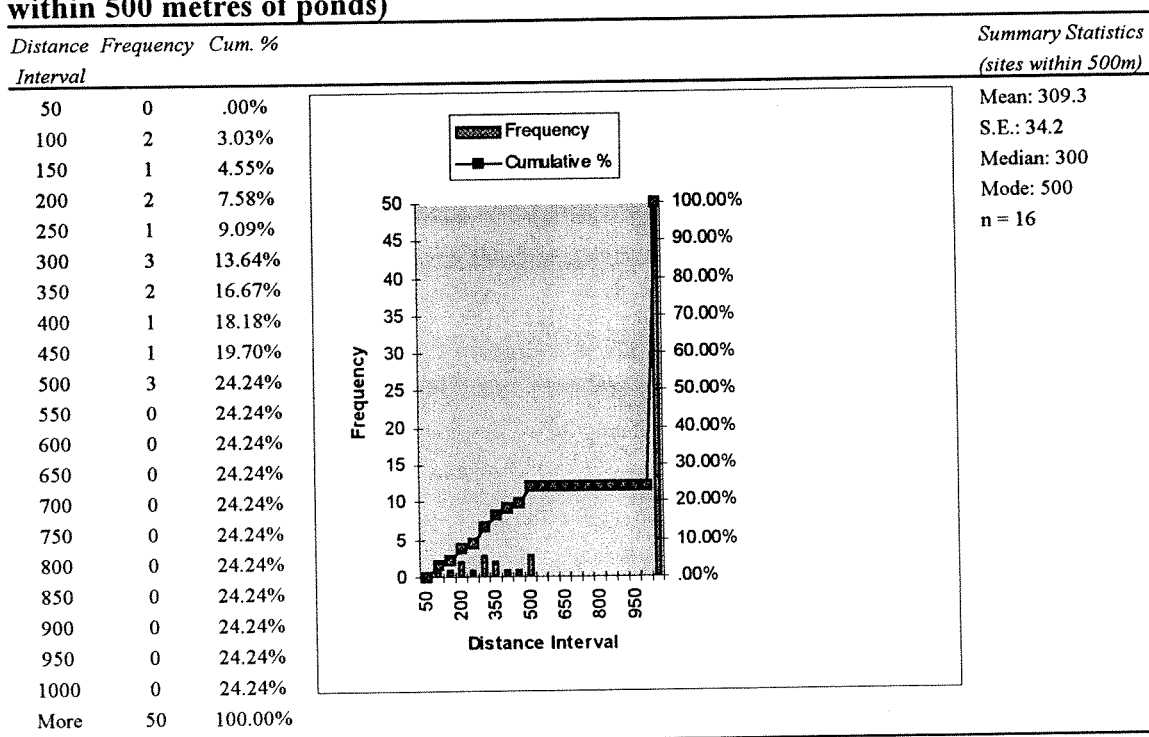


Figure 28 illustrates the distribution of known archaeological sites within 500 metres of ponds in Sub-Zone V. As with the distribution of sites around secondary streams, this distribution offers little useful information about the distribution of archaeological sites in Sub-Zone V in relation to ponds. To be consistent with high potential buffer widths defined for ponds in other Sub-Zones, it is assumed that a 50 metre high potential buffer zone limit would be appropriate. Fifty metres is considered adequate because the main focus of occupation and use of Sub-Zone V is clearly the primary streams and big lakes. This buffer

zone limit accounts for 1 site representing 1.5% of all the sites in Sub-Zone V, and 6.3% of the 16 known sites within 500 metres of ponds in Sub-Zone V.

The spatial analysis of known sites in relation to small lakes in Sub-Zone V is not presented above because there are only two known sites within 1 kilometre of small lakes. Moreover, one of these is a historic site, and the other is at a distance of 1000 metres. Additionally, there are very few small lakes of any great significance within Sub-Zone V, defined as it is as primarily river and big lake valleys. Nevertheless, it is still assumed that small lakes in Sub-Zone V would have been exploited in the past, and that the lack of known sites in relation to small lakes in this Sub-Zone is a direct result of no field surveys having been conducted on any of the small lakes. In order to be consistent with high potential buffer widths defined for small lakes and ponds in other Sub-Zones, it is assumed that a 50 metre high potential buffer zone limit would be appropriate. Fifty metres is considered adequate because the main focus of occupation and use of Sub-Zone V is clearly the primary streams and big lakes. This buffer zone limit currently accounts for no known sites in Sub-Zone V.

Summary of Sub-Zone V Analyses

Table 4 summarizes the high potential buffer limits, the actual numbers of sites explained by the high potential buffer limits for the landscape criteria as single variables, and the cumulative proportion of sites explained by successive application of each buffer on sites in Sub-Zone V -- Low Elevation Areas, Below 790 Metres. Table 4 effectively defines the potential model for Sub-Zone V. Any logging development within these high potential buffer zone limits should be preceded by archaeological impact assessments because there is a relatively great risk of impacting unknown archaeological sites in these areas.

Table 4: Summary of High Potential Buffer Zone Limits and Frequencies of Known Sites Explained for Sub-Zone V -- Low Elevation Areas, Below 790 Metres

Landscape Variable	High Potential Buffer Limit (metres)	No. of Sites Explained by Single Variable High Potential Buffer Zone	Cumulative No. of Sites Explained by High Potential Buffer Zones*
Primary Stream	150	41/66 (34.0%)	41/66 (62.1%)
Big Lake	150	16/66 (32.0%)	56/66 (84.8%)
Small lake	50	0/66 (12.0%)	56/66 (84.8%)
Secondary Stream	50	1/66 (0.0%)	56/66 (84.8%)
Pond	50	0/66 (0.0%)	56/66 (84.8%)
Tertiary Stream	50	1/66 (20.0%)	56/66 (84.8%)
Total no. of sites in Sub-Zone V explained by High Potential Zones			56/66 (84.8%)

*This column illustrates the cumulative effectiveness of each variable's high potential buffer for explaining or accounting for sites within the Sub-Zone. It illustrates a cumulative progression with ever increasing numbers of sites explained. Note that in this progression, sites are only explained once, even though more than one variable buffer may account for any one site.

The expected pattern of dense archaeological site distributions along primary streams and big lakes is apparent in Sub-Zone V. This pattern is probably largely due to the distribution of salmon and the high salmon productivity in this sub-zone.

The model as defined accounts for what appears to be a relatively low proportion (84.8%) of the known sites in Sub-Zone V as compared with that of the other sub-zones. The proportion indicated, however, is somewhat misleading. Of the 10 sites not accounted for in the model, four are historic sites. As this model was developed for pre-contact period sites,

these historic sites could be removed from the total sample of known sites for analytical purposes. This would give an effective proportion of sites accounted for of 56/62 or 90.3%. This proportion is comparable to those from the other sub-zones.

It is apparent that a relatively large sampling bias/data gap is represented in Sub-Zone V. More than in any other area of the District, in Sub-Zone V archaeological survey emphasis has apparently been focused on very narrow zones around big lakes and primary streams. Only a few surveys of other types of areas have been undertaken in this Sub-Zone and these were limited, linear development corridor (e.g. pipelines and transmission line) surveys. Thus, it is possible that, in the future as more surveys are completed within Sub-Zone V, the results may necessitate widening of the current high potential buffer zones defining High archaeological potential. In an area such as Sub-Zone V with high salmon productivity, it could be assumed that there was intensive, habitual use of the area as a whole for as long as the salmon have been around. It would not be surprising to find that Sub-Zone V has the highest actual archaeological site densities of any of the Sub-Zones defined in this study.

Additional Variables and Considerations

Known Archaeological Sites

Known archaeological sites are located in areas of high archaeological potential by definition -- regardless of all other considerations. Areas within 100 metres of the boundaries of a site are defined as having high archaeological potential as well. The presence of an archaeological site indicates that people used the general vicinity of the site in the past and that other sites are likely to be present.

Slope

Slope is an independent variable that has significance in predicting the locations of archaeological sites. However, as opposed to the variables described above, which relate primarily to the general areal locations of archaeological sites in reference to landscape features, slope is significant in reference to specific site locations within any given area. On one hand, a portion of a lake shore with a relatively steep slope (40-50%) down to water level is unlikely to have archaeological sites on it, regardless of close proximity to the lake. On the other hand, a level or gently sloping bench along a lake shore is much more likely to have archaeological sites on it. It is because of these patterns that during field surveys or reconnaissance surveys, steepness of slope is the most frequent reason for assessing a particular area as having low archaeological potential. Slope is treated here as a separate variable because of these considerations. Except in Sub-Zone I, slope cross-cuts all of the above sub-zones and predictive spatial criteria outlined.

In general, the steeper the slope the less likely it is that there will be an archaeological site. Unfortunately, no systematic data exists on this subject to allow any quantification of slope angle in relation to the presence or absence of archaeological sites. In general, archaeologists usually assume that slopes steeper than approximately 16°, or about 30%, are unfavourable for the presence of archaeological sites (e.g. Klassen 1996: 25). On the other end of the scale, however, there are a few site types that frequently occur on areas of very

steep slopes, in particular, rock art, fishing stations on rock outcrops on rivers, crevice or talus slope burials, and rock shelter or cave sites. Of these types, only rock art sites and fishing sites have been found in the V.F.D. These types of sites are most frequently associated with bedrock cliffs or outcrops on rivers and lakes. Such localities are rarely threatened by logging development. Additionally, trails frequently ascend relatively steeply sloped terrain along different sections of their routes.

In light of these considerations, and within the framework of the potential model as a whole, the following two procedures effectively determine archaeological potential in relation to slope. They are discussed individually below:

1) Areas with greater than 24° (45%) slope, as definable on 1:20,000 scale contour maps have low archaeological potential. This assessment is independent of, and takes precedence over the potential rating of the area as defined using the High and Moderate potential Sub-Zone buffers; *except in the following circumstances.*

2) Within Sub-Zone I, slope *should not* be used to define areas of low potential, unless the trail-bed defining the sub-zone area has been identified on-the-ground. In areas where the trail-bed *has* been identified on-the-ground, slope should still not be used to define areas of low archaeological potential within the 250 metre high potential buffer.

The slope value of 45% slope was purposefully defined at a higher value than the generally accepted slope value (30%) for defining low archaeological potential as indicated above. The reason for this was anticipation of application of this potential model at 1:20,000 scale using a GIS. In such an application of the model, all areas of greater than the critical slope value could be defined as low potential map polygons. However, if the 30% value were employed as the critical value, because of the limits of slope resolution at 1:20,000 scale there is a risk of enclosing areas of actually much gentler slopes (and hence higher archaeological potential) within the polygons defined on 30%. Increasing the critical value by 50% -- from 30% slope to 45% slope -- accounts for this map resolution problem. One result of this increase in slope value would be that areas of relatively greater steepness than usually accorded high potential could be selected for AIA. However, this would be of minor

significance, and incidences where it would occur, would be in areas in close proximity to high potential areas initially.

If deemed necessary, the differences between a 30% versus a 45% critical value for slopes at 1:20,000 scale could readily be field tested to determine the appropriateness of the above reasoning. Additionally, archaeological reconnaissance or field inspection of the areas (e.g. logging blocks) under consideration could be conducted to assess archaeological potential in relation to slope in specific logging blocks. During a field assessment of archaeological potential, as opposed to a map-based assessment, the 30% slope value would be acceptable as the critical slope value.

As indicated, under most circumstances the above slope criteria should not be applied within Sub-Zone I. Trails often run up and down relatively steeply sloped areas. Additionally, small level areas on these slopes, or at the tops of passes or hills were frequently used as stopping places or campsites on trails. Employing the slope criteria above for such areas would erroneously assess the areas as having low archaeological potential. Additionally, for most of the documented trails throughout the District, their exact on-the-ground routes remain unknown or unmapped. Assessing areas as having low archaeological potential based on steep slope within the general vicinity of a documented trail route, could inadvertently enclose the actual trail bed.

The Sub-Zone I slope criteria were designed to account for these considerations. In areas where the location of the trail bed is not known, *do not* use slope to assess potential. Following this procedure would prevent the possibility of the actual trail bed being assessed as having low archaeological potential. In areas where the trail bed has been located on-the-ground and mapped, *do not* use slope to assess archaeological potential within the 250 metre high potential buffer zone from the trail bed. Following this last procedure would prevent any small localized level areas near trails beds, and which potentially contain archaeological sites, from being inadvertently assessed as having low archaeological potential. Moreover, CMTs, commonly associated with trails, and which have been found in all kinds of terrain, would be adequately accounted for using this strategy.

