635 8007

GIS MODELLING OF ARCHAEOLOGICAL POTENTIAL for the TFL FOREST LTD. – JOHNSTONE STRAIT OPERATION AREA, 2002

FIA # 6358007   Nov 30/02

ARCAS

ARCAS CONSULTING
2002: NOV 30

GIS MODELLING OF ARCHAEOLOGICAL POTENTIAL for the TFL FOREST LTD. – JOHNSTONE STRAIT OPERATION AREA, 2002

FIA # 6358007 Nov 30/02

ARCAS

GIS MODELLING OF ARCHAEOLOGICAL POTENTIAL for the TFL FOREST LTD. – JOHNSTONE STRAIT OPERATION AREA, 2002

Prepared for:
TFL FOREST LTD. – JOHNSTONE STRAIT OPERATION.
P.O Box 2500
5705 North Island Highway
Campbell River, B.C.
V9W 5C5

Prepared by:
Arcas Consulting Archeologists Ltd.
55 A Fawcett Road
Coquitlam, B.C.
V3K 6V2

November 30th 2002

SUMMARY

Introduction

In 2000-2002, Arcas Consulting Archeologists Ltd (Arcas), in partnership with TFL Forest LTD., Johnstone Strait Operation (TFL), undertook an Archaeological Overview Assessment (AOA) of the Johnstone Strait Operation Area. A previous AOA had been completed for the study area by Golder Associates Ltd (Golder). TFL wished to refine and revise the model that Golder developed for the AOA as that model had been created for a large area of which the Johnstone Strait Operation Area is only a very small part. The purpose of this AOA was to assess and map the archaeological potential within the study area which covers approximately 212,059 hectares consisting of TFL 47 as well as a portion of Forest Licenses situated near Call Inlet and on Quadra Island. The study area encompasses a significant portion of the asserted traditional territory of the K'omoks, Kwiakah, Homalco, Tlowitis, Wei Wai Kai, and Wei Wai Kum First Nations.

This overview is concerned with archaeological sites and resources. An archaeological site is a geographical place which contains physical evidence of past human activities which can be best studied using archaeological methods of investigation. Different kinds of physical evidence (also known as archaeological resources) can be present in various combinations at archaeological sites. Examples of archaeological resources are house depressions, artifact scatters, trails, human burials, fish traps, rock art, and culturally modified trees. Although an archaeological site is restricted to the location containing physical evidence, it is related to the traditional use of the area around a site which often is important for understanding why a site is present and the purpose of the site.

A traditional use site is a geographical place where First Nations people undertook one or more traditional activities. Some traditional use sites contain physical evidence of those activities (and are considered to be archaeological sites as well as traditional use sites), but some traditional activities (such as berry picking, medicine collecting, and spiritual practices) leave little or no physical evidence. Traditional use studies, which rely on interviews and archival research, are best suited to address the nature and location of those traditional use sites which do not contain archaeological evidence.

The overview is based on current knowledge and assumptions, and should be subject to ongoing updates and revisions as our knowledge about the location of archaeological sites in the study area increases. The overview is concerned only with the archaeological (physical) evidence for past human activity, and does not address traditional use activities or other concerns. It was not the intent of this overview to document First Nations interests in the land, and the study was conducted without prejudice to aboriginal rights or title. The participation of First Nations in this overview does not necessarily mean that these First Nations endorse or agree with the process or results of this overview. The overview is not meant to be a substitute for direct consultation with First Nations who have interests in the lands covered by this overview.

Objectives and Methods

The objectives of the overview were to:

- classify the study area into classes of different archaeological potential;
- provide recommendations for each class of potential for the archaeological management of proposed forestry developments; and
- provide accurate digital GIS data (see below) showing the location of recorded archaeological sites.

A computer model created in a geographic information system (GIS) was used to assess the potential for archaeological resources throughout the study area. Broadly defined, a GIS is a computer-based system used to store and manipulate digital geographic information. A model can be defined as a simplified description of a more complex system, which can be used to make predictions about that system. In this case, the system under examination is past First Nation landscape use which resulted in the formation of archaeological sites.

The modelling approach used here is based on the relationship between the various kinds of traditional activities reported for the study area and the characteristics of the natural environment (biophysical variables). This type of modelling relies heavily on ethnographic, historic, and community sources of information. Past changes to the natural environment were also considered. Modelling involved identifying:

- The traditional activities which resulted in physical evidence;
- The types of archaeological sites resulting from these activities;
- The associated archaeological evidence associated with the site types; and
- The locations for each of these site types, along with the mappable biophysical variables associated with these locations.

Given this approach, the overview did not attempt to create a model that predicts the specific locations of archaeological sites. Rather, the overview model predicts the capability of the landscape to support the types of traditional First Nations activities which resulted in physical evidence, thereby forming archaeological sites, with each type of activity resulting in one or more specific kinds of archaeological sites.

The analysis of the interaction between environmental variables in the model is based on the idea of biophysical constraints. From this perspective, variation in archaeological potential can be seen as a result of the number and degree of biophysical constraints which inhibit traditional use of an area, and conversely, the number of favourable biophysical variables which enhance traditional use. The challenge in developing such a model is identifying these constraints and variables, and identifying how their presence or absence affects overall archaeological potential.

GIS modelling requires mapped data in digital (electronic) format. Relevant biophysical data such as stream locations, forest cover, topography, landforms, and wildlife habitat areas were obtained in digital format (or subsequently digitized), as were relevant cultural data such as trail routes and known archaeological site locations. Most of these data were obtained at a scale of 1:20,000. This digital information was entered into the computer and stored as layers of data (coverages). Before applying the model, each coverage was divided into a 30 m grid, creating millions of map "cells" across the study area. The GIS then examined the content of each cell for each coverage, created a database record for each cell, applied the model to each database record, and lastly, predicted the potential for different kinds of traditional activities (and the various kinds of archaeological sites associated with them) for each cell. The highest score for each cell was then placed in a new database, which was used to create digital maps. As the database record for each cell is linked directly to a point on the digital maps, any point on the maps can be queried to obtain the biophysical and cultural data and the archaeological potential scores for that location.

Access to Information

The results of the overview are available as digital maps showing archaeological potential and known archaeological site locations with attached database. The digital data is held by both the Ministry of Forests, Campbell River District, and TFL Forest LTD., Johnstone Strait Operation. Requests for access to digital data or paper printouts of digital plot files should be directed to the Ministry of Forests.

Results

Two different models were used to classify the archaeological potential of the study area. One model focused on archaeological sites that do not include culturally modified trees (CMTs). Three classes of potential were defined: Class 1 (High potential, Low constraint), Class 2 (Moderate potential, Moderate constraint), and Class 3 (Low potential, High constraint) with each level of potential represented by a different colour. The second model focused specifically on the potential for CMTs and while two different approaches were used in order to model, the results were not successful. However, the end results of the CMT model are presented on the final output. On paper and digital maps CMT potential is indicated by hatched lines overlying the coloured non-CMT potential classes.

The classes of archaeological potential do not predict the specific locations of archaeological sites. Rather, these classes predict the potential of the landscape to be favourable to the traditional land use activities that would result in the formation of archaeological sites. High potential areas are the most favourable for such activities, and therefore, the highest probability of finding an archaeological site will occur in these areas. Although the highest overall density of archaeological sites will be found in Class 1 areas, it is important to keep in mind that sites are not necessarily present at all points within all high potential areas. Conversely, Class 3 (Low potential, High constraint) areas have the lowest probability of containing archaeological sites and the lowest overall site density. It is important to remember that low potential areas do not have "zero" potential, and archaeological sites may therefore be present on Class 3 lands.

Model Application and Archaeological Management Recommendations

For the application of the overview results in forestry planning at TFL we recommend the following steps and associated actions:

Step	Required Action
1	Identify the mapsheets for areas where proposed forestry developments (including roads, gravel pits, cutblocks, silviculture areas, etc) are located.
2	Obtain the appropriate digital files and print out paper map.
3	Using the digital or paper archaeological potential maps as an overlay on the development plan, determine the archaeological potential of the area affected by the proposed developments.
4	Determine the appropriate archaeological management action(s) for each development area or portion thereof (see Archaeological Management Recommendations).
5	Obtain additional information necessary for determining the appropriate archaeological work in consultation with the MoF and relevant First Nations.
6	Where required, engage an archaeologist to conduct a field assessment or further research.
7	Document results of all archaeological fieldwork or research so that future revisions to the model can be made.
8	Determine the appropriate management actions for identified archaeological resources in consultation with the MoF, the Archaeology and Forests Branch, and the First Nations.

All proposed developments should be reviewed to determine if any archaeological studies are required. The following is a list of recommended management actions to be carried out in response to a proposed development in the study area. A specific management recommendation concerning First Nations consultation has not been incorporated into the following management recommendations, but, TFL is responsible for consultation with all First Nations who have an identified interest in the proposed study area, and that this consultation should take place in a manner acceptable to all involved parties:

Non-CMT Resource Potential:

- If a proposed development is planned in an area with **Class 3 Potential (low)**, and no conflicts or concerns are demonstrated, then it is recommended that no further archaeological management actions take place. If conflicts or concerns are demonstrated, then it is recommended that the proponent consider the need for an in office review, a preliminary field reconnaissance (PFR), or an archaeological impact assessment (AIA) in consultation with the First Nations, MoF, and the Archaeology and Forests Branch.

- If a proposed development is planned in an area with **Class 2 Potential (moderate)**, the recommended management action is: an in office review, or a PFR, of the development area to identify the presence or absence of micro-features and assess their effect on the

Moderate archaeological rating potential assigned to the area by the overview. If micro-features can be identified on air photos or maps then an in-office review is recommended. If these features are not present on air photos or maps than a PFR is recommended. We also recommend that the PFR be conducted under a heritage inspection permit.

- If a proposed development is planned in an area with only **Class 1 Potential (high)** present, the recommended management action is: an archaeological impact assessment (AIA) of the development area under a heritage inspection permit.

- If a proposed development is planned in an area with a combination of **Class 3 and 2 Potential or Class 2 and 1 Potential**, the recommended management action is for that of the highest class present, to be applied to the entire proposed development area, with the possibility for adjustments to the management action based on a field review.