Eskers

Glacial landforms (other than Glacial Lake Nechako) have not been comprehensively incorporated into the model defined here because of lack of systematic data concerning site locations in relation to glacial landforms. It is pointed out, however, that glacial features, particularly large esker complexes (those of sufficient size to appear on 1:50,000 scale maps), and small pro-glacial lake basins have frequently been cited in other portions of the Province (e.g. Klassen 1996: 42) as having at least moderate significance in predicting archaeological site locations. It is probable that this pattern holds for the V.F.D. as well, and limited evidence of this was found during a survey by TRACES of a logging block west of Eulatazella Lake in which several sites were found, and through which a large glacial esker runs (see Carlson 1996, in prep. 1996 AIAs in the Vanderhoof Forest District, Permit 1996-099). As such, eskers and esker complexes are incorporated as another independent variable in the model. Regardless of sub-zone or high potential buffer zone, any large esker or esker complex (defined as above as those of sufficient size to appear on 1:50,000 scale maps) has high archaeological potential.

Large eskers are located in many parts of the V.F.D., a few of which are enumerated here. In the south, scattered eskers are found west and south of Johnny Lake, and there are several around Davidson Creek, the lower reaches of Fawnie Creek, and the area southwest of Tatelkuz Lake. In the central portion of the District, several esker complexes are located on the base of the north slope of the Nechako Range, and there is a complex south of Tatuk Lake. There is a large esker running across the south end of Eulatazella Lake, and another running around Hogsback Lake. Other eskers are found west of Sinkut River, in the valley west of Limit Lake, just north of Hallett and Tahultzu lakes, and near Targe Lake.

Moderate Potential Areas

Areas of moderate potential usually form an integral part of archaeological potential models. The current model offers no exception. However, areas of moderate potential have been defined in the current model on a different basis than the areas of high archaeological potential were defined. Technically, for a buffer model of archaeological potential, moderate potential should be defined on the basis of archaeological site densities within an area; moderate potential would represent moderate site densities, high potential would indicate high site densities, and low potential would indicate low site densities. Sufficient data do not currently exist to define such potential zones in quantitative terms. High potential areas as defined above account for landscape zones and types of zones with known high site densities. Ultimately, the exact values of the high potential buffers limits defined may or may not be proven to be sufficiently wide. Given that the high potential buffers account for virtually all the archaeological sites in the District, few sites remain with which to define moderate potential areas. Significantly more site location data than currently exists would be necessary to define areas of moderate site densities.

The approach taken here to defining moderate potential areas is based primarily on recognition of the data gaps and sampling biases inherent in the available site location information. Thus, for the purposes of this model, moderate potential is best considered as a reflection of the uncertainties surrounding the defined high potential buffer zone limits. On this basis, several areas are defined as having moderate archaeological potential:

- 1) All areas of Sub-Zones I and II not considered as having either high potential (based on landscape feature high potential buffers) or low potential (based on slope considerations) have moderate archaeological potential. Respectively, these definitions are based on the high proportion and high absolute number of known archaeological sites in Sub-Zone I, and the relatively high proportion of sites left unexplained by the Sub-Zone II model high potential buffers (see above in the respective analysis summaries of these two sub-zones for additional discussion of moderate potential zones);

2) In Sub-Zones IV and V, moderate potential areas are defined as buffer zones around the same landscape features used to define high potential zones. The distance values for these zones are defined by convention as being twice the value of the high potential buffer limit. For example, if the high potential buffer is defined as 100 metres, then the moderate potential buffer is defined as 200 metres; the zone 100-200 metres around the identified landscape feature has moderate archaeological potential.

Defining moderate potential zones in this manner addresses uncertainties in the buffer zone limits defined for high potential zones. In Sub-Zones I and II, the moderate potential zones account for all remaining sites not accounted for by the high potential buffer zones. In Sub-Zone IV, the moderate potential zones account for one of the four sites not explained by the high potential buffer zones, bringing the total proportion of sites explained by high and moderate potential zones in Sub-Zone IV to 98/101 (97%). In Sub-Zone V, the moderate potential zones account for four of the ten sites not explained by the high potential buffer zones, bringing the total proportion of sites explained by high and moderate potential zones to 60/66 (90.9%). If unexplained historic sites are eliminated from this last calculation, the proportion for Sub-Zone V increases to 60/63 (95.2%).

It is recommended that archaeological reconnaissance surveys be conducted in proposed development areas assessed as having moderate archaeological potential. For logging blocks within which areas of high potential have been identified, reconnaissance survey could be easily incorporated into archaeological impact assessment studies of these blocks. Overall, conducting reconnaissance surveys would further reduce the risk of impacting unknown archaeological sites.

Informant Information

One other aspect of archaeological potential assessment that cannot be ignored is informant information. Such information, provided by First Nations persons, local residents, farmers, ranchers and foresters can be incorporated into the assessment process. If such information indicates or suggests that archaeological resources exist in a particular place or

logging block, that particular logging block would be automatically evaluated as having high archaeological potential regardless of how the block fares in reference to the formal model.

Unfortunately it is not an easy task to collect such information comprehensively and/or systematically. It is recommended, however, that such attempts be made. Means of accomplishing systematic collection of local knowledge could include carrying out traditional use studies with local First Nations, and through incorporation of specific questions about archaeological resources into the development plan review process conducted between the Forest Service and First Nations. Additionally, it is recommended that foresters and technicians who often spend a significant amount of time in logging blocks before they are harvested, be instructed to maintain an awareness of the possibility that archaeological resources might be present, and to note any cultural features or possible cultural features in their field records. To facilitate this, introductory training workshops on archaeology and site identification should continue as it has in the Vanderhoof Forest District.

POTENTIAL MODEL SUMMARY AND APPLICATION

THE V.F.D. ARCHAEOLOGICAL POTENTIAL MODEL

The archaeological potential model for the V.F.D. developed and described above provides a comprehensive assessment and definition of areas of high, moderate, and low archaeological potential within the District. It is a buffer model of archaeological potential defining spatial buffer zones from a set of landscape features. It is based on the known distribution of archaeological sites in the District, examined in relation to landscape features. Although not all kinds of natural areas in the District have been surveyed equally for the presence of archaeological sites, our current understanding of site distributions allows useful generalizations about archaeological site locations to be made.

The kinds of places where archaeological sites are known to exist have high archaeological potential. Areas of high archaeological potential would be recommended for archaeological impact assessment if logging developments were planned within them. The kinds of places where it has been shown archaeological sites exist or can be expected to exist, but which have or probably have moderate to low site densities have moderate archaeological potential. Areas of moderate archaeological potential would be recommended for archaeological reconnaissance survey if logging developments were planned within them. The kinds of areas where it has been demonstrated or assumed because of negative evidence that archaeological sites rarely occur have low archaeological potential. No further archaeological investigations would be recommended for developments proposed in these areas. Lastly, areas where little or no information about archaeological site distributions exists have unproven archaeological potential. Areas of unproven archaeological potential should be sampled through either an inventory survey specifically designed to discover and outline the distribution of archaeological sites within such areas, or through a sampling strategy implemented in conjunction with archaeological impact assessments of logging developments within such areas.

The model defines five areal sub-zones within the V.F.D. each of which has a demonstrably different distribution of known archaeological sites, and within each of which a unique set of high archaeological potential buffers are defined. These sub-zones each correspond to relatively large-scale cultural, environmental and/or physiographic zones within the District. Each of these sub-zones would have offered a different complex of subsistence and other resources to past peoples exploiting these zones. As such, differences in the distributions of archaeological sites in these sub-zones is not unexpected. The sub-zones are exclusive areal zones exhibiting no overlap between them.

- ▶ ***Sub-Zone I -- Trail Corridors*** is defined as all areas within 1 kilometre of documented aboriginal trails in the District. This sub-zone is a cultural landscape zone defining areas of demonstrated habitual use -- the trails themselves and their immediate surroundings, connecting specific areas of habitual use across the District. This sub-zone takes precedence over all other sub-zones.

- Sub-Zone I High Potential Zones include:

- 0-250 metres from the documented or approximated actual Trail Bed;
- 0-200 metres from Primary Streams;
- 0-100 metres from any water body of any size (Big Lake, Small Lake, Pond);
- 0-100 metres from Secondary Streams;
- 0-50 metres from Tertiary Streams, and;
- 0-50 metres from wetlands of any size.

- Sub-Zone I Moderate Potential Zones include:

- All remaining areas of the sub-zone except those defined as having low potential based on slope criteria.

- Sub-Zone I Low Potential Zones include:

- All areas between 250-1000 metres from the documented or approximated Trail Bed that have a slope greater than 45% as measurable on 1:20,000 scale contour maps; **OR**, that have a slope greater than 30% as established on-the-ground.

- ▶ ***Sub-Zone II -- Glacial Lake Nechako*** is defined as all areas within the boundaries of Glacial Lake Nechako which enclosed the Nechako Valley between Cluculz Lake and Fort Fraser in the Late Pleistocene-Early Holocene. This zone represents an optimum environment for human exploitation which existed throughout the Holocene, and exhibits the greatest variation in the distribution of known archaeological sites of all the sub-zones. It takes precedence over all other sub-zones except Sub-Zone I.

- Sub-Zone II High Potential Zones include:

- 0-300 metres from Big Lakes;
- 0-150 metres from Primary Streams;
- 0-100 metres from Secondary Streams;
- 0-100 metres from Small Lakes;
- 0-50 metres from Ponds, and;
- 0-50 metres from Tertiary Streams.

- Sub-Zone II Moderate Potential Zones include:

- All remaining areas of the sub-zone except those defined as having low potential based on slope criteria.

- Sub-Zone II Low Potential Zones include:

- All areas that have a slope greater than 45% as measurable on 1:20,000 scale contour maps; **OR**, that have a slope greater than 30% as established on-the-ground.

- ▶ ***Sub-Zone III -- High Elevation Areas, Above 1,150 Metres*** is defined as all areas above the elevation of 1,150 metres, but not within 1 kilometre of documented trails. This zone represents the high elevation mountain and plateau areas of the District. No archaeological sites are known from this Sub-Zone, and very few archaeological surveys have been conducted in such high elevation areas. Therefore, the entire area of Sub-Zone III is defined as having unproven (unknown) archaeological potential.
-

- ▶ ***Sub-Zone IV -- Middle Elevation Areas, Between 790-1,150 Metres*** is defined as all areas within the elevation range 790-1,150 metres, but not within 1 kilometre of documented trails. This zone represents the middle elevation plateau areas between the major river valleys, dominated by lakes and smaller streams.

- Sub-Zone IV High Potential Zones include:

- 0-100 metres from Big and Small Lakes;
- 0-50 metres from Ponds;
- 0-50 metres from all streams (Primary, Secondary, Tertiary), and;
- 0-50 metres from wetlands of all sizes.

- Sub-Zone IV Moderate Potential Zones include:

- 100-200 metres from Big and Small Lakes;
- 50-100 metres from Ponds;
- 50-100 metres from all streams (Primary, Secondary, Tertiary), and;
- 50-100 metres from wetlands of all sizes.

- Sub-Zone IV Low Potential Zones include:

- All areas not enclosed by the Moderate and High potential zones, and;
- All areas, regardless of potential zone, that have a slope greater than 45% as measurable on 1:20,000 scale contour maps; **OR**, that have a slope greater than 30% as established on-the-ground.

- ▶ ***Sub-Zone V -- Low Elevation Areas, Below 790 Metres*** is defined as all areas below 790 metres elevation, but not within 1 kilometre of documented trails, and not within the margins of the Glacial Lake Nechako Basin. This zone represents the valleys of the dominant river-lake system of the District, and corresponds with the distribution of the major salmon runs in the region.

- Sub-Zone V High Potential Zones include:

- 0-150 metres from Primary Streams;
-

- 0-150 metres from Big Lakes;
 - 0-50 metres from all remaining streams (Secondary and Tertiary Streams), and;
 - 0-50 metres from all remaining water bodies (Small Lakes and Ponds).
- Sub-Zone V Moderate Potential Zones include:
- 150-300 metres from Primary Streams;
 - 150-300 metres from Big Lakes;
 - 50-100 metres from all remaining streams (Secondary and Tertiary Streams), and;
 - 50-100 metres from all remaining water bodies (Small Lakes and Ponds).
- Sub-Zone V Low Potential Zones include:
- All areas not enclosed by the Moderate and High potential zones, and;
 - All areas, regardless of potential zone, that have a slope greater than 45% as measurable on 1:20,000 scale contour maps; **OR**, that have a slope greater than 30% as established on-the-ground.
- ***Other High Potential Areas:*** Several other specific kinds of places, regardless of Sub-Zone and the buffer zones outlined above have High Potential. These include:
- Known archaeological sites and their immediate surroundings (within 100 metres of site boundaries);
 - Large glacial eskers and complexes and their immediate surroundings;
 - Bedrock cliffs and bluffs, particularly large ones within the major river-lake system of Sub-Zone V;
 - Any area identified by informant information as having or possibly having archaeological remains.
-

APPLYING THE MODEL

Application of this model in an archaeological overview assessment of logging blocks in the V.F.D. could be accomplished either by hand or by using a GIS. Application through either of these means would use the same rationale and general framework, although the media employed would be different. If applying the model through a GIS, development would be facilitated through close cooperation and consultation between Forest Service GIS technicians and TRACES.