CMT Resource Potential

- If a proposed development is planned in an area with **Low CMT Potential**, and no conflicts or concerns are demonstrated, then it is recommended that no further archaeological management actions take place. If conflicts or concerns are demonstrated, then it is recommended that the proponent decide on the need for an in office review, PFR, or AIA in consultation with the First Nations, MoF, and the Archaeology and Forests Branch.

- If a proposed development is planned in an area with **Moderate-to-High CMT Potential**, the recommended management action is: a PFR in order to identify the presence or absence of CMTs. Where the PFR identifies CMTs, a subsequent AIA may be required. The need for an AIA should be determined in consultation with the MoF and the Archaeology and Forests Branch.

- If a proposed development contains areas with potential for both CMT and non-CMT resources, the recommended management action is that an in office review, PFR, or AIA be conducted under a heritage inspection permit, depending on the level of non-CMT potential.

- Due to the problems associated with the CMT model, if a proposed development contains old growth western redcedar and/or yellow cedar, the recommended management action is that an in-office review should be applied to the development using the CMT modelling criteria to ascertain whether a PFR should be conducted in order to identify the presence or absence of CMTs. Where the PFR identifies CMTs, a subsequent AIA may be required.

CREDITS

Project Manager	Heather Pratt, MA
Data Coordination	Michele Whitlow, BA
Model Development	Heather Pratt D. Geordie Howe, BA Richard Brolly, BA
Archaeological Research	Heather Pratt Richard Brolly
Archaeological Site Mapping	Michele Whitlow
GIS Services	(Doug Campbell) Range and Bearing Environmental Resource Mapping
Report Drafting	Michele Whitlow
Report Contributors	All personnel are employed by Arcas Consulting Archeologists Ltd, unless otherwise indicated

ACKNOWLEDGEMENTS

Arcas Consulting Archeologists Ltd. (Arcas) would like to thank TFL Forest LTD., Johnstone Strait Operation for their ongoing support and the opportunity to conduct this overview. We would also like to thank EBA Engineering Consultants Ltd., the Hamatla Treaty Society, the Ministry of Forests, Campbell River Forest District, and the Archaeology and Forests Branch. This project was funded by Forest Renewal British Columbia and as the last AOA funded by FRBC it is hoped that the Provincial Government will continue to provide funding opportunities for further projects of this scope.

Numerous people from the TFL Johnstone Strait Operation office were involved in this project from its commencement in April 2000 and they are gratefully acknowledged, particularly Tom Miller and Colin Buss who have always been willing to provide comments, thoughts, and insight throughout the project.

Several other people deserve special acknowledgement. Dee Cullon acted as a liaison between Arcas and the Hamatla Treaty Society and was able to convey various comments and concerns to Arcas throughout this project. Kathryn Willis of the Homalco First Nation was also willing to provide input to the project. Comments and input from Mary-Pat Mathers (Aboriginal Liaison Officer) from the Ministry of Forests, Campbell River Forest District are also gratefully acknowledged. David Elstone of EBA was responsible for overseeing the project on behalf of TFL and he was always willing to be helpful in solving the latest "emergency".

Arcas would like to acknowledge Ted Lewis (Wei Wai Kai First Nation), Gerald Joseph (Homalco First Nation), and Darren Matilipi (Tlowitis First Nation) for their participation in the groundtruthing portion of this project. It was a pleasure working together and learning about the traditional territories through their eyes. The many other people who participated in the groundtruthing portion of this project are also thanked for their willingness to provide modes of transportation and expertise during a somewhat limited window of opportunity.

Although the expertise of many individuals has contributed to making this project what it is, the professional opinions expressed in this report are those of the authors, and not necessarily those of any individuals, groups, or institutions involved with the study. Arcas is solely responsible for the contents of this report, including any errors, omissions, or shortcomings.

TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

This report presents the methods and results of an **Archaeological Overview Assessment (AOA)** of lands located within the Johnstone Strait Operation Area for TFL Forest LTD, Johnstone Strait Operation (TFL). This AOA was conducted in order to revise and refine a previously conducted AOA created by Golder Associates Ltd (Golder).

An AOA is conducted in order to assess the archaeological potential of a defined study area. There are several ways in which archaeological potential can be assessed, but the most common method is usually through the creation of a model which is then applied to the study area and used to predict the relative archaeological potential of the study area landscape. This results in the production of a map showing the levels of archaeological potential present. The findings of an AOA can be used as an important planning tool for managing archaeological resources and future proposed developments.

The terms of reference for this project required that the AOA fulfill its goal of predicting archaeological potential for the Johnstone Strait Operation Area through digital means, more specifically, through a **Geographic Information System (GIS)**-based predictive modelling scheme. GIS is a digital system used to store and manipulate information about the physical landscape (see Chapter Two for more information about GIS). The model developed by the study team uses GIS-based digital data to analyse the physical landscape for certain attributes such as forest cover or slope. Depending on the presence or absence of these attributes, the model predicts archaeological potential over the landscape of the study area. The results of this AOA consist of a series of digital maps and digital files which reside with TFL Forest LTD, Johnstone Strait Operation office.

The primary objective of this overview was to map the relative archaeological potential of the study area. There were benefits for all groups with an interest in the protection and appropriate management of archaeological resources of the study area. Some of the benefits from the outcome of this project are:

- Precise mapping of known archaeological site locations;
- Identification of areas in need of future inventory studies;
- Identification of areas with the highest archaeological concern;
- Assisting all interested parties in making appropriate land use decisions; and
- Recommending appropriate archaeological assessments in proposed forestry developments.

The overview was conducted by Arcas Consulting Archeologists Ltd. (Arcas) with the assistance of Doug Campbell of Range & Bearing Environmental Resource Mapping Corporation (digitization and GIS services). This overview was funded by Forest Renewal British Columbia. TFL Forest LTD., Johnstone Strait Operation, was the lead partner on the project.

1.1 Definitions

First Nation people have lived on Vancouver Island for thousands of years. In that time they have engaged in a variety of activities, some of which still make up a part of their lives. Today, the locations where these activities took (take) place are called **traditional use sites**. Those traditional use sites with physical evidence are called **archaeological sites**. Examples of archaeological sites are village sites, fishing places, or travel routes. The physical materials found at archaeological sites include **cultural features** such as house depressions at village sites, rock or wooden fish traps at fishing places, trails and blazed trees along travel routes. An archaeological site results from all of the activities that took place at one site over many years and can vary in size. Some sites are the result of a single activity such as stripping cedar trees for bark, some are the result of many activities such as a village site. Some sites are old, some are young. Some sites are occupied only once, while others were returned to on a regular basis for thousands of years.

Because an archaeological site can be many different combinations of cultural features, this overview is concerned with predicting the potential for the specific activities and resulting archaeological resources that make up a site, rather than for the site itself.

In order to predict archaeological potential, the overview relied on ethnographic, archaeological and historical information. **Ethnography** is the description of the culture of particular social groups, based on First Nation testimony, participant observation, and written records. **Archaeology** is the study of past cultures through the examination of material remains, that is, physical evidence. **History** is the study of the human past through the examination of written records.

1.2 Study Area

The study area consists of those lands situated within TFL Forest LTD's, Johnstone Strait Operation Area (Figure 1). The study area extends from the northern tip of Quadra Island to Call Inlet and is approximately 212,059 hectares in area. None of the study area is situated on Vancouver Island. The study area is located in the Campbell River Forest District.

There is considerable environmental and cultural diversity in the study area, with the following environmental settings present: inside coast, coastal mountains, inlets, estuaries, Seabird Lake, inland mountains, and river valleys. Associated cultural settings present include: village sites, forest utilization sites, travel routes, spiritual sites, and fishing stations (Figures 2, 3, 4, and 5).

1.3 Study Team

The individual members of the study team are listed on the Credit Sheet. Overall project management, documentary research, direct consultation, model development and review, and reporting were the responsibility of Arcas staff. Doug Campbell of Range and Bearing Environmental Resource Mapping Corporation (R&B) was subcontracted to provide digitized coverages for the model developed by Arcas.

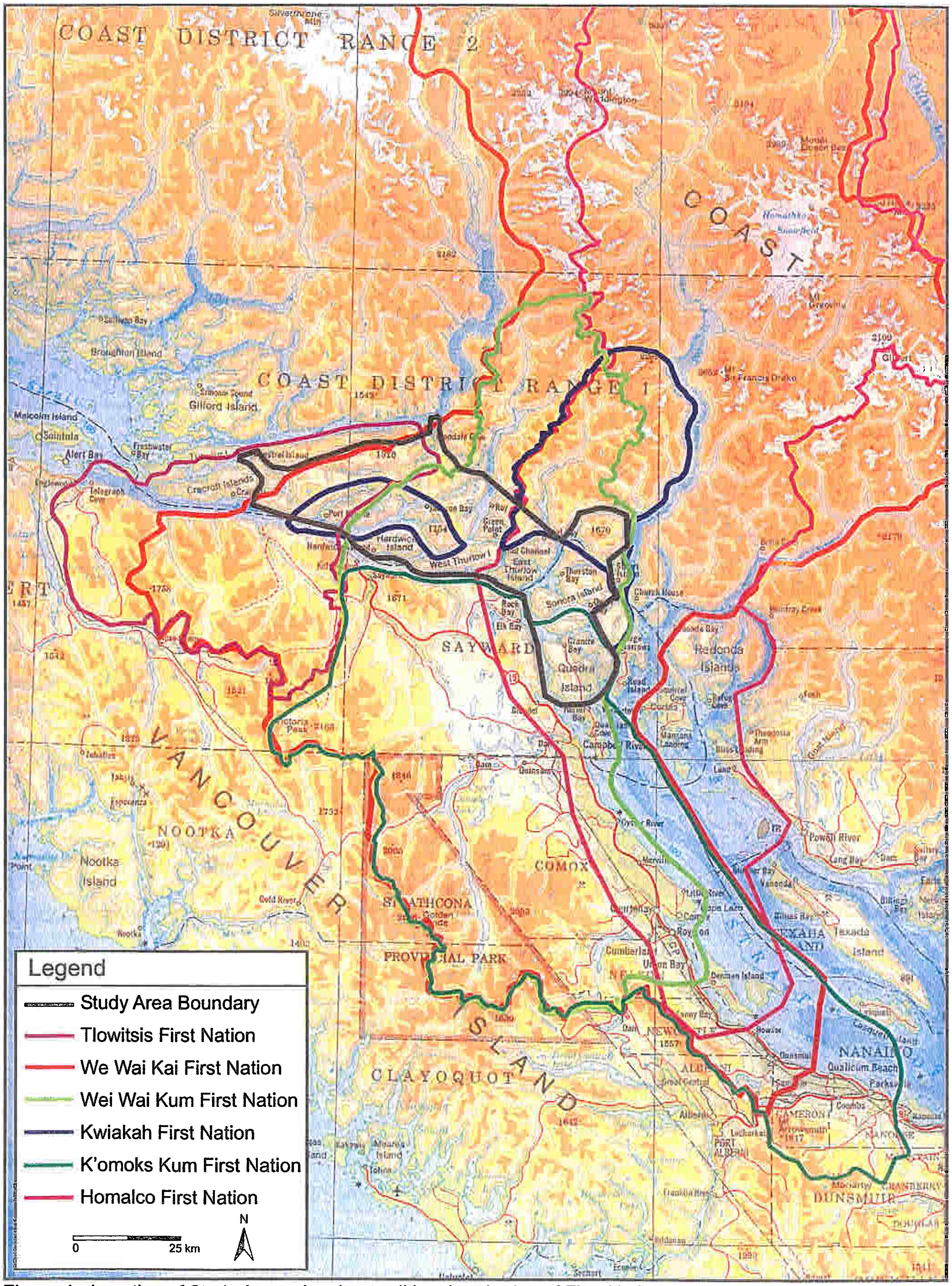

Figure 1. Location of Study Area, showing traditional territories of First Nations Communities (1:1,250,000).

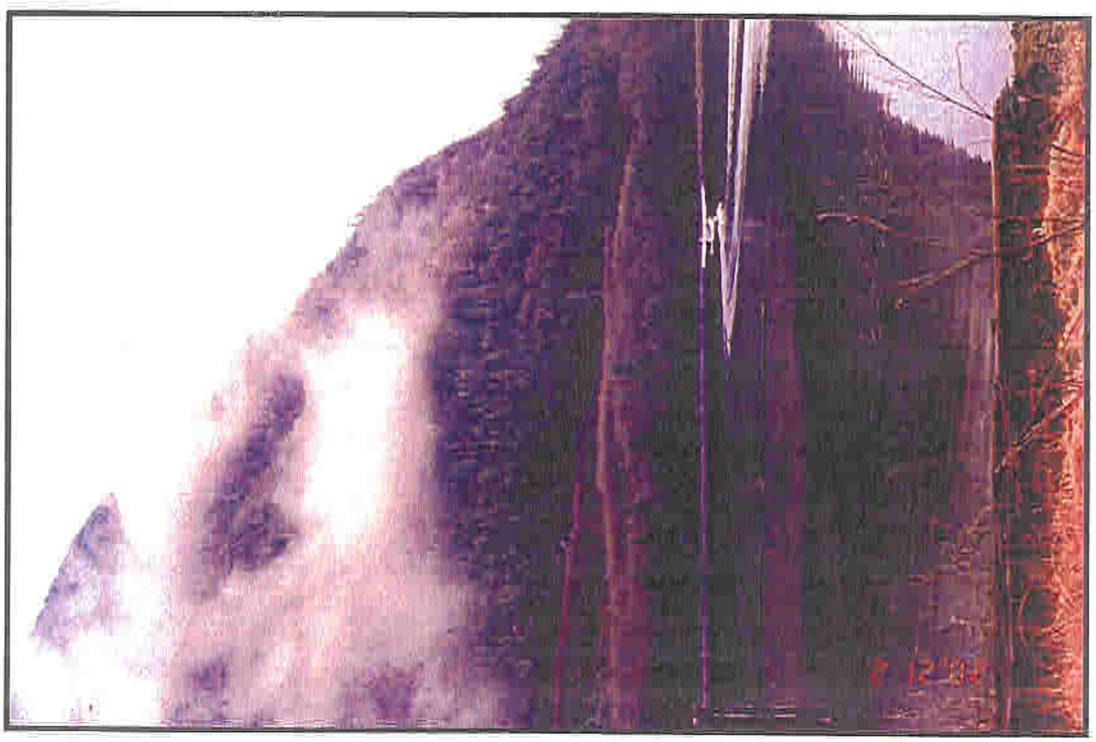

Figure 2. Jackson Bay (92K.051).

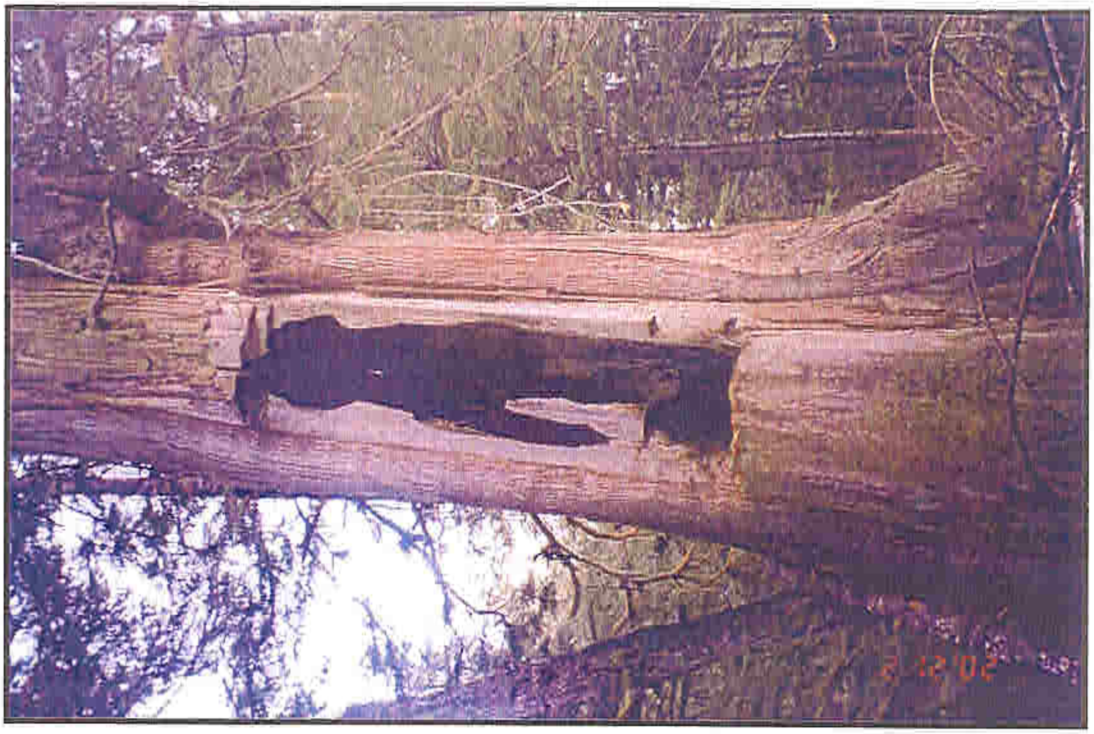

Figure 3. Standing Planked tree, Jackson Bay.

Figure 4. Owen Bay, Sonora Island (92K.034).

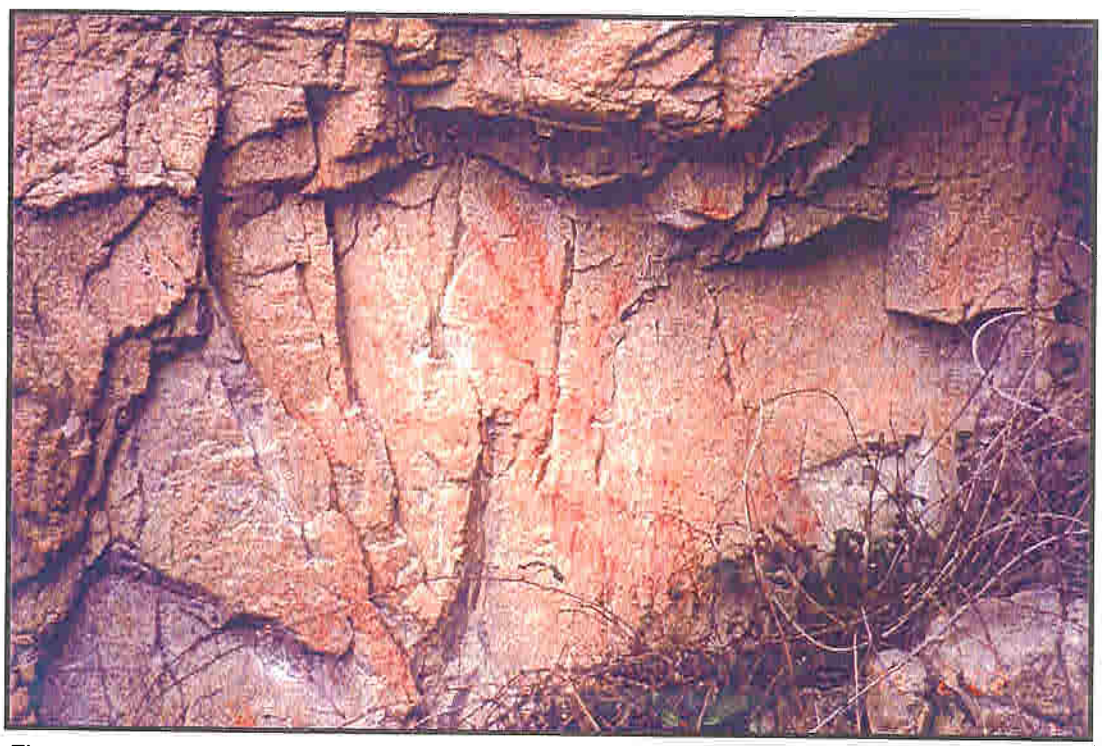

Figure 5. Pictograph site EcSi-006, Sonora Island.