The purpose of the overview assessment would be to identify areas of high, moderate, and low archaeological potential within specific logging developments. Based on these assessments recommendations for further archaeological work would be made -- High Potential areas = Archaeological Impact Assessment; Moderate Potential areas = Reconnaissance Survey; Low Potential areas = No Further Work; Unproven Potential areas = Field Sampling Strategy.

Application of the model by hand should proceed step-wise through the following stages using 1:20,000 scale development plan maps (must include contour information) in conjunction with maps illustrating the locations of documented aboriginal trails and recorded archaeological sites:

- 1) Identify the Sub-Zone within which the logging block is located;
- 2) Determine the closest distance of the block to the landscape features identified above under the appropriate Sub-Zone model;
- 3) Identify and delineate areas of High, Moderate, Low, or Unproven archaeological potential within the logging block based on the defined buffer zones and other criteria outlined above for the sub-zone within which the block is located;
- 4) Make management recommendations.

Application of the model through a GIS would be most readily accomplished through production of 1:20,000 scale overlay maps illustrating areas of high, moderate, low and unproven archaeological potential. These maps could then be used atop the development plan

maps to highlight areas of concern within each logging block. Several stages of data entry and base-map production, each requiring greater or lesser amounts of effort would need to be accomplished before such overlay maps could be produced. These include:

- 1) Combine the digital information provided by the Terrain Resource Inventory Maps (TRIM) and the Forest Cover Maps (FC1), both preferably using NAD 83, into a comprehensive set of digital base maps containing in particular the following information: contours; lakes and streams of all sizes and/or types; and wetlands of all sizes and/or types;
- 2) Develop a formal classification of the lakes and streams of the District that is both consistent with the archaeological potential model, and useable in terms of the digital base maps and associated databases;
- 3) Digitize the following information onto the digital base maps: known archaeological sites; documented trails; and the margins of Glacial Lake Nechako.

An alternative method of application through a GIS would be through development of a weighted scoring system based on the buffer zones and other significant criteria defined above. Each block would be scored in reference to its proximity to the identified landscape criteria and other variables. The scoring system would necessarily have to be designed such that logging blocks or particular areas having a particular score value, or falling within a range of score values would have high, moderate, low, or unproven archaeological potential as defined in the model. Such a scoring system could easily be defined where high potential areas equal 3 or greater, moderate potential areas equal 2, low potential areas equal 1, and unproven potential areas equal 0. Development of a scoring system would necessarily have to ensure consistency between the score values and the intended potential assessments for each area within each sub-zone.

Example Application of Model

Application of this model to assess the archaeological potential of a limited set of logging blocks is outlined here. The blocks chosen include a set of blocks assessed previously

using the earlier potential model developed by TRACES (Carlson 1996). The results of this exercise provide an example of the results of application of this model, and allow comparison of these results with the results of the earlier potential model.

The blocks examined consist of 65 Fraser Lake Sawmills and S.B.F.E.P. logging blocks proposed for development between 1997-2001 and located in the area covered by NTS map sheet 93 F/15 -- south of Fraser Lake, east of Francois Lake and north of the Nechako River. This map sheet was chosen because there is a relatively large number of proposed logging blocks in the area, several of which have been surveyed on-the-ground, and because all five areal sub-zones are represented.

Application of the model was done by hand. A full application of the model was not completed. In particular, the assessment was done at 1:50,000 scale, when it would be much better applied at 1:20,000 scale, and slope was not considered because of lack of contour maps at 1:20,000 scale. Table 5 presents a summary of the results, including the earlier assessment results of the same blocks. A key is at the bottom of the table.

Note that under the *New Arch. Potential* field in Table 5, the assessment indicated only represents the highest potential rating found within the block. For example, a block indicated as having high potential in the table usually only means a portion of the block has high potential. The other portions of the block would have moderate and low potential. The blocks for which this is the case can be identified through examination of the recommendation made for the block. Those blocks recommended for partial AIA have only a portion of their areas assessed as high potential

Table 5: Summary of Reassessment of Archaeological Potential of 1996-2001 Logging Blocks on NTS Map 93 F/15

Block	District Sub-Zone	Previous Arch. Potential	Previous Recom.	New Arch. Potential	Criteria	New Recom.
A7929	IV	L	NFW	L	n/a	NFW
103 128	III	L	NFW	UP	n/a	Sample
103 125	III	L	NFW	UP	n/a	Sample

Block	District Sub-Zone	Previous Arch. Potential	Previous Recom.	New Arch. Potential	Criteria	New Recom.
160	I	H-M	AIA	H	SL, P, T	AIA
106 138	IV	H-M	AIA	H	TS	AIA (par.)
106 139	IV	H-M	AIA	H	P, TS	AIA (par.)
106 939	IV	H-M	AIA	M	P, TS	REC (par.)
106 140	II	H-M	AIA	H	TS, WL	AIA (par.)
103 122	III	L	NFW	UP	n/a	Sample
103 123	III	L	NFW	UP	n/a	Sample
103 124	IV	L	NFW	H	TS	AIA (par.)
103 121	IV	L	NFW	H	TS	AIA (par.)
103 119	IV	L-M	REC	H	TS	AIA (par.)
102 120	I	H-M	AIA	H	TS, WL	AIA (par.)
102 118	I	H-M	AIA	H	P, T	AIA
102 117	I	H-M	AIA	H	P, T	AIA
102 116	I	L-M	REC	M	T	REC (par.)
144	IV	H-M	AIA	H	P, WL	AIA (par.)
145	IV	H-M	AIA	H	TS, WL	AIA (par.)
164	IV	H-M	AIA	H	P, TS, WL	AIA (par.)
165	II	H-M	AIA	H	TS, WL	AIA (par.)
166	II	H-M	AIA	H	P, WL	AIA (par.)
188	IV	L-M	REC	M	WL	REC (par.)
186	IV	L	NFW	H	TS	AIA (par.)
187	IV	L	NFW	L	n/a	NFW
189	IV	H-M	AIA	H	TS	AIA (par.)
A52119	IV	H-M	AIA	H	SS	REC (par.)
A52118	IV	H-M	AIA	L	n/a	NFW
184	IV	H-M	AIA	M	SS	AIA (par.)
183	IV	L	NFW	M	SS	REC (par.)
182	IV	H-M	AIA	H	P	AIA (par.)
104 129	IV	L	NFW	L	n/a	NFW
79 174	IV	L	NFW	M	TS	REC

Block	District Sub-Zone	Previous Arch. Potential	Previous Recom.	New Arch. Potential	Criteria	New Recom.
79 175	III	L	NFW	UP	n/a	Sample
79 158	III	L	NFW	UP	n/a	Sample
79 157	IV	L	NFW	M	TS	REC
79 156	III	L	NFW	UP	n/a	Sample
79 153	IV	L-M	REC	H	TS	AIA (par.)
79 155	IV	L	NFW	H	TS	AIA (par.)
79 154	IV	L	NFW	L	n/a	NFW
79 152	IV	L	NFW	L	n/a	NFW
81 173	IV	H-M	AIA	H	P, TS, WL	AIA (par.)
104 149	III	L	NFW	UP	n/a	Sample
81 171	III	L	NFW	UP	n/a	Sample
81 172	III	L	NFW	UP	n/a	Sample
81 170	III	L-M	REC	UP	n/a	Sample
A52123	IV	H-M	AIA	H	WL	AIA (par.)
A52122	IV	H-M	AIA	H	TS, WL	AIA (par.)
909	I	H-M	AIA	H	SS, T	AIA (par.)
101 115	I	H-M	AIA	H	TS, T	AIA
101 113	I	H-M	AIA	H	T	AIA (par.)
101 114	IV	L-M	REC	L	n/a	NFW
101 110	IV	H-M	AIA	M	SS, TS	REC (Par.)
A52982 179	I	H-M	AIA	H	P, T	AIA
A45370	II	H-M	AIA	H	P	AIA
A40791	IV	H-M	AIA	H	P, TS, WL	AIA
A52978 176	IV	L-M	REC	L	n/a	NFW
A52979 177	IV	H-M	AIA	M	SL	REC
A52980 178	IV	H-M	AIA	H	SS	AIA (par.)
A40783 450	III / IV	L	NFW	UP / H	n/a / TS, WL	AIA (par.)
A52125	IV	H-M	AIA	H	TS	AIA (par.)
A40783 425	IV	L-M	REC	H	TS	AIA (par.)
100 103	IV	L-M	REC	H	P, TS, WL	AIA (par.)

Block	District Sub-Zone	Previous Arch. Potential	Previous Recom.	New Arch. Potential	Criteria	New Recom.
A50814	IV	L	NFW	H	SS	AIA (par.)
100 100	IV	L	NFW	H	SS	AIA (par.)

Arch. Potential: **H**=High potential; **M**=Moderate Potential; **L**= Low Potential; **UP**=Unproven Potential

Criteria: **SS**=Secondary Stream; **TS**=Tertiary Stream; **SL**=Small Lake; **P**=Pond; **WL**=Wetland

Recommendations: **AIA**=Archaeological Impact Assessment; **AIA(par.)**=Partial Archaeological Impact Assessment; **REC**=reconnaissance Survey; **REC(par.)**=Partial Reconnaissance Survey; **NFW**=No Further Work; **Sample**=Survey a sample of unproven potential blocks.

Summary of Table 5

NEW MODEL

- 7/65 (10.8%) blocks have only high potential areas -- Recommend full AIA
- 30/65 (46.2%) blocks have high, moderate, and low potential areas -- Recommend partial AIA and associated reconnaissance surveys
- 3/65 (4.6%) blocks have only moderate potential areas -- Recommend full reconnaissance
- 6/65 (9.2%) blocks have moderate and low potential areas -- Recommend partial reconnaissance
- 8/65 (12.3%) blocks have only low potential areas -- Recommend no further work
- 11/65 (16.9%) blocks have unproven potential -- Recommend full AIAs on a 5-15% sample of these blocks (1 to 2 blocks)

OLD MODEL

- 31/65 (47.7%) blocks were recommended for full AIA under previous model
- 9/65 (13.8%) blocks were recommended for full reconnaissance under previous model
- 25/65 (38.5%) blocks were recommended for no further work under previous model

On cursory review, it might seem that the revised potential model assesses more areas as having high archaeological potential than the original model. This is not the case. More individual blocks requiring some level of AIA are in fact selected in the new model (37 out of 65) than in the old model (31 out of 65). However, of the blocks picked up in the new model, 30 of them only require partial AIAs and only 7 require full AIAs. Under the old model all 31 blocks required full AIAs. For a logging block, a full AIA consists of a systematic field survey of the entire logging block, whereas a partial AIA entails only systematic survey of an identified portion of the logging block. For most of the partial AIAs

identified in Table 5, the areas recommended for survey include relatively small areas consisting of the margins of small streams and wetlands located on the edges of the logging blocks. These recommendations represent a significant reduction, from the early model to the new model, in the overall area that would require field investigation. It is estimated to be an approximate 75% decrease in the total area recommended for AIA, which represents a significant increase in overall efficiency.

Following a full application of the new potential model, it is probable that an even greater decrease in the overall area recommended for further field investigation would be apparent. As indicated, slope considerations were not applied in the example application above. It is likely that incorporation of slope into the model's application would further reduce the areas recommended for field study. Additionally, in the example above, the model was applied at 1:50,000 scale. Given inaccuracies in measurement at this scale, and inaccuracies in the plotted locations of the actual block boundaries, it is quite probable that many actual block boundaries are at greater distances than indicated at 1:50,000 scale. Application of the model at 1:20,000 scale is recommended as it would provide more precise information on the location of block boundaries in relation to the significant landscape features.