2.0 ARCHAEOLOGICAL POTENTIAL MODELLING APPROACH

A **model** represents a simplified set of relationships or information about a more complex system such as the real world. In this case, the system we are attempting to understand is the First Nations use of the landscape. This overview does not try to create a model that predicts the location of archaeological sites. Modelling for archaeological sites is dependent on the distribution of known sites and the archaeological site inventory for the study area is inadequate for this type of modelling. Instead, this study uses a model that predicts **archaeological potential**, which is the capability of a landscape to support the types of traditional First Nations land use activities which would have resulted in the formation of archaeological sites comprised of physical cultural features.

A GIS was used in this study to describe and analyse the terrain of the study area, focusing specifically on landscape attributes associated with traditional activities. Information on these landscape attributes, initially derived from the GIS, was used to develop a model of archaeological potential for the overview area.

A GIS-based model brings a great deal of analytical power to the archaeological potential modelling process, but it restricts the user because of its ability to only utilize spatial information in digital form. GIS models can be negatively affected by limitations within map datasets, such as missing features or a lack of digital data for physical features that would be useful in the model.

Three sources of local knowledge data were incorporated into the model used in this overview, including: the ethnographic record, in-house field experience, and known archaeological site distribution.

The ethnographic record provided information concerning traditional activities and their resulting archaeological evidence. In some cases the ethnographic record was silent about certain traditional activities. We were able to address these data gaps and model for undocumented traditional activities because of in-house experience. There is little written information about the location of forest utilization sites, but because of the extensive field experience that Arcas personnel have had in the study area, we were able to attempt to create a model that predicts the potential for CMTs over the landscape. Another source of data for model building comes from the known archaeological sites recorded within the study area.

Of special significance to this overview was the creation of two models that are used together in order to predict the potential for archaeological resources over the landscape. One model focused on the potential for **culturally modified trees (CMTs)** on the landscape. A CMT can be defined as a tree that has been altered by First Nations people as part of their traditional use of the forest. The CMT model does not differentiate between prehistoric (pre-1846) and historic CMTs; the model predicts the archaeological potential for CMTs on the physical landscape and includes cedar trees greater than 80 years of age. It was reasoned while setting up the CMT model that it would be better to err on the side of caution than to ignore younger stands and possibly miss the scattered old growth stand that could have CMT potential thought to exist in the study area. This reasoning assumes that a forest utilization site often has a long time period through which the trees in the area are utilized.

Therefore, if an area was used 100 years ago, it was also more than likely used 200 years ago as well. A decision was also made to attempt to model for CMTs in second growth stands, something not previously attempted.

A second model was created to predict the potential for archaeological resources other than CMTs (non-CMT resources such as fishing stations and shellfish harvesting areas) and the potential for their presence on the landscape. Traditionally, this model type has been the major focus of overview projects, but it does not adequately capture areas with CMT potential. Both the CMT and non-CMT model are integral parts of the overall archaeological potential model.

In the preliminary stages of this study it was discussed and decided that an attempt would be made to model for both CMT and non-CMT potential using Terrestrial Ecosystem Mapping (TEM) which had been recently completed for the TFL Johnstone Strait Operation Area. TEM is an extremely powerful tool which acts as a digital record of the landscape and can include information about biogeoclimatic zone, physiography, surficial geology, bedrock geology, soil, and vegetation. This overview is the first attempt at using TEM data for the purpose of modelling for archaeological resource potential.

2.1 Assumptions and Constraints

The underlying assumption of the archaeological potential model is that all of the study area has potential for supporting traditional land use activities that would leave some physical evidence, but some areas have a lower probability for archaeological resources due to the number and degree of certain biophysical constraints that inhibited past use of an area. For the model to work, these constraints must be identified, and the effects of their presence or absence on archaeological potential must be considered.

Using a GIS modelling perspective, constraints are identified on the basis of physical landscape variables which can be classified into macro-features and micro-features.

- **Macro-features** are large-scale features easily identifiable on maps (digital or paper). Macro-features include: distance to water, major landforms, slope, aspect, climate, elevation, broad vegetation zones, and wildlife habitat.

- **Micro-features** are small-scale features identifiable from field inspections or examination of aerial photos; most mapping does not have the resolution to detect the presence or absence of these features. The presence or absence of micro-features modifies the level of constraints posed by macro-features. Micro-features include: specific aquatic characteristics, minor topographic features, ground terrain, specific vegetation, and specific habitat.

In order for the potential model to work, we must identify the specific biophysical variables associated with traditional activities and the types of archaeological resources resulting from such activities. This exercise is presented in a table format in Section 3.4. The effect that each variable has on either increasing or decreasing constraints on activities must then be identified. The more constraints that are imposed by biophysical variables at a particular place on the landscape, the less potential there is for the activities to occur there. Conversely, the fewer the constraints that are imposed, the greater potential there is for activities to occur.

2.2 Potential Classes

Various combinations of different macro and micro-features can create different levels of potential. Each level of potential may require different archaeological resource management actions. The two models created for this overview use slightly different approaches to potential which are discussed below.

Non-CMT Resource Potential

Three levels of potential are proposed for non-CMT archaeological resources:

- **Class 1 (High potential, Low constraint)**: This is the highest level of archaeological resource potential. The highest density of archaeological sites, and the greatest range in archaeological site types, is expected for this class. Few or no constraints on use of the landscape are presented by the macro-features. The micro-features are not expected to increase the level of constraints (decrease potential).

- **Class 2 (Moderate potential, Low constraint)**: A moderate-to-high site density and range of site types is expected. This level has some constraints presented by macro-features, but is expected to have areas where micro-features either increase or decrease the level of constraint.

- **Class 3 (Low potential, High constraint)**: A low density of sites and only a few site types is expected. This level has a high degree of constraints resulting from macro-features, and is not expected to have micro-features which decrease the level of constraint (which would increase the level of potential).

CMT Resource Potential

In terms of CMT potential the landscape was regarded as either having Low or Moderate-to-High potential. It was determined that if the most important macro-features (forest cover, slope, and distance to water) were within predefined parameters, there was Moderate-to-High potential for CMTs. A preliminary field reconnaissance (PFR) would help clarify whether or not the micro-features present would increase or decrease the level of constraint and the resulting level of potential.

2.3 GIS Mapping and Digital Data

This overview is spatially based, using elements of the landscape that can be described with geographical shapes such as points, lines, or areal shapes (polygons). These elements are predominantly biophysical in character, which is typical of most overview studies dedicated to modelling prehistoric land use. The geographic information used by a GIS must be in digital form, being derived from either existing sources or manually digitized. Once the information is entered into the computer, it is stored as discrete *layers* of data, sometimes referred to as *themes*, or, in the case of the software employed by this study (Arc/Info), as *coverages*. By recording the geographic locations of objects that can be summarised as points (x- and y- coordinates), lines (points linked in sequence), or enclosed areal shapes (polygons), and by allowing for complex manipulation of this data, a series of analysis functions becomes possible. Coverages can be displayed separately or brought together in new combinations. Questions can be asked about the relations between coverages. These functions progress from basic descriptive activities such as new map displays, to more interpretive actions where the data is presented in new combinations, and finally on to the prescriptive activities like spatial modelling, which produce new spatial information (Berry 1997).

The storage and manipulation of spatial information typically employs one or both of two GIS data management methods:

- **Vector:** the surface of the earth is segmented into a set of discrete unique areal shapes. Points, lines, and polygons are the units used to describe the landscape. An example of one of these discrete units would be a 100 m buffer around the lake feature that would form a discrete unit. Both the lake shape and the buffer shape subsequently make their own contribution to the model.

- **Raster (also known as Grid):** the coverages used to describe the landscape are systematically divided into square cells of a size deemed small enough to accurately represent the terrain. Each cell carries information from each coverage for that section of the landscape. Each resulting grid can be compared or merged with all other coverage grids used in the model.

2.4 Analysis and Modelling Capabilities of a GIS

With map-based input forming the foundation of a GIS, mapped output is a basic initial part of the analysis. Displays of individual variables at various scales and in combination with other elements within the system provide useful views of how well the data capture process has worked. A further step in display is when data in its raw form is *reclassified*. Slope, for example, can be grouped according to specified ranges. The relationship between variables can be explored, using *overlay* operations, where two separate coverages are allowed to intersect to provide new information. For example, a water coverage showing streams can be matched to a slope coverage to determine stream sections too steep to be included in the model. Various *distance* and *connectivity* measurements can also be made. In this overview, numerous distance measurements were made from the site locations to other landscape features. Finally, *adjacency* or *neighbourhood* analyses can be important in describing various features relationships to each other (Berry 1997).

Often these four operations represent the entire function of a GIS and are certainly at the core of its analytic capabilities. However, once the data has been updated and re-examined more complex spatial modelling operations are still possible. New areas can be described around various features using *buffering* operations, and once a series of areal or polygon shapes have been defined, score values can be attached to them. These scores can then be accumulated to provide a final modelled landscape that becomes an effective decision-making tool.

2.5 Review of Previous Modelling Attempts

Arcas, in the past, has been involved in a number of large-scale GIS-based archaeological overviews. Through time, these overviews have evolved from simple, coarse-scaled mapping projects to sophisticated, complex, and fine-scaled modelling studies. With this evolution, the overviews have increased greatly in accuracy and resolution.

The earliest GIS-based overviews were produced for the Land and Resource Management Plan (LRMP) process (Arcas 1994a) and the Commission on Resources and Environment (CORE) process (I.R. Wilson Consultants Ltd 1992). For the most part, these overviews simply mapped out archaeological potential by creating hand-drawn buffers around major aquatic features, modified by a few additional variables, which were subsequently digitized. They were largely mapping exercises that did not utilize the full capabilities of a GIS. Although useful from a general, regional-scale planning perspective, these LRMP overviews are inadequate for operational level planning. The mapping scale of 1:250,000 is inadequate for identifying many of the micro-features which influence archaeological potential.