CONCLUSION

DISCUSSION

The archaeological potential model presented above represents close and careful consideration of patterning in the locations of known archaeological sites in the District, and provides a useful tool for archaeological resource management in relation to logging development. The two level framework of 1) stratification of the V.F.D. into sub-zones and, 2) definition of unique and specific potential models for each sub-zone, gives relatively great predictive precision to the model as a whole.

The stratification of the District represents an attempt at defining relatively broad, yet homogenous cultural/environmental sub-zones within each of which past human occupation and resource exploitation patterns would be relatively similar. The analyses presented above highlighted some general patterns in site distributions that would be expected given the rationale for the sub-zone definitions. For example, a significantly high proportion (approx. 60%) of the known sites in the District are found within Sub-Zone I -- Trail Corridors, which was taken to represent areas of habitual use and to connect areas of habitual use. Additionally, very high site densities are apparent on the primary river and lake margins of Sub-Zone V which represents the most productive salmon areas in the District. The concentration of sites around lakes in Sub-Zone IV, the middle elevation plateau areas outside the primary river valleys is also an expected pattern in site distributions. Observation of these expected patterns supports the overall validity of the sub-zone stratification adopted.

The primary weaknesses, or uncertainties in the model as a whole virtually all stem from gaps in our knowledge of the archaeology of the District. Where significant data gaps became apparent, reliance on assumptions or analogies from other areas was necessary to define appropriate high potential buffer zone limits. One of the advantages of the analysis undertaken was to point out areas where significant data gaps apparently exist. Some of the more notable of these include: high elevation areas; primary streams in Sub-Zone IV;

secondary streams throughout the District; and areas between 50 and 500 metres from primary streams and big lakes in Sub-Zone V. The identification of these data gaps provides useful information for guiding, planning, and implementing future possible archaeological inventory surveys within the District.

Another relatively significant weakness in this model has to do with the difference between low and unproven potential. In all but the high elevation areas (Sub-Zone III), where it is easily demonstrable that few archaeological studies have been undertaken, it has been assumed that we have more-or-less representative samples of the kinds and distributions of sites found throughout the areas; it has been assumed that in areas at greater than one or two hundred metres from the landscape features identified, that there will be low archaeological site densities and thus low archaeological potential. The field work that has been completed in such areas supports this hypothesis of low archaeological site densities. However, the field work that has been undertaken in such areas represents coverage of much less than one percent of the total area under discussion. This is clearly not a representative sample of field coverage. Thus for the greater portions of most of the sub-zones evaluated as having low archaeological potential, it would perhaps be better to consider these areas as having unproven archaeological potential.

Because of the above considerations; it is stressed that this model cannot be considered as the "final word" on the archaeological potential of the Vanderhoof Forest District. Continuing field research will eventually increase our known site data set, and allow more confident definition of high archaeological potential zones (whether by decreasing or increasing the buffer widths remains to be determined). The model is intended as the current best estimate of archaeological potential zones for the V.F.D., and has much utility for archaeological resource management decision-making at this time. This is all it is, however, a tool, and cannot be interpreted as a full representation of the distribution of all the archaeological sites in the District. The model has been designed to be flexible and can and should be reconsidered and modified regularly or as necessary in light of new information. Moreover, the model itself would provide a useful framework for designing and implementing a comprehensive inventory survey with the goal of filling the gaps in our knowledge of archaeological site distributions in the Vanderhoof Forest District.

RECOMMENDATIONS

The following recommendations, stemming from development of the above archaeological potential model, are made to facilitate management of archaeological resources in relation to forest industry development in the Vanderhoof Forest District and are intended to minimize the risk of impacting unknown archaeological sites by development activities:

- Replace the earlier model of archaeological potential (Carlson 1996) with the new model developed here.
 - Follow the model and recommendations implied within the model as stated to avoid corrupting the model's intent and comprehensiveness. (All aspects of the model are interrelated. Single aspects cannot be removed or modified without affecting changes in other aspects of the model. Modifications to the model cannot be made *ad hoc* to meet pre-determined management conditions without significantly decreasing the model's utility and increasing the risks of impacting unknown archaeological sites).
 - Develop and implement application of this model through a GIS and 1:20,000 scale mapping.
 - Conduct archaeological impact assessments in all areas identified in the model as having high archaeological potential and within which logging developments are proposed.
 - Conduct archaeological reconnaissance surveys in all areas identified in the model as having moderate archaeological potential and within which logging developments are proposed.
 - Design a sampling strategy to investigate archaeological site distributions in areas of unproven potential. Such a strategy could be implemented through either a specific study with this aim in mind, or could be implemented in conjunction with archaeological impact assessments of specific logging blocks within unproven potential areas.
 - Reassess the potential model annually in reference to the results of continuing archaeological field investigations throughout the District.
-

- Inform all Ministry field technicians about the potential presence of archaeological sites in logging blocks, and direct them to maintain a comment section in their field notes about the presence of archaeological sites that they *may* notice while conducting field reconnaissance or other activities (it is recognized that this is not systematic data-collection, or a substitute for archaeological investigations).
- Conduct traditional use studies with local First Nations to collect further information on trails and archaeological sites within the District, and incorporate this information into the model.
- Present 1:20,000 scale overlay maps of the model devised here, along with copies of this report to the First Nations of the District for their review.

In conclusion, this study was concerned with potential impacts to archaeological sites by proposed forestry operations. It did not address potential impacts to traditional use sites by these operations. Moreover, it was not the intent of this study to document First Nations interest in the land. The study was conducted without prejudice to First Nations Treaty Negotiations, aboriginal rights or aboriginal title.

Lastly, an archaeological potential model, overview, or a reconnaissance survey cannot be considered as a substitute for an archaeological impact assessment. A recommendation for no further work based on an overview study, or the failure to identify sites in a reconnaissance survey do not constitute negative evidence about the presence of archaeological sites in a study area. Moreover, the possible failure of the archaeological potential model described above to predict the presence of an archaeological site or sites would reflect the incomplete archaeological site location information upon which the model is based. Moreover, such a failure would not indicate, imply, or assign fault to the model or TRACES Archaeological Research and Consulting Ltd. Use of this model for archaeological resource management planning or other purposes implies explicit recognition of these factors.

REFERENCES CITED

Archaeology Branch

- 1995 B.C. Archaeological Impact Assessment Guidelines. 2nd Revised Edition. Ministry of Small Business, Tourism, and Culture, Archaeology Branch, Victoria.

Carlson, Arne K.

- 1995 Archaeological Sites of the Nechako Canyon, Cheslatta Falls and Vicinity, Central Interior British Columbia. TRACES Archaeological Research and Consulting Report prepared for the B.C. Ministry of Forests, Vanderhoof District. Archaeological Permit 1994-097.
- 1996 Detailed Archaeological Overview Assessment of Proposed 1997-2001 Logging Developments in the Vanderhoof Forest District (October 1995 Version of Development Plan). TRACES Archaeological Research and Consulting Ltd. report prepared for the B.C. Ministry of Forests, Vanderhoof District.

Holland, Stuart S.

- 1964 Landforms of British Columbia, A Physiographic Outline. B.C. Department of Mines and Petroleum Resources Bulletin No. 48. Victoria.

Klassen, Michael

- 1996 Archaeological Review of the Five-Year Consolidated Forest Development Plan for the Chilcotin Forest District. Joint Antiquus Ltd. and Arcas Ltd. report prepared for the B.C. Ministry of Forests Chilcotin District.

Morice, Fr. Adrien G.

- 1978 The History of the Northern Interior of British Columbia. Reprint of 1905 original. Interior Stationery, Smithers.
-

Plouffe, Alain

- 1991 Preliminary Study of the Quaternary Geology of the Northern Interior of British Columbia. Current Research, Part A, G.S.C., Paper 91-1A, pp. 7-13.

Tipper, H.W.

- 1971 Glacial Geomorphology and Pleistocene History of Central B.C. G.S.C. Bulletin 196.

APPENDIX 1 -- KNOWN SITES LOCATION DATA TABLE

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
GaSg 1	C	93 K/3	2400	0	99999	99999	0	99999	99999	99999	99999	99999
GaSg h. 2	H,G	93 K/3	2300	550	750	99999	7350	99999	500	99999	99999	99999
GaSf 1	C	93 K/2	2300	850	99999	99999	50	99999	99999	99999	99999	99999
GaSf 2	G	93 K/2	2400	1550	1000	99999	200	99999	99999	99999	99999	99999
GaSf 4	C	93 K/2	2200	350	99999	99999	25	99999	500	99999	99999	99999
GaSf 5	A,B,C	93 K/2	2300	25	99999	99999	3000	99999	99999	20	99999	99999
GaSf 6	C	93 K/2	2300	25	99999	99999	4100	99999	99999	99999	99999	99999
GaSf 7	B,C	93 K/2	2400	50	99999	150	2250	99999	99999	99999	99999	99999
GaSf h. 8	H	93 K/2	2900	5700	99999	50	4550	99999	99999	99999	99999	99999
GaSf h.10	H	93 K/2	2500	100	99999	50	4250	99999	99999	99999	99999	99999
GaSf h.11	H	93 K/2	2400	1000	99999	200	6000	99999	99999	99999	99999	99999
GaSf 12	C	93 K/2	2300	2500	99999	99999	2850	99999	99999	99999	99999	99999
GaSf 13	M	93 K/2	3000	1800	99999	99999	1900	500	99999	99999	99999	99999
GbSe h. 1	H,J	93 K/2	2800	12250	400	99999	8050	25	99999	99999	99999	750
GbSe 2	C	93 K/2	2900	12200	99999	99999	8050	25	99999	99999	99999	800
GaSe 2	C	93 K/2	2200	8500	1000	99999	0	99999	99999	99999	99999	99999
GaSe 3	B	93 K/2	2200	5200	99999	99999	0	99999	99999	99999	99999	99999
GaSe 4	C,D,K	93 K/2	2200	7800	99999	99999	0	99999	99999	99999	99999	99999
GaSe 7	J,L	93 K/2	2200	8000	99999	99999	0	99999	99999	99999	99999	99999
GaSe 8	C	93 K/2	2200	9850	0	99999	0	99999	99999	99999	99999	99999
GaSe 10	A,B	93 K/2	2200	8450	950	99999	50	99999	99999	99999	99999	99999
GaSe h.11	H,N	93 K/2	2200	10350	99999	99999	5750	200	99999	99999	99999	99999
GaSd 1	E	93 K/2	2200	2500	99999	99999	50	99999	99999	99999	99999	99999
GaSd 2	C	93 K/2	2300	200	99999	0	250	99999	99999	99999	99999	50
GaSd 3	G,A,C	93 K/2	2200	150	99999	99999	700	99999	99999	99999	99999	600
GaSd 6	E	93 K/2	2300	4500	99999	99999	100	99999	99999	99999	99999	99999
GaSd 7	E	93 K/2	2300	3500	99999	99999	100	99999	99999	99999	99999	99999
GaSd h.8	H	93 K/2	2200	2300	99999	99999	200	99999	300	99999	99999	99999
GaSd h.9	H,C	93 K/2	2300	500	99999	99999	250	99999	99999	99999	99999	650
GaSd 10	D	93 K/2	2200	25	99999	150	25	99999	99999	99999	99999	150
GaSd 11	C,D	93 K/2	2300	200	99999	100	150	99999	99999	99999	99999	250
GaSd 12	C	93 K/2	2200	350	99999	99999	250	99999	99999	99999	99999	500
GaSd 7		93 K/2	2200	1300	99999	300	100	99999	99999	99999	99999	99999
Is. adze	C	93 K/2	2300	3350	99999	100	350	1000	99999	99999	99999	99999
GaSc 1	C	93 K/1	2400	3100	99999	99999	10400	99999	99999	99999	0	99999
GaSc 2	C	93 K/1	2300	550	99999	150	15350	99999	99999	99999	0	99999
GaSb h.1	H	93 K/1	2200	0	99999	99999	11850	99999	99999	99999	0	99999
GaSb h.2	H	93 K/1	2200	150	99999	99999	12150	99999	99999	99999	0	99999
GaSb h.3	H	93 K/1	2200	300	99999	99999	12350	99999	99999	99999	0	99999
GaSb h.4	H	93 K/1	2450	5900	99999	99999	7950	99999	99999	99999	0	99999
GbSa h.1	H	93 K/1	2800	6100	99999	99999	22500	0	99999	99999	99999	99999
GbSa 2	C	93 K/1	2800	6350	400	99999	22600	0	99999	99999	99999	99999
GbSa 3	D	93 K/1	2800	6300	200	99999	22700	99999	99999	0	99999	99999
GbSb (2)		93 K/1	2800	4350	99999	200	21150	99999	99999	25	99999	99999
GaSa 19	C,D	93 K/1	2800	7000	99999	99999	21600	0	99999	99999	99999	750
GaSa 20	D	93 K/1	2800	7750	99999	99999	21300	0	99999	99999	99999	99999
GaSa 21	D	93 K/1	2800	7900	99999	99999	21100	0	99999	99999	99999	99999
GaSa 1	A,B,C	93 K/1	2100	0	99999	99999	6600	99999	99999	99999	0	200
GaSa 2	C	93 K/1	2200	5000	850	50	13100	99999	99999	99999	0	99999
GaSa h.3	H	93 K/1	2300	6700	99999	150	13650	99999	99999	99999	0	99999
GaSa 4	C	93 K/1	2000	0	99999	99999	6650	99999	99999	99999	0	250
GaSa 5	C	93 K/1	2000	50	300	99999	6750	99999	99999	99999	0	99999
GaSa 6	C	93 K/1	2200	600	99999	100	7900	99999	99999	99999	0	99999
GaSa 7	C	93 K/1	2100	100	99999	99999	7950	99999	99999	99999	0	99999
GaSa 8	B	93 K/1	2200	5000	99999	0	12850	99999	99999	99999	0	99999
GaSa 9	C	93 K/1	2200	2650	100	99999	9750	99999	99999	99999	0	650
GaSa 10	A,B,C,H	93 K/1	2100	100	99999	99999	6700	99999	99999	99999	0	99999