The archaeological overview assessment for the Okanagan Timber Supply Area (Arcas 1997a) was a more sophisticated application of GIS mapping. It was completely digital and each variable considered in the model existed as a separate digital coverage layer. These digital coverages were not hand-digitized versions of the vaguely defined variables used in the LRMPs, but rather were based on real world digital mapping, which improved accuracy and resolution. For instance, environmental units were based on biogeoclimatic zones, which are more representative of actual conditions. Also, rivers and lakes were classified and buffered consistently using digital mapping, and slope was calculated from digital data.

Each coverage in the Okanagan AOA was assigned a numeric score or, in the case of buffers, a series of decreasing scores as distance from the feature increased. When the coverages were combined, new polygon shapes resulted and these were given the cumulative score from the contributing coverages. This is similar to the process used for the TFL overview. In the Okanagan case, however, the cumulative score was sufficient for assigning potential; it was not analysed for the presence or absence of particular coverages. The final potential class resulted from assigning ranges of values to the cumulative result (i.e., 0-3 = Low, 4-6 = Medium and so on). This approach resulted in a much more consistent assessment across the region as well as providing more flexibility in the choice and application of biophysical variables.

Despite the substantial improvement of the Okanagan overview relative to the LRMP overviews, a number of limitations have been identified. For example, the model was based largely on the distribution of known archaeological sites, and did not necessarily account for all site types. Well-surveyed lower elevation valley and lake areas were emphasized, and less consideration was given to mid and high elevation areas. Streams were classified on the basis of size alone, and did not account for fish values or environmental zones. Not all digital coverages were complete (i.e. forest cover, ungulate range) and not all biogeoclimatic zones were used.

The simple cumulative approach used in the Okanagan overview can misrepresent the relative potential of polygons. For example, an area with only a few variables present will receive a low score. These variables, however, may be sufficient to indicate fairly high potential for a certain type of activity that does not require a rich suite of biophysical elements to be present. A bark-gathering place, for example, would not require the more optimal, low constraint setting required by a major village site.

The GIS-based overviews (Arcas 1998a and 1998b), most recently conducted by Arcas, were designed to overcome many of the problems associated with the Okanagan overview. In the Nuu-chah-nulth overview, archaeological potential is determined **not** from a simple addition of scores from each of the variables (the cumulative method), but rather on the basis of a specific combination of variables (see Model Building, Review, and Application, Section 3.8). The result provides a more sophisticated assignment of potential and, in addition, it shows the variables which contributed to the potential assessment and the types of traditional activities that could have been carried out at that location.

Golder completed an AOA of the Central Coast LRMP Area in June 1999. Their report for that project was entitled "An Archaeological Overview Assessment of the Central Coast LRMP Area, Golder Associates, June 1999" (Golder 1999). While the AOA was conducted as a part of the LRMP process, the methodology employed by Golder was more sophisticated than earlier modelling attempts had been for LRMP overviews. The Golder AOA is a predictive model (see following discussion concerning predictive and inductive models) for a variety of different archaeological site types as defined by Golder. The study area for the Golder AOA encompasses almost 4.8 million hectares which is a huge area. By necessity, the Golder AOA was an overview focused on delineating areas of archaeological potential over large geographic areas of land. In order to implement such a model, the variables used tend to generalize and simplify the potential. As stated in the Golder report, "Applying predictive models across such a large and culturally diverse study area tends to mask the effects of cultural variability or archaeological site types and distribution" (Golder 1999: 962-1936). When the Golder AOA was incorporated into TFL's management process, it was ascertained that there were limitations to the model that needed to be addressed in order to better assist in the management of archaeological resources and archaeological resource potential within the Johnstone Strait Operation Area. It was proposed by TFL that Arcas create a new AOA that focused on the unique environment of the study area. To aid in creating a new model, TFL gave Arcas access to more accurate and specific environmental data that would aid in producing a more powerful model.

Previous models have been **inductive** in nature, in other words, the variables used to predict site locations have been largely determined on the basis of known site distributions. This approach is problematic in that it assumes that known site distributions and survey coverages are representative. Predictions based on these models are generally difficult to test. A **deductive** approach, on the other hand, is based on ethnographically-supported patterns of human behaviour. This means that not even a single site location needs to be known for a model to be built, although known site distribution is required to test the effectiveness of the model.

The Arcas overview uses **constraint** modelling. This type of modelling considers the variables which mitigate against (i.e. decrease) potential. For example, an unfavourable slope value can quickly assign large areas of land to the lowest potential. **Sensitivity analysis** is used to determine which variables are the most sensitive to altering the modelling outcome. Slope is a highly sensitive value, because changing the slope value by a small increment can lead to massive changes in the polygons, whereas changing the weight of the ungulate winter range will in most cases result in relatively minor changes to potential.

In summary, the modelling approach used in this study relied on the following assumptions:

- The existing level of archaeological survey in the study area is limited and unrepresentative; therefore, known archaeological site distribution alone is inadequate and unreliable for predicting archaeological potential;

- Ethnographic, historic, and contemporary sources documenting traditional use activities are relatively comprehensive;

- Traditional activities resulting in archaeological evidence may have taken place across the entire landscape; therefore, the entire landscape has archaeological potential;

- Various biophysical constraints decrease the diversity, intensity, and frequency of traditional activities, thereby reducing archaeological potential, while other favourable variables enhanced traditional use, thereby increasing archaeological potential;

- Major biophysical constraints and favourable variables can be identified using a GIS, while minor constraints and variables can only be identified through fieldwork; and

- Certain combinations of constraints and favourable variables are associated with specific traditional activities and archaeological site types.

3.0 AOA METHODOLOGY

3.1 First Nations Consultation

Arcas submitted a proposal in June 2000 which was accepted by TFL. The AOA unofficially began in April 2000 with a preliminary start-up meeting in Campbell River attended by Arcas and TFL to discuss the need for revisions to the recently completed Golder AOA.

An initial meeting was held in Campbell River at the Kwakiutl Laich-Kwil-Tach Nations Treaty Society (now called the Hamatla Treaty Society or HTS) on March 16th, 2001 in order to discuss the possibility of incorporating the Treaty Society's recently completed traditional use study with the AOA. The Treaty Society represents the K'omoks, Kwiakah, Tlowitis, Wei Wai Kai, and Wei Wai Kum First Nations. A second meeting was held at the TFL Forest LTD. Johnstone Strait Operation office and attended by representatives of the HTS, MoF Campbell River Forest District, and Arcas. A representative from the Homalco First Nation was unable to attend due to a scheduling conflict. Further meetings were conducted on January 31st and February 1st, 2002 and attended by various representatives of TFL, HTS, Homalco, and MoF. The meetings took place at Campbell River and Nanaimo.

The Da'naxda'xw Nation was contacted about the project and sent information concerning the project in March 2001. The band office was in the midst of moving and they were not able to respond back concerning the project until May 2001. At that point it was requested that further information concerning the project be sent and that a final definitive boundary of the study area also be sent in order for the band to assess whether the study area lay within their asserted traditional territory. The information requested was forwarded and no answer was forthcoming. An attempt was made in Feb 2002 to confirm that the appropriate information had been received and no further action was going to be taken by the band, but there has been no further communication at this point. In the northeast portion of the study area (TRIM map 92K/062) approximately one half of the TRIM map in this area suggests that there is overlap between the Tlowitis, HTS, and the Da'naxda'xw.

Besides the aforementioned meetings, there was frequent phone, email, and fax correspondence between Arcas and the aforementioned parties particularly concerning the use of TUS data and the groundtruthing component of the AOA.

3.2 Other Consultation

One section of the overview was subcontracted to another consultant. R&B was subcontracted to assist Arcas with the GIS-based modelling, digitize datasets, create map-database linkages, create and implement data set formatting, and produce digital and paper end map products. Doug Campbell (R&B president) provided his input and expertise concerning matters relating to GIS and GIS modelling throughout the project. R&B has a long history of working with Arcas on archaeological overview projects and it was anticipated that the partnership between Arcas and R&B would greatly benefit the project.

3.3 Background Research

Before developing a model of archaeological potential, it is essential to have an understanding of the natural and cultural context of the study area and its archaeological resources. The background component of this AOA involved a review of pertinent ethnographic, archaeological, and biophysical sources. This information was used to develop the model of archaeological potential that forms the basis of this study. Introductory statements about the ethnographic, archaeological, biophysical, and GIS-modelling information are presented in the remaining sections.

3.4 Ethnography

The ethnographic section is not an all-encompassing discourse on the First Nations people within whose traditional territory the study area resides. Early in the project the relevance of spending time and money on a detailed ethnographic literature review was discussed. Much has already been written about the various First Nations people and it was not the intent of this study to be an exhaustive review of previous work. It was hoped that a partnership between the HTS and Arcas could be formed in order to provide the overview with some of the TUS data compiled by the HTS for the study area, particularly information about village sites. A request was made by Arcas that such a partnership be formed, but the HTS declined the offer at this time, although it is hoped that there will be ongoing conversations between the HTS and TFL concerning the sharing of TUS and AOA digital data. A preliminary step was made towards creating a table (based on Galois 1994) but the information was not digitized as a part of this project.

The ethnographic research was conducted in order to determine the types and locations of traditional activities that would have left a physical record on the landscape of the study area. The sources used to obtain this information include: written documents recording observations of early Euro-Canadian visitors to the region, descriptions of aboriginal culture by anthropologists and other researchers, and the oral histories and traditions of the First Nations people within whose traditional territory the study area resides. These sources are important for understanding the traditional First Nations ways of life and they help to place the archaeological resources into a cultural and historical context.

3.4.1 First Nations Communities

The study area is situated within the asserted traditional territories of several First Nations, which are shown on Figure 1. The territorial boundaries are based upon maps obtained from the appropriate First Nations. The Kwakwaka'wakw communities (Mamilikulla, Tlowitsis, Wei Wai Kai, Wei Wai Kum, and Kwiahkah) all speak Kwak'wala, of the Wakashan language stock (Codere 1990). The K'omoks and Homalco groups speak Island and Mainland forms (respectively) of Comox, part of the Coast Salishan language stock (Kennedy and Bouchard 1990).

The superficial homogeneity of modern First Nations is somewhat illusory, due to a complex process of amalgamation that occurred in the early-Contact period and more recently as a result of government policies. For this reason, modern First Nations' communities represent a mix of formerly-independent tribes or groups, each with its respective history, hereditary chiefs, territories, and ancestral rights. Aboriginal land use is intrinsically linked to the constituent tribes, and the completeness of ethnographic information on land and sea use depends on how well the respective histories from component tribes are taken into account.

Both Kwakwaka'wakw and Coast Salishan-speaking groups believe that since time immemorial they are the original inhabitants of the Johnstone Strait region. The archaeological record signifies that the region has been occupied for at least 8000 years, and potentially longer (R.Carlson 1990; Mitchell 1989, 1990). Some archaeologists have asserted that the ancestors of Kwak'wala-speaking people migrated into the Johnstone Strait region from a homeland on the West Coast of Vancouver Island around 2500 BP (Mitchell 1988, 1989), though there are other ways of interpreting the evidence that Mitchell presents. What is clear, is that from the earliest times, the Aboriginal occupants of Johnstone Strait exhibited an intimate relationship with the coastal environment, and were expert hunters, fishers, and woodworkers. Their annual subsistence system was scheduled to exploit seasonal resources available on a sometimes fluctuating basis, including shellfish, herring, halibut, lingcod, salmon, dolphins and porpoises, seals and sea lions, deer and elk, berries, roots, medicinal plants, and cedar bark and timber.

3.4.2 Ethnographic Sources

The earliest reports by Europeans about Kwak'wala-speaking and Coast Salishan-speaking people appear in the late 18th century. These reports are dominated by the observations of Captain George Vancouver and his crew, who extensively explored the waters between Vancouver Island and the Mainland Coast in 1793 (Galois 1994).

Beginning in the late 19th century and continuing into the 1950s, a considerable amount of ethnographic fieldwork was conducted among several Kwakwaka'wakw communities. This work was pioneered by ethnographer Franz Boas, and continued by his students after WW2. Like many traditional ethnographic works, these early reports emphasize traditional lifeways prior to contact, because it was assumed that First Nations' cultures were disappearing and it was imperative to document them prior to their demise. Due in large part to the fact that Kwakwaka'wakw communities had had only minimal contact with European settlers, many aspects of their traditional social structure and ceremonial life still existed when Boas began his fieldwork in the 1880s. For this reason, the ethnographic literature for the Kwakwaka'wakw is the most extensive and comprehensive for any Northwest Coast First Nation. Compared to neighbouring regions, Johnstone Strait is well-served by ethno-geographic studies (e.g., Boas 1934; Galois 1994) that precisely record locations of traditional use sites where resources were (and continue to be) harvested and processed.

The ethnographies are an important source of information for this study because of the need to compile data about traditional Kwakwaka'wakw activities and the physical places where these activities took place. The reports of Franz Boas (1909, 1921, 1925, 1934) represent the most important "classic" ethnographic works for these people. Codere (1990) represents a modern summary of Kwakwaka'wakw ethnography, and the HTS have brought together a considerable amount of ethnographic information on their website at www.hamatla.com. Lastly, an ethno-geographic study of Vancouver Island, including the islands within Johnstone Strait, was prepared by Wilson, Bouchard and Kennedy (1992).

In comparison to the Kwak'wala-speaking groups, the Coast Salishan-speaking K'ómoks and Homalco have been less-intensively studied by ethnographers. The most important source for Coast Salishan groups was written by Homer Barnett (1955). Kennedy and Bouchard (1990) represent a more recent summary, and the ethno-geographic survey of Vancouver Island (Wilson, Bouchard and Kennedy 1992) also covers lands in Johnstone Strait.

3.4.3 Traditional Places

The major settlements of the Kwakwaka'wakw peoples are well reported in the ethnographic literature (esp. Galois 1994), but only limited information is available for K'ómoks and Homalco communities in the literature (Kennedy and Bouchard 1990).

Existing information collected on some places is likely incomplete and not representative of the First Nation communities. Although the ethnographies identify traditional activities, this information has been gathered from a limited number of individuals or families and is not comprehensive nor necessarily representative of the entire community.

Table 1 summarizes information about traditional places within the study area from those sources. The following is not an exhaustive list and should not be considered so.

Table 1. Traditional Places Reported in the AOA Study Area.

Affiliation	Place #[1]	Place Name	Type	Season	Size
Mamilikulla	No Mamilikulla traditional places are recorded within the TFL 47 study area according to Galois (1994)				
Tlowitsis	Mt1	*Etsekin* ['abalone on back']	Winter village	Winter	7 houses in 1885; 8 houses in 1887
	Mt3	Giltum *[no translation]*	Winter village	Winter	4 houses in 1887
	Mt4	*Hanatsa* [no translation]	Resource site w/buildings	?	Some "old houses in 1914
	Mt7	*Kakum* [no translation]	Resource site w/buildings	Summer	5 houses in 1914
	Mt8	*Keogh* [no translation]	Status uncertain	?	?
	Mt9	*Kikum* [no translation]	Resource site	Spring/ Summer/Fall	?

Affiliation	Place #[1]	Place Name	Type	Season	Size
	Mt11	*Kwatsas* ['bent']	Resource site - location uncertain	Spring?	?
	Mt14	*Mahmagalesala* [rocks standing separately on beach]	Resource site - location uncertain	Spring/ Summer	?
	Mt15	*Musas* ['salmon trap']	Resource site	Spring/ Summer	?
	Mt17	*Pawala* ['blowing sound']	Resource site	Spring	?
	Mt20	*œŭdzËâ´•lis* ['fort on flat on beach' or 'can see all sides']	Fort	?	?
	Mt21	*Zazawadalalis* [no translation]	Resource site	?	?
	Mt22	Site unnamed	Status uncertain - location uncertain	?	?
	Tt10	*Keogh* [same site as Mt8]	Resource site	Summer	?
	Tt16	*Wakidatsi* ['toad basket' or 'toad box']	Resource site; old village	Spring/ Summer	?
	Tt24	Site unnamed	Resource site w/buildings	?	?
Wei Wai Kai Wei Wai Kum Kwiahkah	Ha2	*Gwakdala* [no translation]	Resource site; old village	Winter?/ Spring	?
	Ha6	*Quatselees* [no translation]	Resource site - old village - location uncertain	Winter	?
	Ha9	Site unnamed	Status uncertain	?	?
	Kn2	*Homayno* [no translation]	Status uncertain	?	?
	Kn4	*Pakaiyouk* [no translation]	Status uncertain	?	?
	Kn5	*Samama* [no translation]	Status uncertain	?	?
	Kn9	Site unnamed	Status uncertain	?	?
	Ku1	*Hahum* [no translation]	Status uncertain	?	?
	Ku4	*Matltun* [no translation]	Winter village	Winter	?
	Ku6	*Tatapowis* [no translation]	Resource site	Summer?	?
	Ku7	*Tekya* [same site as Wy18]	Status uncertain	?	
	Ku9/Tl3	*Tsaiiyeuk* ['run on rock village']	Winter village	Winter/ Summer	3 houses in 1885; 2 house in 1888
	Ku11	*œŭdzËdzâ´•lis* ['fort on flat on beach']	Status uncertain	?	

Affiliation	Place #[1]	Place Name	Type	Season	Size
	Wm1	*Gáýat* [no translation]	Old village - location uncertain	?	
	Wm2	*Homayno* [no translation]	Resource site; old village - location uncertain	Winter?	2 buildings in 1888
	Wm5	*Matltun* ['calm point']	Winter village	Winter	6 houses in 1888; 1 house in 1902
	Wm6	*Ogwiltoia* [no translation]*]*	Resource site; old village	Summer	
	Wm7	*Pakaiyouk* [no translation]	Winter village	Fall/ Winter	
	Wm9	*Samama* ['place where there are mussels']	Resource site; old village	Summer	
	Wm12	*Tekya* [no translation]	Status uncertain	?	
	Wm18	Site unnamed	Status uncertain	?	
	Wy9	*Kanis* [no translation]	Winter village	Winter	
	Wy10	*ˆax°ayºm* ['place of dog salmon']	Resource site w/old buildings	Winter	2 houses in 1914
	Wy11	*mºd*^{z}*ek°amin* [no translation]	Resource site	Summer?	?
	Wy12	*qaØicºn* [no translation]	Resource site	Winter?	?
	Wy16	*t'agi* [no translation]	Resource site	Summer?	?
	Wy18	*Tekya* ['mud' or 'soil, dirt, earth']	Winter village; possible fort	Winter	?
	Wy22	*Yakwen* [no translation]	Resource site w/old buildings	Summer; Winter?	3 houses in 1888
	Wy23	Site unnamed	Status uncertain	?	?
K'ómoks	2	*qáøis* [translation unknown - same site as Wy9]	Village	?	?
	3	*gáýal* [no translation]	Village	?	?
	4	*gá•giðn* ['bent over back']	Village	?	?
Homalco	13	*mú·šqin* [no translation]	Village	?	?
	16	*¿á¿pu•us* ['goes dry a little bit on the face side]	Village	?	?

[1] Reference numbers cited in Galois (1994) or Kennedy and Bouchard (1990).

3.4.4 Traditional Activities/Material Culture

The purpose of this overview is to predict archaeological resource potential within the traditional territories present in the study area using a model developed specifically for the study area. Past models made predictions about archaeological site locations dependent upon known site distribution and survey coverage. This method of prediction is somewhat flawed because it is dependent on the assumption that where people have surveyed is representative of the entire physical landscape, which is often not the case.

This model attempts to 'deduce' (also known as deductive modelling) the potential for archaeological sites based on ethnographically-supported patterns of human behaviour and how that behaviour was constrained by the landscape. In order for the model to work, it is necessary to know about the cultural landscape inhabited by past people. This was done by gathering data about past activities known to have taken place within the study area. Once the data had been gathered, a table was created which included known traditional activities, the specific kinds of archaeological evidence that might be found, the types of archaeological sites expected from such activities, the physical location of the activities, the biophysical variables present at the location, and the digital coverages required for modelling the variables. Table 2 attempts to bring together the ethnographic data gathered in order to produce the model. This data was assembled in a table format, which is more visual and provides a better idea of how a particular traditional activity can be expressed in the archaeological record.