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
GaSa 11	B	93 K/1	2100	100	99999	99999	7450	99999	99999	99999	0	99999
GaSa 12	C	93 K/1	2100	50	99999	20	7550	99999	99999	99999	0	99999
GaSa 13	B	93 K/1	2100	0	99999	50	6600	99999	99999	99999	0	99999
GaSa 17	A,B	93 K/1	2100	900	99999	99999	5650	99999	99999	99999	0	300
GaSa 18	C	93 K/1	2100	950	950	99999	5400	99999	99999	99999	0	100
GaRv 1	A,C	93 J/4	2000	25	99999	99999	11400	99999	99999	99999	99999	99999
GbRw 2	C	93 J/4	2300	250	99999	99999	99999	99999	200	99999	99999	99999
FISg 1	B,D	93 F/14	2400	3150	99999	50	25	99999	100	99999	99999	500
FISg 2	B,D	93 F/14	3100	12750	99999	350	25	99999	99999	99999	99999	50
FISg 3	D	93 F/14	3100	9999900	99999	99999	0	99999	99999	99999	99999	99999
FISg 4	B,C,D	93 F/14	3100	9999950	99999	99999	0	99999	99999	99999	99999	99999
FISg 5	D	93 F/14	3100	9000	0	500	6000	600	99999	99999	99999	99999
FISg 6	B	93 F/14	3200	11500	99999	99999	4200	300	99999	99999	99999	100
FISg 7	C	93 F/14	3100	12250	99999	99999	4500	25	99999	99999	99999	50
FISe 1	B	93 F/15	3100	10700	99999	50	18650	99999	0	99999	99999	250
FISd 1	B	93 F/15	2300	50	99999	99999	19200	99999	99999	99999	99999	99999
FISd 2	C,D,O	93 F/15	2300	50	99999	99999	19200	99999	99999	99999	99999	99999
FISd 3	B	93 F/15	2300	50	99999	99999	19050	99999	400	99999	99999	99999
FISd 4	B,C	93 F/15	2300	50	99999	99999	19000	99999	300	99999	99999	99999
FISd 5	D	93 F/15	2300	50	99999	99999	19000	99999	350	99999	99999	99999
FISd 6	C	93 F/15	2300	25	99999	500	19600	99999	350	99999	99999	99999
FISd 7	C,D	93 F/15	2300	50	99999	450	18500	99999	450	99999	99999	99999
FISd 8	C,D	93 F/15	2300	50	99999	200	18000	99999	99999	99999	99999	99999
FISd 9	A,B,C,D	93 F/15	2300	25	99999	99999	17250	99999	99999	99999	99999	99999
FISd 10	D	93 F/15	2300	25	99999	400	17600	99999	99999	99999	99999	99999
FISd 11	B	93 F/15	2300	50	99999	300	18400	99999	500	99999	99999	99999
FISh (1)		93 F/14	2400	13800	99999	99999	0	99999	99999	99999	99999	99999
FkSb (1)		93 F/16	3800	19700	1000	99999	11850	99999	99999	100	99999	99999
FkSf 14	D	93 F/15	2800	8900	50	99999	13500	750	99999	99999	99999	100
FkSf 15	B,C	93 F/15	2800	8650	200	99999	14200	50	99999	200	99999	150
FkSe 11	B	93 F/15	2700	9800	99999	99999	23700	25	99999	99999	99999	500
FkSe 12	B,D	93 F/15	2700	9850	99999	99999	23600	50	99999	99999	99999	450
FkSe 13	B,D	93 F/15	2700	9999950	99999	99999	23500	25	99999	99999	99999	400
FkSe 14	C,B	93 F/15	2700	9999950	99999	99999	23400	25	99999	99999	99999	250
FkSe 15	D	93 F/15	2700	10000	99999	99999	23350	25	99999	99999	99999	200
FkSe 16	B,C,D	93 F/15	2700	10000	99999	99999	23300	50	99999	99999	99999	100
FkSe 17	D,F	93 F/15	2700	10100	99999	150	22950	50	99999	99999	99999	0
FkSe 18	B,D	93 F/15	2700	9999900	99999	99999	22500	25	99999	99999	99999	50
FkSe 19	D	93 F/15	2700	8000	99999	200	19600	0	99999	99999	99999	1000
FkSe 20	D	93 F/15	2700	8100	99999	99999	19600	0	99999	99999	99999	800
FkSe 21	D	93 F/15	2700	8350	99999	99999	19700	0	99999	99999	99999	600
FkSe 22	A,B,D	93 F/15	2700	8400	99999	99999	19850	25	99999	99999	99999	500
FkSe 23	B,D	93 F/15	2700	8600	99999	99999	24400	0	99999	99999	99999	99999
FkSe 24	D	93 F/15	2700	8400	99999	99999	24600	0	99999	99999	99999	99999
FkSe 25	D	93 F/15	2700	8900	99999	99999	24300	0	99999	99999	99999	99999
FkSe 26	C	93 F/15	2700	9000	99999	99999	24150	25	99999	99999	99999	99999
FkSe 27	D	93 F/15	2700	9200	99999	99999	23950	25	99999	99999	99999	99999
FkSe 28	D	93 F/15	2700	9250	99999	99999	23900	25	99999	99999	99999	99999
FkSe 29	B	93 F/15	2700	9500	99999	99999	23750	25	99999	99999	99999	850
FkSe 30	B,C,D	93 F/15	2700	9550	99999	99999	23700	25	99999	99999	99999	550
FkSe 31	C	93 F/15	2700	9550	99999	99999	23950	25	99999	99999	99999	550
GaRx 1	C	93 J/4	2000	25	99999	99999	13050	99999	100	99999	0	99999
GaRx 2	C	93 J/4	2200	1000	99999	50	11000	99999	99999	99999	0	99999
GaRx 3	B	93 J/4	2100	100	99999	100	9000	99999	99999	99999	0	99999
GaRx 4	B	93 J/4	2100	100	99999	100	9050	99999	99999	99999	0	99999
FkSc 1	B	93 F/16	3600	11150	99999	50	22150	99999	0	99999	99999	99999
FkSc 2	B	93 F/16	3500	10950	99999	99999	22050	99999	250	99999	99999	99999

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FISb 1	C	93 F/16	2400	10850	99999	99999	200	99999	99999	99999	0	99999
FISb 2	A	93 F/16	2300	13400	99999	99999	150	99999	150	99999	0	99999
FISb 3	C	93 F/16	2400	15600	150	100	800	99999	99999	99999	0	200
FISb h.4	H,J	93 F/16	2400	13650	99999	99999	200	99999	99999	99999	0	50
FISb 5	C	93 F/16	2300	15750	50	0	100	99999	99999	99999	0	50
FISa 1	C	93 F/16	2300	6450	250	99999	1500	99999	99999	99999	0	600
FISa 2	C,G	93 F/16	2400	6350	350	99999	200	99999	99999	99999	0	300
FISa 3	C	93 F/16	2300	5900	300	99999	200	99999	100	99999	0	100
FISa 4	J	93 F/16	2400	12500	99999	99999	600	99999	99999	99999	0	99999
FISa 5	C	93 F/16	2400	14900	99999	99999	0	99999	99999	99999	0	99999
FISa 6	C	93 F/16	2400	10500	99999	99999	300	99999	99999	99999	0	99999
FISa 7	C	93 F/16	2400	12450	99999	99999	250	99999	99999	0	0	800
FISa h.8	F,H	93 F/16	2400	9450	350	99999	1000	99999	500	99999	0	50
FISa 9	B	93 F/16	2400	14900	99999	99999	250	99999	99999	99999	0	99999
FISa 10	B	93 F/16	2400	14600	99999	99999	200	99999	99999	99999	0	99999
FIRx 1	B,C	93 G/13	2300	10650	0	99999	9000	0	99999	99999	0	0
FIRx 2	C	93 G/13	2300	12000	99999	0	6600	0	99999	0	0	0
FIRw 1	C	93 G/13	2500	12600	99999	99999	9000	25	100	99999	99999	0
FIRw 2	C	93 G/13	2100	25	650	50	15500	99999	500	99999	0	99999
FIRw h.3	H	93 G/13	2300	2950	99999	0	7900	99999	99999	99999	0	99999
FIRw 4	A,C	93 G/13	2500	11800	600	99999	3000	0	99999	0	0	99999
FIRw 5	C	93 G/13	2500	12600	850	99999	50	99999	99999	99999	0	99999
FIRw 6	B	93 G/13	2600	13000	300	99999	100	99999	99999	50	0	99999
FIRw 7	C	93 G/13	2600	12550	99999	99999	9450	25	500	100	99999	200
FIRv 1	A,C,I	93 G/13	2500	24800	300	99999	11800	99999	99999	0	0	200
FIRv 2	C	93 G/13	2500	9300	99999	99999	0	99999	99999	99999	0	99999
FIRv 3	A,B,C	93 G/13	2000	25	99999	99999	19999950	99999	99999	99999	0	99999
FIRv 4	C	93 G/13	2500	8950	99999	99999	0	99999	99999	99999	0	99999
FIRv 5	C	93 G/13	2500	12800	99999	99999	0	99999	99999	99999	0	250
FIRv 6	C,D	93 G/13	2500	13100	750	99999	0	99999	99999	99999	0	800
FIRv 7	B,C	93 G/13	2500	8300	700	99999	0	99999	99999	0	0	500
FIRv 8	C	93 G/13	2500	9350	99999	99999	0	99999	99999	99999	0	99999
FIRv 9	C	93 G/13	2500	10050	99999	99999	0	99999	99999	99999	0	99999
FIRv 10	C	93 G/13	2500	11850	99999	99999	0	99999	99999	99999	0	99999
FIRv 11	B,C,D	93 G/13	2500	12350	99999	99999	0	99999	99999	99999	0	99999
FIRv 12	C	93 G/13	2500	9700	99999	99999	0	99999	99999	99999	0	900
FIRv 13	C	93 G/13	2500	10750	99999	99999	0	99999	99999	99999	0	99999
FIRv 14	C	93 G/13	2500	10600	99999	99999	0	99999	99999	99999	0	99999
FIRv 15	C	93 G/13	2500	8450	25	99999	200	99999	99999	99999	0	150
FIRv 16	C,F	93 G/13	2500	6200	50	99999	2250	99999	99999	99999	0	800
FIRv 17	B,F	93 G/13	2100	0	99999	99999	9999950	99999	99999	99999	0	99999
FIRv 18	B	93 G/13	2000	0	99999	99999	10950	99999	99999	99999	0	99999
FIRv 20	C	93 G/13	2500	3200	99999	99999	6450	0	99999	99999	0	99999
FIRv 21	C	93 G/13	2500	3400	99999	99999	6450	25	99999	99999	0	99999
FIRv 22	C	93 G/13	2500	3350	99999	99999	6750	25	99999	99999	0	99999
FIRv 23	C	93 G/13	2500	3200	99999	99999	7000	25	99999	99999	0	99999
FIRv 24	C	93 G/13	2500	2900	99999	99999	7400	25	99999	99999	0	99999
FIRv 25	B	93 G/13	2100	100	99999	99999	10600	99999	99999	99999	0	99999
FIRv 26	B	93 G/13	2000	0	1000	99999	8300	99999	99999	99999	0	99999
FISb 6 (Q)		93 F/16	3000	15150	99999	0	8650	99999	99999	99999	99999	0
FIRu 1	A,B	93 G/14	2100	0	99999	99999	12100	99999	99999	99999	99999	99999
FkRv 1	B,C,G,H	93 G/12	2700	24850	600	99999	12500	0	99999	99999	99999	450
FjSa 1	B	93 F/9	3100	1100	99999	99999	0	99999	99999	99999	99999	99999
FjSa 2	B	93 F/9	3100	450	99999	99999	0	99999	99999	99999	99999	99999
FjSa 3	B	93 F/9	3100	2400	99999	99999	0	99999	99999	99999	99999	99999
FjSa 4	B	93 F/9	3100	2400	99999	99999	0	99999	99999	99999	99999	99999
FjSa 5	B	93 F/9	3100	2500	99999	99999	0	99999	99999	99999	99999	99999

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FjSa 6	B	93 F/9	3100	2050	99999	99999	0	99999	99999	99999	99999	99999
FjSa 7	B	93 F/9	3100	1800	99999	99999	0	99999	99999	99999	99999	99999
FjSa 8	B	93 F/9	3100	1800	99999	99999	0	99999	99999	99999	99999	99999
FjSa 9	B	93 F/9	3100	1200	99999	450	0	700	99999	99999	99999	99999
FjSa 10	B	93 F/9	3100	1100	99999	500	0	850	99999	99999	99999	99999
FjSa 11	B	93 F/9	3100	350	99999	99999	0	99999	99999	99999	99999	99999
FjSa 12	B	93 F/9	3100	700	99999	99999	0	1000	99999	99999	99999	99999
FjSa 13	B,H,C	93 F/9	3100	950	99999	99999	0	99999	99999	99999	99999	99999
FjSa 14	B,C	93 F/9	2900	100	99999	100	2350	50	99999	25	99999	99999
FjSa 15	B,I	93 F/9	2900	0	99999	150	2400	25	99999	100	99999	99999
FjSc 1	B	93 F/9	3200	15500	99999	99999	4800	25	99999	200	99999	750
FjSc 2	B	93 F/9	3200	15250	99999	99999	4750	0	99999	200	99999	900
FjSc 3	B	93 F/9	3200	15050	99999	99999	4500	0	99999	100	99999	725
FjSc 4	B	93 F/9	3200	14950	99999	99999	4500	25	99999	99999	99999	1000
FjSc 5	B	93 F/9	3200	16250	300	99999	5750	25	99999	50	99999	750
FjSc 6	B,C	93 F/9	3100	16150	500	99999	5700	25	99999	50	99999	750
FjSc 7	A,B	93 F/9	3100	16000	99999	99999	5600	50	99999	99999	99999	500
FjSc 8	B	93 F/9	3200	16850	150	99999	6100	450	99999	99999	99999	500
FjSb 1	A,B,C	93 F/9	3000	10100	500	99999	200	950	99999	99999	99999	50
FjSb 2	B	93 F/9	3100	10300	99999	99999	25	99999	99999	99999	99999	99999
FjSb 3	B,C,D	93 F/9	3100	10100	99999	99999	0	99999	99999	99999	99999	99999
FjSb 4	A,B	93 F/9	3100	10650	550	99999	25	750	99999	99999	99999	250
FjSb 5	C	93 F/9	3100	10450	400	99999	50	700	99999	99999	99999	250
FjSb 6	A,B	93 F/9	3100	10400	350	99999	50	700	99999	99999	99999	250
FjSb 7	B	93 F/9	3100	10350	300	99999	50	800	99999	99999	99999	400
FjSb 8	C	93 F/9	3100	10100	350	99999	25	850	99999	99999	99999	250
FjSb 9	B	93 F/9	3000	3150	99999	99999	0	99999	99999	99999	99999	99999
FjSb 10	B,H	93 F/9	3000	2900	99999	99999	25	99999	99999	99999	99999	99999
FjSb 11	B	93 F/9	3000	2750	99999	99999	0	99999	99999	99999	99999	99999
FjSb 12	B	93 F/9	3000	2500	99999	99999	0	99999	99999	99999	99999	99999
FjSb 13	B	93 F/9	3000	2450	99999	99999	0	99999	99999	99999	99999	99999
FjSb 14	C	93 F/9	3200	11800	100	99999	2200	0	99999	99999	99999	99999
FjSb 15	B	93 F/9	3200	11000	99999	99999	2300	0	99999	99999	99999	99999
FjSb 16	C	93 F/9	3200	14100	550	99999	4600	50	99999	99999	99999	900
FjSb 17	C	93 F/9	3200	13950	850	100	4900	25	99999	99999	99999	0
FjSb 18	C	93 F/9	3200	13850	900	50	4500	0	99999	99999	99999	50
FjSb 19	B	93 F/9	3200	11000	99999	99999	3050	0	99999	99999	99999	99999
FjSb 20	B	93 F/9	3200	10900	99999	99999	3500	25	99999	99999	99999	99999
FjSb 22	B	93 F/9	3200	13650	99999	99999	3900	0	99999	99999	99999	99999
FjSb 23	B,C	93 F/9	3200	13500	99999	99999	3700	0	99999	99999	99999	99999
FjSb 24	B,C	93 F/9	3200	12650	99999	99999	3600	0	99999	99999	99999	99999
FjSb 25	B	93 F/9	3200	12000	99999	99999	3250	0	99999	99999	99999	99999
FjSb 26	B	93 F/9	3200	12050	99999	99999	3250	0	99999	99999	99999	99999
FjSb 27	B	93 F/9	3200	11800	99999	99999	3250	0	99999	99999	99999	99999
FjSb 29	B	93 F/9	3200	9800	99999	0	4450	25	99999	99999	99999	99999
FjSb 30	B	93 F/9	3200	11250	99999	99999	4400	50	99999	99999	99999	99999
FjSb 31	B	93 F/9	3200	11650	99999	99999	4600	100	99999	99999	99999	99999
FjSb 32	B	93 F/9	3200	13550	99999	99999	3650	0	99999	99999	99999	1000
FjSb 33	B,C	93 F/9	3200	12300	99999	99999	3350	0	99999	99999	99999	99999
FjSb 34	C	93 F/9	3100	11250	99999	99999	0	99999	99999	99999	99999	99999
FjSb 35	B	93 F/9	3100	8850	99999	99999	0	99999	99999	99999	99999	99999
FjSb 36	B	93 F/9	3100	7300	99999	0	0	99999	99999	99999	99999	99999
FjSb 37	B	93 F/9	3100	9750	99999	99999	0	99999	99999	99999	99999	99999
FjSb 38	B	93 F/9	3100	12900	300	99999	25	99999	99999	99999	99999	150
FjSb 39	C	93 F/9	3100	12750	450	99999	25	99999	99999	99999	99999	500
FjSb 40	B	93 F/9	3100	12800	800	99999	25	99999	99999	99999	99999	600
FjSb 41	B	93 F/9	3100	12400	950	99999	25	99999	99999	99999	99999	500

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FJSb 42	B	93 F/9	3100	12050	99999	99999	25	900	99999	99999	99999	500
FJSb 43	B	93 F/9	3100	11450	99999	99999	25	1000	99999	99999	99999	750
FJSb 44	B,C,H	93 F/9	3100	11300	99999	99999	25	99999	99999	99999	99999	750
FhSc 1	C	93 F/8	3800	22400	99999	99999	13000	0	99999	99999	99999	99999
FiSb 9	B	93 F/8	3000	16750	50	99999	11800	99999	99999	99999	99999	0
FiSc 1	B	93 F/8	3600	17900	150	99999	10300	99999	99999	99999	99999	50
FiSc 2	B	93 F/8	3100	17350	25	99999	10500	99999	99999	99999	99999	100
FiSc 3	B,C	93 F/8	3600	26100	99999	99999	14600	25	99999	99999	99999	500
FiSc 4	B,C	93 F/8	3600	25550	99999	99999	15150	0	500	99999	99999	500
FiSc 5	C	93 F/8	3600	25900	99999	99999	15100	25	99999	99999	99999	250
FiSc 6	C	93 F/8	3600	26200	99999	99999	14900	0	99999	0	99999	175
FiSc 7	C,N	93 F/8	3600	26200	99999	99999	14750	25	99999	0	99999	175
FiSc 8	B,C	93 F/8	3600	26200	99999	99999	14650	25	99999	50	99999	175
FiSc 9	C	93 F/8	3000	24900	99999	99999	15600	25	99999	99999	99999	0
FiSc 10	C	93 F/8	3600	23600	700	99999	16300	0	99999	99999	99999	750
FiSc 11	A,B	93 F/8	3600	23200	300	99999	16500	25	99999	99999	99999	1000
FiSc 12	B	93 F/8	3600	23200	100	99999	16850	200	99999	0	99999	750
FiSc 13	B	93 F/8	3600	23000	150	0	16750	100	99999	0	99999	1000
FiSc 14	A,B	93 F/8	3600	23050	300	99999	16450	0	99999	50	99999	99999
FiSc 15	B	93 F/8	3600	23550	750	99999	16150	0	99999	99999	99999	750
FiSc 16	B	93 F/8	3600	23700	900	99999	16050	0	99999	99999	99999	750
FiSc 17	C	93 F/8	3600	23300	400	99999	16350	0	99999	99999	99999	900
FiSc 18	B	93 F/8	3600	23100	350	99999	16300	0	99999	150	99999	99999
FiSc 19	B	93 F/8	3600	23150	700	99999	16100	0	99999	99999	99999	99999
FiSc 20	B	93 F/8	3600	23550	99999	99999	15650	0	99999	99999	99999	99999
FiSc 21	B	93 F/8	3600	24100	99999	99999	15400	0	99999	99999	99999	1000
FiSc 22	B	93 F/8	3600	23500	850	99999	16000	0	99999	99999	99999	1000
FiSc 23	B	93 F/8	3600	24750	99999	200	14850	0	99999	99999	99999	99999
FiSc 24	B	93 F/8	3600	24800	99999	99999	14800	0	99999	99999	99999	1000
FiSc 25	B	93 F/8	3600	25300	99999	0	14600	0	99999	99999	99999	1000
FiSc 26	B	93 F/8	3600	23400	600	99999	16050	0	99999	99999	99999	900
FiSc 27	B	93 F/8	3600	23250	800	99999	15950	0	99999	99999	99999	99999
FhSa 1	C	93 F/1	3000	50	99999	400	25950	99999	99999	99999	99999	0
FhSa 2	C	93 F/1	3000	300	99999	25	28100	99999	99999	99999	99999	150
FhSb 1	C	93 F/1	3200	50	99999	100	20850	99999	99999	99999	99999	0
FhSb 2	B	93 F/1	3200	50	99999	300	21050	99999	99999	99999	99999	0
FhSc 2	B	93 F/1	3700	11950	900	99999	11050	25	99999	99999	99999	99999
FhSc 3	B	93 F/1	3700	11900	800	99999	11150	25	99999	99999	99999	99999
FhSc 4	B	93 F/1	3700	12000	750	99999	11300	0	99999	99999	99999	99999
FhSc 5	B	93 F/1	3600	10100	50	0	11750	400	99999	99999	99999	99999
FhSc 6	B	93 F/1	3600	10050	25	0	11800	500	99999	99999	99999	99999
FgSb 1	E	93 F/1	3300	50	99999	99999	14850	100	99999	99999	99999	0
FgSc 63	C	93 F/1	3200	50	99999	99999	12350	100	99999	99999	99999	0
FgSc 19?	B,C	93 F/1	3200	50	99999	99999	11400	50	99999	99999	99999	0
FgSc 18	B,C,F,H	93 F/1	3200	25	99999	99999	11300	50	500	99999	99999	0
FgSc 17	C	93 F/1	3200	50	99999	99999	10900	50	450	99999	99999	0
FgSc 16	C	93 F/1	3200	50	99999	99999	10750	100	400	99999	99999	0
FgSc 15	C	93 F/1	3200	50	99999	99999	10400	50	250	99999	99999	0
FgSc 14	C	93 F/1	3200	25	99999	99999	10100	25	500	99999	99999	0
FgSc 60	B	93 F/1	3200	25	99999	0	9200	25	99999	99999	99999	0
FgSc 2	A	93 F/1	3200	100	200	99999	8200	100	99999	99999	99999	50
FgSc 61	B	93 F/1	3200	50	99999	0	4750	50	450	99999	99999	0
FkSe 1	B	93 F/10	2400	700	99999	0	13150	99999	450	99999	99999	1000
FkSe 2	A,B	93 F/10	2400	1100	99999	50	13150	99999	0	99999	99999	1000
FkSe 3	D	93 F/10	2400	25	99999	99999	14150	99999	99999	99999	99999	99999
FkSe 4	D	93 F/10	2400	25	99999	99999	14000	99999	99999	99999	99999	99999
FkSe 5	D	93 F/10	2400	25	99999	99999	13950	99999	99999	99999	99999	99999