The model relies heavily on documented information about past traditional activities. Future opportunities for additional TUS data which could come from the work already completed by the HTS would be beneficial. As previously mentioned, there is very little written information about the use of inland areas of the study area, but due to the presence of CMTs in the overview area, we were able to attempt to create a CMT model for predicting the potential for the presence of forest utilization sites that is not dependent on the written sources.

3.4.5 Trails Research

Aboriginal trails were/are used by First Nation peoples as trade and communication routes, or to provide access to resource locations for hunting, fishing, plant collecting, procurement of lithic materials, and so on. They are an important variable in the development of an archaeological potential model, since many activities that could potentially leave material remains are expected to occur along trail corridors. It is suspected that most trail routes should be distinguished by linear concentrations of sites along their routes; by extension, such linear concentrations of sites might represent ancient travel corridors for which no physical or documentary evidence now exists.

Aboriginal trails can be identified through historic maps and archival sources, and through community-based research involving discussions with elders and other community members. In the project proposal it was acknowledged that one of the existing data gaps to be addressed was the lack of information available about aboriginal trail locations. Some trails research was conducted through the Golder AOA, but it was discovered that only two known trails were documented in the study area and in the future it would be useful to conduct a Trails research project in conjunction with the Homalco and HTS.

3.5 Archaeology

As previously mentioned in Section 1.1, an archaeological site is a location that contains physical evidence of past human activity, and which can be studied by archaeological methods of investigation, including site survey, excavation, and data analysis. In British Columbia, most archaeological sites are attributable to pre-Contact settlement and land use by First Nations people, though locations of Euro-Canadian or Asian-Canadian settlement pre-dating 1940 are recorded as historic archaeological sites in some circumstances. Records of archaeological sites in British Columbia are maintained by the Archaeology & Recreation Inventory Section (Archaeology and Forests Branch, Ministry of Sustainable Resource Management).

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
Forest Utilization – western redcedar	Culturally modified tree	CMT – bark-strip, CMT – logged feature	Straight, old redcedar stands accessible from shore, water courses, lakes, and trails. Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Forest stand type -Distance from shore -Distance from water courses -Elevation -Slope	-Forest cover -TRIM -DEM
	Special artifact type (wood working tools)	Artifact Scatter, Midden, Wetsite			
	Special artifact type (baskets, etc.)	Artifact Scatter, Midden, Wetsite			
	Transitory camps	Artifact Scatter, Midden, Wetsite			
Forest utilization – yellow cedar	Culturally modified tree	CMT – bark-strip, CMT – logged feature	Straight, old yellow cedar stands accessible from shore, water courses, lakes, and trails. Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Forest stand type -Distance from shore -Distance from water courses -Elevation -Slope	-Forest cover -TRIM -DEM
	Special artifact type (wood working tools)	Artifact Scatter, Midden, Wetsite			
	Special artifact type (baskets etc.)	Artifact Scatter, Midden, Wetsite			
	Transitory camp	Artifact Scatter, Midden, Wetsite			
Gathering – medicinal plants	Transitory camp	Artifact scatter	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Slope -Proximity to potable water supply -Proximity to shellfish resources -Presence of slow-moving/still water -Presence of anaerobic subsurface environment	-TRIM -DEM
		Midden			
		Wetsite			
	Botanical remains	Midden	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Slope -Proximity to shellfish resources -Proximity to potable water supply -Presence of slow-moving/still water -Presence of anaerobic subsurface environment	
		Wetsite			
	Trail	Trail	As mapped	-Proximity to non-navigable water -Presence of montane passes and/or drainage divides -Absence of natural barriers to movement	
Gathering – food plants	Transitory camp	Artifact Scatter	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow	-Slope -Proximity to potable water supply -Presence of slow-moving/still water -Presence of fine-textured sediments	-TRIM
		Midden			

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
		Wetsite	moving water, fine-textured sediments, and anaerobic subsurface environment.	-Presence of anaerobic subsurface environment	
	Trail	Trail	As mapped	-Proximity to non-navigable water -Presence of montane passes and/or drainage divides -Absence of natural barriers to movement	
	Botanical remains	Midden Wetsite	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Slope -Proximity to potable water supply -Presence of slow-moving/still water -Presence of fine-textured sediments -Presence of anaerobic subsurface environment	
Gathering - technology	Transitory camp	Artifact Scatter Midden Wetsite	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Slope -Proximity to potable water supply -Proximity to shellfish resources -Presence of slow-moving/still water -Presence of anaerobic subsurface environment	-TRIM
	Trail	Trail	As mapped	-Proximity to non-navigable water -Presence of montane passes and/or drainage divides -Absence of natural barriers to movement	
	Botanical remains	Midden Wetsite	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Slope -Proximity to potable water supply -Proximity to fish stream/river -Proximity to shellfish resources -Presence of slow-moving/still water -Presence of fine-textured sediments -Presence of anaerobic subsurface environment	
Gathering - eggs	Faunal remains	Midden	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to	-Relatively level terrain -Proximity to potable water supply -Presence of fish stream/river	-TRIM

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
			food sources.		
Gardening	Rock feature	Petroform	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of traditional plant resources.	-Alpine/subalpine parkland settings -Proximity to mineral exposures used as animal-licks -Proximity to game trails/migration routes -Proximity to montane passes/drainage divides -Presence of traditional plant resources	-TRIM
		Artifact Scatter		-Presence of level terrain -Well drained subsurface sediments -Proximity to potable water -Proximity to fish stream/river	
	Transitory camp	Artifact Scatter	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources.	-Presence of level terrain -Proximity to potable water -Proximity to fish stream/river	
	Canoe run	Canoe Run	Presence of shingle/cobble/boulder beaches, proximity of traditional resources.	-Presence of shingle/cobble/boulder beaches -Proximity of traditional resources	
Fishing - salmon	Fish weir	Fish Weir	On mud, silt, or gravel tidal flats at the mouth of salmon streams; on lower reaches of salmon streams.	-Presence of creek with salmon run -Mud/silt/gravel beach	-TRIM -Marine chart
	Fish trap	Fish Trap	On flat beaches	-Presence of beach	-TRIM
	Trail	Trail	Along salmon streams/rivers; on or near shores of lakes containing salmon.	-Proximity to non-navigable waterways -Presence of montane passes and/or drainage divides	-TRIM -DEM
	Transitory camp, seasonal base camp	Artifact Scatter, Midden, Wetsite	On stream exiting from lake and connected to coastline.	-Presence of creek with salmon run -Presence of lake -Slope	-TRIM -DEM
			On or near shores of lake containing salmon.	-Presence of lake -Slope	
			On flat land near the lower reaches or mouth of salmon streams.	-Presence of creek with salmon run -Slope	
Fishing - eulachon	Seasonal base camp, transitory camp	Artifact Scatter, Midden, Wetsite	On flat beaches	-Presence of beach	-TRIM

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
	Fish weir	Fish Weir			
	Fish trap	Fish Trap			
	Trail	Trail			
Fishing- deep water	Transitory camp	Artifact scatter, Midden, Wetsite	On flat beaches	-Presence of level terrain -Proximity to potable water supply -Proximity to fish stream/river -Presence of slow-moving/still water -Presence of anaerobic subsurface environment	-TRIM
	Special artifact type (halibut hook)	Artifact Scatter, Midden, Wetsite			
	Faunal remains	Midden, Wetsite			
Fishing – inshore	Transitory camp	Artifact Scatter, Midden, Wetsite	On flat beaches	-Slope -Proximity to potable water supply -Proximity to fish stream/river -Presence of slow-moving/still water -Presence of fine-textured sediments -Presence of anaerobic subsurface environment	-TRIM -DEM -Marine chart
	Fish trap	Fish Trap		-Proximity to water -Presence of gently sloping foreshore -Presence of shingle/cobble beach	
	Fish weir	Fish Weir		-Major watercourse -Low stream gradient -Stream bottom characteristics	
Fishing – herring	Special artifact type (herring rake)	Midden, Wetsite	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of traditional plant resources. Presence of slow moving water, fine-textured sediments, and anaerobic subsurface environment.	-Slope -Proximity to potable water supply	-TRIM -DEM -Marine chart
	Faunal remains				
Fishing – fresh water	Transitory camp	Artifact Scatter, Midden, Wetsite	Low stream gradient; stream bottom characteristics; on or near shores of lake containing fish; on or near fish bearing streams/rivers.	-Slope -Well drained subsurface sediments -Proximity to potable water -Proximity to fish stream/river -Proximity to shellfish resources -Presence of slow-moving/still water -Presence of fine-textured sediments -Presence of anaerobic subsurface environment	-TRIM -DEM
	Fish weir	Fish Weir		-Major watercourse -Low stream gradient -Stream bottom characteristics	

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
	Trail	Trail		-Proximity to non-navigable waterways -Presence of montane passes and/or drainage divides	
	Special artifact type (canoe)	Artifact Scatter		-Presence of level terrain -Well drained subsurface sediments -Proximity to potable water -Proximity to fish stream/river	
Gathering – shellfish (mussel, barnacle, abalone, sea urchin)	Faunal remains	Midden, Wetsite	On flat land adjacent to tidal flats.	-Presence of level terrain -Proximity to potable water -Proximity to fish stream/river -Proximity to shellfish resources -Presence of slow-moving/still water -Presence of fine-textured sediments -Presence of anaerobic subsurface environment	-TRIM -DEM
	Special artifact type (basket)	Midden			
Gathering – shellfish (clams, cockles, scallops)	Faunal remains	Midden, Wetsite			
Hunting - bears	Large dead fall trap consisting of logs and rocks	Artifact Scatter	On flat land near salmon streams.	-Presence of salmon streams -Slope	-TRIM -DEM
	Transitory camp, rockshelter	Artifact Scatter, Petroform			-TRIM -DEM
	Trail	Trail	As mapped	-Proximity to non-navigable waterways -Presence of montane passes and/or drainage divides	-TRIM -DEM
Hunting - furbearers	Transitory camp	Artifact Scatter	Granitic bedrock exposures in alpine parkland.	-Granitic bedrock -Presence of alpine parkland	-Bedrock geology -Biogeo climatic zones
	rockshelter	Petroform			
	Trap feature	Artifact Scatter			
	Trail	Trail			
Hunting- elk and deer	Transitory camp	Artifact Scatter	On flat land near streams and lakes; on flat land along migratory corridors; on flat land in ungulate (deer, elk) habitat.	-Presence of lakes -Slope -Presence of streams	-TRIM -Biogeoclimatic zones -DEM -Ungulate (deer, elk) habitat
	rockshelter	Petroform			
	Trail	Trail			
	Trap feature	Artifact Scatter			
Hunting - goats	Transitory camp	Artifact Scatter	On flat land near streams and lakes; on flat land along migratory corridors; on flat land in ungulate (goat) habitat; granitic bedrock exposures in alpine parkland.	-Presence of lakes -Slope -Presence of streams -Granitic bedrock -Presence of alpine parkland	-TRIM -Biogeoclimatic zones -DEM -Ungulate (goat) habitat
	Rockshelter	Petroform			
	Hunting blind	Artifact Scatter			
	Trail	Trail			
Hunting - waterfowl	Transitory camp	Artifact Scatter, Midden, Wetsite	On or near shores of lakes, marshes, streams, and rivers.	-Presence of lakes -Slope -Proximity to fish stream/river	-TRIM -DEM
	Special artifact type (netweight)				