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FkSe 6	D	93 F/10	2400	25	99999	99999	13100	99999	99999	99999	99999	99999
FkSe 7	D	93 F/10	2400	25	99999	99999	13000	99999	99999	99999	99999	99999
FkSe 8	D	93 F/10	2400	25	99999	99999	12750	99999	99999	99999	99999	99999
FkSe 9	D	93 F/10	2400	25	99999	99999	12700	99999	99999	99999	99999	99999
FkSe 10	C	93 F/10	2400	25	99999	200	12650	99999	99999	99999	99999	99999
FhSe 1	B	93 F/7	3100	20750	99999	99999	25	99999	99999	99999	99999	1000
FhSe 2	A,B	93 F/7	3100	20300	99999	99999	25	99999	99999	99999	99999	99999
FhSe 3	A	93 F/7	3100	19200	99999	99999	50	99999	99999	99999	99999	99999
FhSe 4	B	93 F/7	3100	21600	99999	99999	50	99999	99999	99999	99999	99999
FhSe 5	B	93 F/7	3100	21400	99999	99999	25	99999	99999	99999	99999	250
FhSe 6	C	93 F/7	3100	20200	99999	99999	25	99999	99999	99999	99999	500
FhSe 7	B	93 F/7	3100	19800	99999	99999	50	99999	99999	99999	99999	99999
FhSe 8	B,C	93 F/7	3100	19600	99999	99999	25	99999	99999	99999	99999	1000
FhSe 9	A	93 F/7	3100	19500	99999	99999	25	99999	99999	99999	99999	99999
FhSe 10	B	93 F/7	3100	19250	99999	99999	50	99999	99999	99999	99999	99999
FhSe 11	B	93 F/7	3100	18800	99999	99999	25	99999	99999	99999	99999	99999
FhSe 12	C	93 F/7	3200	23100	350	99999	550	99999	99999	99999	99999	400
FhSe 13	B,H,I	93 F/7	3200	22900	550	99999	450	99999	99999	99999	99999	400
FhSe 14	B	93 F/7	3100	22150	99999	99999	25	99999	99999	99999	99999	450
FhSe 15	B	93 F/7	3100	22250	99999	99999	25	99999	99999	99999	99999	500
FhSe 16	B	93 F/7	3100	22350	99999	99999	25	99999	99999	99999	99999	600
FhSe 17	B	93 F/7	3100	22600	750	99999	25	99999	99999	99999	99999	600
FhSe 18	B	93 F/7	3100	23000	500	99999	50	99999	99999	99999	99999	500
FhSe 19	C	93 F/7	3100	23150	400	99999	25	99999	99999	99999	99999	200
FhSe 20	I	93 F/7	3100	23150	0	99999	25	99999	99999	99999	99999	0
FhSe 21	C	93 F/7	3100	22650	450	99999	25	99999	99999	99999	99999	0
FhSe 22	B,C	93 F/7	3100	22050	99999	99999	100	99999	99999	99999	99999	0
FhSe 23	B	93 F/7	3200	23000	350	99999	200	99999	99999	99999	99999	50
FhSe 24	B	93 F/7	3100	19850	99999	99999	100	99999	99999	99999	99999	200
FhSe 25	B	93 F/7	3100	19999900	99999	99999	50	99999	99999	99999	99999	250
FhSe 26	B,C	93 F/7	3100	20150	99999	99999	25	99999	99999	99999	99999	200
FhSe 27	B	93 F/7	3100	21200	99999	99999	25	99999	99999	99999	99999	0
FhSe 28	C	93 F/7	3100	22650	99999	99999	25	99999	99999	99999	99999	250
FhSe 29	B	93 F/7	3100	21850	99999	99999	25	99999	99999	99999	99999	200
FhSe 30	B	93 F/7	3100	22000	99999	99999	25	99999	99999	99999	99999	250
FhSd 2	B	93 F/7	3100	18550	99999	99999	50	99999	99999	99999	99999	99999
FhSd 3	C	93 F/7	3100	17300	99999	99999	25	99999	99999	99999	99999	99999
FhSd 6	B	93 F/7	3100	17900	99999	99999	50	99999	99999	99999	99999	500
FhSd 7	B	93 F/7	3100	17200	99999	99999	50	99999	99999	99999	99999	99999
FhSd 8	B	93 F/7	3100	16900	800	99999	50	99999	99999	99999	99999	99999
FhSd 11	C	93 F/7	3100	17000	99999	99999	50	99999	99999	99999	99999	300
FhSd 12	C	93 F/7	3100	17200	99999	99999	50	99999	99999	99999	99999	500
FhSd 13	B	93 F/7	3100	17550	99999	99999	50	99999	99999	99999	99999	99999
FhSd 14	B	93 F/7	3100	19050	99999	99999	50	99999	99999	99999	99999	250
FhSd 15	B	93 F/7	3100	18400	99999	99999	50	99999	99999	99999	99999	100
FhSd 16	B	93 F/7	3100	19750	99999	100	50	99999	99999	99999	99999	200
FhSd 17	B	93 F/7	3100	17200	99999	0	3150	99999	99999	99999	99999	100
FhSd 1	A,B	93 F/2	3700	8550	0	99999	0	99999	99999	99999	99999	0
FhSd 4	B,C	93 F/2	3100	15550	200	99999	50	99999	99999	99999	99999	50
FhSd 5	B	93 F/2	3200	15450	500	99999	50	99999	99999	99999	99999	0
FhSd 9	C,D	93 F/2	3100	15850	750	99999	0	99999	99999	99999	99999	250
FhSd 10	B	93 F/2	3100	15800	850	99999	0	99999	99999	99999	99999	200
FgSd 3	A	93 F/2	3200	25	99999	250	3650	99999	99999	99999	99999	0
FgSd 4	A	93 F/2	3200	25	99999	99999	3650	99999	99999	99999	99999	0
FgSf 1	A	93 F/2	3200	25	99999	150	1050	99999	0	0	99999	99999
FgSf 2	C,L	93 F/2	3200	25	99999	200	1000	99999	150	150	99999	99999
FjSg 1	C	93 F/11	2900	3950	99999	99999	3700	99999	0	50	99999	99999

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FjSg 2	C,D	93 F/11	2900	7250	99999	99999	6050	0	99999	99999	99999	99999
FjSg 3	C,D	93 F/11	2900	6600	99999	99999	5550	0	99999	99999	99999	99999
FjSg 4	D	93 F/11	2900	6000	99999	150	5150	0	99999	99999	99999	99999
FjSg 5	C,D	93 F/11	2900	4850	99999	99999	5900	0	99999	99999	99999	99999
FjSg 6	C	93 F/11	2900	4650	99999	50	6000	0	50	50	99999	99999
FjSg 7	C	93 F/11	2600	6150	99999	99999	25	99999	99999	99999	99999	100
FjSg 8	C	93 F/11	2600	5900	99999	99999	25	99999	99999	99999	99999	200
FjSg 9	C	93 F/11	2600	5250	99999	99999	25	99999	99999	99999	99999	350
FjSg 10	C	93 F/11	2600	4900	99999	100	25	99999	99999	99999	99999	200
GaSh h. 2	G?,H	93 K/3	2400	10250	99999	99999	50	99999	99999	99999	99999	99999
GaSh (3)		93 K/3	2400	10250	99999	200	50	99999	99999	99999	99999	99999
FfSj 6	C	93 C/13	3600	10250	99999	99999	1900	25	99999	99999	99999	99999
FfSk 1	C,D	93 C/13	3600	10650	100	99999	100	100	99999	99999	99999	0
FfSk 4	B,C	93 C/13	3500	10150	99999	99999	1350	150	99999	200	99999	0
FfSk 5	C	93 C/13	3500	10550	0	99999	50	50	99999	99999	99999	0
FfSk 6	C	93 C/13	3500	10200	800	99999	50	100	99999	99999	99999	0
FjSf 12	B	93 F/10	2900	400	99999	99999	8100	99999	99999	99999	99999	150
FjSf 21	C	93 F/10	2600	50	99999	99999	7550	99999	99999	99999	99999	0
FjSf 22	C	93 F/10	2600	50	99999	99999	7650	99999	99999	99999	99999	0
FjSf 23	B	93 F/10	2700	200	99999	99999	7650	99999	99999	99999	99999	50
FjSf 28	B,D	93 F/10	2500	25	99999	300	7050	99999	99999	99999	99999	50
FjSf 27	B	93 F/10	2500	50	99999	250	6900	99999	99999	99999	99999	100
FjSf 24	C	93 F/10	2600	150	99999	250	6900	99999	99999	99999	99999	25
FjSf 26	A,B	93 F/10	2500	100	99999	100	6800	99999	99999	99999	99999	150
FjSf 25	A,B,C,D,F?	93 F/10	2500	50	99999	150	6750	99999	99999	99999	99999	100
FjSf 29	B	93 F/10	2500	100	99999	350	6600	99999	99999	99999	99999	25
FjSf 38	C,J?	93 F/10	2500	50	99999	150	6650	99999	99999	99999	99999	150
FjSf 43	B,D	93 F/10	2600	100	99999	50	6650	99999	99999	99999	99999	0
FjSf 44	C,D?	93 F/10	2700	200	99999	25	6600	99999	99999	99999	99999	100
FjSf 40	B	93 F/10	2700	300	99999	100	6550	99999	99999	99999	99999	100
FjSf 48	C	93 F/10	2700	400	99999	50	6500	99999	99999	99999	99999	150
FjSf 39	A?,B	93 F/10	2700	250	99999	200	6500	99999	99999	99999	99999	100
FjSf 45	C	93 F/10	2500	100	99999	250	6550	99999	99999	99999	99999	50
FjSf 46	B,D	93 F/10	2600	150	99999	250	6500	99999	99999	99999	99999	0
FjSf 47	C	93 F/10	2600	200	99999	250	6450	99999	99999	99999	99999	25
FjSf 30	C,D	93 F/10	2600	50	99999	99999	6350	99999	99999	99999	99999	25
FjSf 41	A?,B	93 F/10	2600	200	99999	500	6300	99999	99999	99999	99999	50
FjSf 31	B,F?	93 F/10	2500	50	99999	350	6200	99999	99999	99999	99999	0
FjSf 32	B	93 F/10	2600	150	99999	400	6200	99999	99999	99999	99999	50
FjSf 34	B	93 F/10	2600	100	99999	500	6050	99999	99999	99999	99999	0
FjSf 42	C	93 F/10	2700	550	99999	350	5900	99999	99999	99999	99999	200
FjSf 51	C	93 F/10	2600	200	99999	100	5850	99999	99999	99999	99999	25
FjSf 50	B	93 F/10	2600	150	99999	25	5850	99999	99999	99999	99999	0
FjSf 49	B	93 F/10	2600	150	99999	25	5850	99999	99999	99999	99999	0
FjSf 53	B?,C,D	93 F/10	2600	150	99999	50	5750	99999	99999	99999	99999	0
FjSf 52	C,D	93 F/10	2600	250	99999	50	5700	99999	99999	99999	99999	100
FjSf 7	C	93 F/10	2600	250	99999	25	5800	99999	99999	99999	99999	50
FjSf 54	B	93 F/10	2600	100	99999	99999	5100	99999	99999	99999	99999	25
FjSf 55	B	93 F/10	2700	350	99999	99999	4800	99999	100	99999	99999	50
FjSf 59	B	93 F/10	2700	400	99999	99999	4600	99999	100	99999	99999	50
FjSf 60	B	93 F/10	2700	500	99999	99999	4550	99999	150	99999	99999	50
FjSf 69	B	93 F/10	2700	500	99999	99999	4450	99999	250	99999	99999	50
FjSf 68	B	93 F/10	2700	500	99999	99999	4400	99999	250	99999	99999	100
FjSf 67	B	93 F/10	2700	450	99999	99999	4400	99999	200	99999	99999	50
FjSf 66	A?,B	93 F/10	2700	350	99999	99999	4400	99999	150	99999	99999	0
FjSf 58	B	93 F/10	2700	300	99999	99999	4400	99999	150	99999	99999	25
FjSf 61	A,B,D	93 F/10	2700	350	99999	99999	4550	99999	50	99999	99999	100

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FjSf 62	B	93 F/10	2600	200	99999	99999	4600	99999	25	99999	99999	250
FjSf 63	B	93 F/10	2600	150	99999	99999	4650	99999	100	99999	99999	300
FjSf 64	B	93 F/10	2600	100	99999	99999	4550	99999	150	99999	99999	250
FjSf 65	B	93 F/10	2600	100	99999	99999	4450	99999	200	99999	99999	200
FjSf 56	A?,B	93 F/10	2700	150	99999	99999	4500	99999	400	99999	99999	25
FjSf 57	A?,B	93 F/10	2600	50	99999	99999	4300	99999	400	99999	99999	150
FjSf 83	A?,B	93 F/10	2600	50	99999	99999	4600	99999	500	99999	99999	100
FjSf 82	B	93 F/10	2600	150	99999	99999	4250	99999	99999	99999	99999	0
FjSf 81	C,D	93 F/10	2600	100	99999	99999	4500	99999	99999	99999	99999	100
FjSf 80	B	93 F/10	2600	100	99999	99999	4550	99999	99999	99999	99999	100
FjSf 79	B	93 F/10	2600	100	99999	99999	4650	99999	99999	99999	99999	100
FjSf 86	B	93 F/10	2700	200	99999	99999	4650	99999	99999	99999	99999	0
FjSf 104	D	93 F/10	2600	150	99999	99999	4550	99999	99999	99999	99999	0
FjSf 103	B,D	93 F/10	2600	150	99999	99999	4700	99999	99999	99999	99999	0
FjSf 102	A,B,C,D	93 F/10	2600	100	99999	99999	4800	99999	99999	99999	99999	50
FjSf 84	B	93 F/10	2500	100	99999	99999	3600	99999	99999	99999	99999	200
FjSf 85	B	93 F/10	2500	100	99999	99999	3450	99999	99999	99999	99999	250
FjSf 109	A,B,D	93 F/10	2700	200	99999	99999	3100	99999	450	99999	99999	0
FjSf 120	B	93 F/10	2600	100	99999	99999	3300	99999	99999	99999	99999	50
FjSf 118	C	93 F/10	2500	100	99999	99999	3150	99999	99999	99999	99999	50
FjSf 117	C,D	93 F/10	2500	50	99999	99999	3050	99999	500	99999	99999	100
FjSf 119	B	93 F/10	2600	150	99999	99999	3100	99999	99999	99999	99999	25
FjSf 105	B	93 F/10	2700	450	99999	99999	2750	99999	100	99999	99999	250
FjSf 106	B,D	93 F/10	2700	350	99999	99999	2800	99999	100	99999	99999	200
FjSf 87	A,B,D	93 F/10	2700	400	99999	99999	2700	99999	25	99999	99999	200
FjSf 88	A?,B	93 F/10	2600	200	99999	99999	2750	99999	200	99999	99999	25
FjSf 89	C	93 F/10	2500	50	99999	99999	2750	99999	350	99999	99999	250
FjSf 90	B	93 F/10	2600	300	99999	99999	2400	99999	250	99999	99999	100
FjSf 91	B,D,F	93 F/10	2500	200	99999	99999	2400	99999	350	99999	99999	150
FjSf 92	B	93 F/10	2500	300	99999	99999	2300	99999	350	99999	99999	50
FjSf 35	A,B	93 F/10	2400	25	99999	99999	2500	99999	450	99999	99999	300
FjSf 107	A,B,D,F	93 F/10	2400	50	99999	99999	2450	99999	99999	99999	99999	350
FjSf 101	B	93 F/10	2500	350	99999	99999	2150	99999	99999	99999	99999	200
FjSf 13	A,B,C,D	93 F/10	2400	50	99999	99999	2550	99999	99999	99999	99999	500
FjSf 14	A,B,D	93 F/10	2400	100	99999	99999	2500	99999	99999	99999	99999	500
FjSf 15	A,B,D,N	93 F/10	2500	100	99999	99999	2500	99999	99999	99999	99999	550
FjSf 16	B,D	93 F/10	2500	150	99999	99999	2500	99999	99999	99999	99999	550
FjSf 116	D	93 F/10	2400	25	99999	99999	2750	99999	99999	99999	99999	50
FjSf 115	B,D	93 F/10	2400	25	99999	99999	2750	99999	99999	99999	99999	50
FjSf 77	A,B,C,D	93 F/10	2400	25	99999	99999	2700	99999	99999	99999	99999	50
FjSf 37	C	93 F/10	2400	25	99999	99999	2600	99999	99999	99999	99999	150
FjSf 36	B	93 F/10	2400	100	99999	99999	2550	99999	99999	99999	99999	150
FjSf 76	A,B,D	93 F/10	2400	50	99999	99999	2750	99999	99999	99999	99999	25
FjSf 75	B	93 F/10	2400	50	99999	99999	2900	99999	99999	99999	99999	150
FjSf 74	B	93 F/10	2400	25	99999	99999	3000	99999	99999	99999	99999	300
FjSf 110	B	93 F/10	2600	350	99999	99999	3350	99999	99999	99999	99999	700
FjSf 111	B	93 F/10	2400	50	99999	99999	3000	99999	99999	99999	99999	500
FjSf 112	A,B,D	93 F/10	2400	50	99999	99999	2900	99999	99999	99999	99999	400
FjSf 133	C,D	93 F/10	2600	400	99999	99999	2550	99999	0	99999	99999	100
FjSf 124	A,B,D	93 F/10	2700	700	99999	99999	2550	99999	300	99999	99999	600
FjSf 127	B	93 F/10	2700	750	99999	99999	2400	99999	300	99999	99999	600
FjSf 125	B,D	93 F/10	2700	550	99999	99999	2450	99999	100	99999	99999	150
FjSf 126	B	93 F/10	2700	650	99999	99999	2400	99999	250	99999	99999	250
FjSf 128	B	93 F/10	2700	850	99999	99999	2250	99999	450	99999	99999	450
FjSf 129	B	93 F/10	2600	850	99999	99999	2150	99999	500	99999	99999	350
FjSf 130	B	93 F/10	2600	800	99999	99999	2100	99999	450	99999	99999	350
FjSf 131	B	93 F/10	2600	900	99999	99999	2050	99999	99999	99999	99999	450

Site	Type	Map	Elev. ft.	1 Stream	2 Stream	3 Stream	1 Lake	2 Lake	Pond	Swmp	Glacial	Trail
FJSf 132	A?,B	93 F/10	2700	1000	99999	99999	2100	99999	99999	99999	99999	500
FJSf 123	D	93 F/10	2600	650	99999	99999	2150	99999	400	99999	99999	200
FJSf 150	C	93 F/10	2700	450	99999	99999	1550	99999	99999	99999	99999	450
FJSf 151	B	93 F/10	2600	200	99999	99999	1150	99999	99999	99999	99999	750
FJSf 108	C	93 F/10	2600	400	99999	99999	1850	99999	300	99999	99999	100
FJSf 100	B,C	93 F/10	2500	200	99999	99999	1850	99999	99999	99999	99999	0
FJSf 20	B	93 F/10	2500	25	99999	99999	2100	99999	99999	99999	99999	250
FJSf 33	C,D?	93 F/10	2500	25	99999	99999	2150	99999	99999	99999	99999	300
FJSf 19	B,D	93 F/10	2500	50	99999	99999	2250	99999	99999	99999	99999	400
FJSf 18	B,D	93 F/10	2500	100	99999	99999	2150	99999	99999	99999	99999	350
FJSf 17	B	93 F/10	2500	50	99999	99999	2050	99999	99999	99999	99999	250
FJSf 73	C	93 F/10	2500	100	99999	99999	2800	99999	99999	99999	99999	25
FJSf 148	C	93 F/10	2600	200	99999	350	2800	99999	99999	99999	99999	25
FJSf 149	B,C	93 F/10	2600	150	99999	300	1750	99999	99999	99999	99999	50
FJSf 147	C,D	93 F/10	2600	25	99999	150	1700	99999	99999	99999	99999	50
FJSf 70	C	93 F/10	2500	50	99999	99999	2300	99999	99999	99999	99999	300
FJSf 4	A,B	93 F/10	2500	150	99999	99999	2450	99999	99999	99999	99999	200
FJSf 11	A,B,C,D	93 F/10	2500	50	99999	99999	2800	99999	99999	99999	99999	350
FJSf 5	C	93 F/10	2600	25	99999	99999	1850	99999	99999	99999	99999	25
FJSf 6	C	93 F/10	2600	25	99999	99999	1950	99999	99999	99999	99999	150
FJSf 95	C	93 F/10	2500	25	99999	99999	2500	99999	450	99999	99999	650
FJSf 96	C	93 F/10	2400	25	99999	99999	2850	99999	99999	99999	99999	750
FJSf 97	C	93 F/10	2400	25	99999	99999	2900	99999	99999	99999	99999	750
FJSf 98	C	93 F/10	2400	25	99999	99999	3000	99999	99999	99999	99999	750
FJSf 99	C,D	93 F/10	2400	25	99999	99999	3100	99999	99999	99999	99999	850
FJSf 10	B	93 F/10	2500	150	99999	99999	2800	99999	99999	99999	99999	550
FJSf 3	C	93 F/10	2400	50	99999	99999	2950	99999	99999	99999	99999	650
FJSf 71	C,D	93 F/10	2400	25	99999	99999	2800	99999	99999	99999	99999	600
FJSf 72	A,B,D	93 F/10	2500	25	99999	99999	2650	99999	99999	99999	99999	600
FJSf 113	B	93 F/10	2400	50	99999	99999	3300	99999	99999	99999	99999	950
FJSf 114	A,B,D,F?	93 F/10	2400	25	99999	99999	3750	99999	99999	99999	99999	99999
FJSf 121	C,D	93 F/10	2400	25	99999	99999	3800	99999	99999	99999	99999	99999
FJSf 122	C	93 F/10	2400	25	99999	99999	4250	99999	99999	99999	99999	99999
FJSf 93	D	93 F/10	2400	25	99999	99999	3950	99999	99999	99999	99999	99999
FJSf 94	A,B,D	93 F/10	2700	650	99999	99999	4150	99999	99999	99999	99999	99999
FJSf 156	A,B	93 F/10	2600	200	99999	99999	6050	99999	99999	99999	99999	100
FJSf 157	B	93 F/10	2400	150	99999	99999	3100	99999	99999	99999	99999	350
FJSf 142	B	93 F/10	2700	850	99999	99999	3500	99999	99999	99999	99999	750
FJSf 140	B	93 F/10	2700	800	99999	99999	3600	99999	99999	99999	99999	600
FJSf 141	A?B	93 F/10	2700	750	99999	99999	3600	99999	99999	99999	99999	500
FJSf 143	B	93 F/10	2600	250	99999	99999	3250	99999	99999	99999	99999	100
FJSf 144	B	93 F/10	2600	400	99999	99999	3200	99999	99999	99999	99999	250
FJSf 145	B	93 F/10	2600	450	99999	99999	3250	99999	99999	99999	99999	350
FJSf 135	B	93 F/10	2600	650	99999	99999	3300	99999	99999	99999	99999	550
FJSf 136	B	93 F/10	2600	550	99999	99999	3250	99999	99999	99999	99999	500
FJSf 137	B	93 F/10	2600	350	99999	99999	3050	99999	99999	99999	99999	200
FJSf 138	B	93 F/10	2600	400	99999	99999	3100	99999	99999	99999	99999	250
FJSf 139	B	93 F/10	2600	300	99999	99999	3050	99999	99999	99999	99999	150
FJSf 158	A?,D	93 F/10	2600	25	99999	25	1600	99999	99999	99999	99999	50
FJSf 159	B	93 F/10	2600	25	99999	25	1500	99999	99999	99999	99999	100
FJSf 160	B	93 F/10	2600	25	99999	150	1400	99999	99999	99999	99999	100
FJSf 161	C,D	93 F/10	2600	25	99999	350	25	99999	99999	99999	99999	500
FJSf 162	C	93 F/10	2700	300	99999	99999	50	99999	99999	99999	99999	200
FJSf 163	C	93 F/10	2700	600	99999	99999	100	99999	99999	99999	99999	100
FJSf 2	J?	93 F/10	2600	350	99999	99999	25	99999	99999	99999	99999	150
FJSf 146	A,B,D	93 F/10	2900	2600	99999	0	4350	99999	99999	99999	99999	99999
FJSf 152	A,B,D	93 F/10	2900	1500	99999	0	4900	99999	25	99999	99999	99999

[illegible]