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
	Faunal remains	Midden, Wetsite			
Hunting – cetaceans (dolphin, porpoise)	Special artifact type (harpoon) Faunal remains Transitory camp	Artifact Scatter, Midden, Wetsite	On flat beaches; near villages.	-Slope -Proximity to potable water supply -Proximity to fish stream/river	-TRIM -DEM
Hunting – pinnepeds (seal, sea lion, fur seal)	Special artifact type (harpoon) Faunal remains Transitory camp	Artifact Scatter, Midden, Wetsite	On flat beaches, near villages.	-Slope -Distance from shore -Presence of beach	-TRIM -DEM
Transportation	Trail	Trail	As mapped. Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources. Presence of sheltered rock bluffs, near tidewater, and presence of prominent boulders along shoreline. Presence of shingle beaches and proximity to traditional resources.	-Presence of lakes -Slope -Presence of streams -Proximity to non-navigable waterways -Presence of montane passes and/or drainage divides	-TRIM -DEM
	Transitory camp	Artifact Scatter			
	Pictograph. Petroglyph	Rock Art			
	Canoe run	Canoe Run			
Habitation - village	House depression/line Midden	Artifact Scatter, Midden	On level sheltered land adjacent to tidal flats (beaches) in upper reaches of inlets and coves.	-Slope -Distance from shore -Presence of beach	-TRIM -DEM
	Canoe run	Canoe Run			
	Pole (house, mortuary, welcome)	Artifact Scatter			
	Pictograph, petroglyph	Rock Art			
	Trail	Trail			
	Wells	Artifact Scatter			
Habitation - defence	Trench embankment	Artifact Scatter, Midden, Earthworks	On small islands with steep cliffs or on narrow headlands with steep sides; close to villages.	-Presence of villages -Presence of narrow headlands -Presence of offshore islands with steep bluffs	-TRIM -Villages -DEM or hand polygon
Lithic procurement	Lithic workshop Transitory camp, rockshelter Special raw material	Artifact Scatter, Midden, Quarry	Relatively level terrain, well-drained subsurface sediments, proximity to potable water supply and proximity to food sources.	-Exposures of desirable lithic raw materials -Accumulations of the same materials in alluvial/colluvial settings -Slope -Proximity to potable water supply -Elevation	-TRIM -DEM

Table 2. Traditional Use Table

Traditional Activity	Resulting Archaeological Evidence	Archaeological Site Type in Overview	Location of Site	Modelling Variables (Macro Features)	Digital Coverage
	Trail	Trail			
Spirituality	Rock art	Rock Art	Near the ocean on steep cliffs near burial caves.	-Slope Proximity to water or caves	_TRIM -DEM
	Rockshelter	Petroform			
	Special artifact cache	Artifact Scatter			
Mortuary practices	Burial, ground/midden	Human Remains	At villages or camps	-Slope -Proximity to potable water supply -Proximity to shellfish resources -Proximity to fish stream -Distance from shore -Presence of village or camp	-TRIM -Forest cover -Villages
	Burial, tree		In spruce trees near the ocean, near villages; in spruce trees on islets near villages.	-Forest stand type -Distance from shore -Presence of islets -Distance from villages	
	Burial, bent box		Near villages or water or in caves.	-Distance from villages -Distance from shore	
	Burial, rockshelter		In rock shelters, caves, and crevices close to shore and villages.	-Distance from shore -Presence of rock bluffs -Distance from villages	

Documented archaeological sites contribute predictive power to the archaeological potential model because the presence of a site signifies that the surrounding landscape had the ability to support the types of traditional land use that resulted in the formation of archaeological resources. Thus, the existence of one site in a particular setting would tend to support an assertion that additional, as-yet undiscovered sites may also exist nearby, or in other settings with similar biophysical features and constraints.

The archaeology of the study area is not well known when compared to other parts of the province. The study area becomes less known archaeologically as one travels north. Only one major excavation has taken place within the study area, and only portions of the study area have been systematically surveyed.

Canadian archaeological sites are numbered according to the Borden Site Designation system (Borden 1952). This scheme is based on the maps of the National Topographic System and uses latitude and longitude to pinpoint the location of a site. The four alternating upper and lower case letters (e.g., EeSk) designate a unique block measuring 10 minutes of latitude by 10 minutes of longitude. Sites are numbered sequentially within a block, based (usually) on their date of discovery; therefore, EeSk-001 would be the first site recorded in block "EeSk".

3.5.1 Review Of Archaeological Sources

Recent overview studies prepared by Wilson, Bouchard and Kennedy (1992) and Golder Associates (1999) summarize the history of archaeological research in the Johnstone Strait region, and evaluate the present state of the regional site inventory. This information need not be repeated in this report.

A general account of pre-Contact archaeology throughout British Columbia was prepared by Knut Fladmark (1986), while Ames and Maschner (1999) focus exclusively upon tbe Northwest Coast. Matson and Coupland (1995), R. Carlson (1990), and Mitchell (1990) represent more scholarly works on Northwest Coast prehistory. Mitchell (1969a, 1981, 1988, 1989) has written several reports on the results of archaeological investigations specific in the Johnstone Strait and Queen Charlotte Strait regions.

In recent years, there has been a greater emphasis on the identification of inland archaeological sites and on the recording of forest utilization sites comprised of CMTs (Figure 3). This is in part a direct result of the implementation of Section 51 of the *Forest Practices Code* (1995) requiring archaeological assessments of proposed forestry developments. Forestry related surveys in the vicinity of Johnstone Straits have been conducted for a variety of proposed forestry developments. The vast amount of this work has been completed as a component of archaeological impact assessments (AIAs) and, while the number of AIAs has increased substantially within the study area since 1994 (e.g., Simonsen 1988a, 1988b; Wilson 1989a, 1989b; Millennia Research 1990; Arcas Consulting Archeologists 1994, 1995), it is insignificant in comparison to some other regions of the province. However, the context within which modern AIAs are being done (that is, the coastal rain forest) is significant because in the past most survey work on the coast took place within 200 m of the shoreline. Moving inland has greatly added to our knowledge of past traditional activities away from the water or the shoreline.

3.5.2 Regional Archaeological History

The Johnstone Strait region is within the Northwest Coast Culture Area, as defined by archaeologists and anthropologists (Mitchell 1990; Matson and Coupland 1995). In comparison with the neighbouring Strait of Georgia region, only a sketchy record of pre-Contact settlement and occupancy has been established for Johnstone Strait. What is known of the prehistory of this region has resulted from major investigations and small-scale test-excavations at a number of sites. Significant archaeological excavations have taken place at the following locations:

- Fort Rupert (EeSu-001) in Beaver Harbour, excavated by Katherine Capes (National Museum of Canada) in 1960 (Capes 1964);
- the O'Connor Site (EeSu-005) at Port Hardy, excavated by Margo Chapman (Simon Fraser University) in 1971 and 1973 (Chapman 1972, 1982);
- the Rebecca Spit Earthworks (EaSh-006) on Quadra Island, excavated by Don Mitchell (University of Victoria) in 1966 (Mitchell 1969b);
- Hopetown Village (EfSq-002) on Watson Island near Kingcome Inlet, excavated by Don Mitchell in 1974 and 1976 (Mitchell 1979);
- Bear Cove (EeSu-008) in Hardy Bay, excavated by Catherine Carlson (Archaeological Sites Advisory Board) in 1978 (C. Carlson 1979);
- the Sondrup Site (EeSu-039) at Port Hardy, excavated by John Somogyi-Csimazia (Port Hardy Museum) in 1988 (Somogyi-Csimazia 1990); and
- the Glenlion River Site (EeSu-013) near Port Hardy, excavated by Brad Smart (I.R. Wilson Consultants) in 1992 (I.R. Wilson Consultants 1993).

Less intensive test-excavations of archaeological sites has also been carried out at the following locations in this region:

- Eight sites (EiSo-001, EeSo-014 and -019, EeSp-012, -017, -048, -066, and -095) on the Retreat Passage shore of Gilford Island, on Baker Island, and in Fife Sound, all tested by Don Mitchell in 1974 (Mitchell 1981);
- Cheslakee Village or *xwalkw* (EdSr-012) near the mouth of the Nimpkish River, tested by Geordie Howe (Provenance Research) in 1982 (Ham and Howe 1983); and
- Betty Cove (EeSq-001) on Bonwick Island, by Ian Wilson (I.R.Wilson Consultants) in 1989 (Wilson 1989b).

The cultural chronology established by Mitchell (1990) for this region is based on the results of these investigations and others in neighbouring areas, and in particular, on the radiocarbon age estimates for these sites reported by archaeologists. Table 3 summarizes the radiocarbon dates reported for sites within the Johnstone Strait region, including those on northern Vancouver Island and other locations outside of the study area.

Table 3. Radiocarbon Dates for Archaeological Sites in the Johnstone Strait Region[1].

Site #	Site Name	Normalized Age[2]	Laboratory #
EdSn-010	--	1900 ± 90 BP	GaK-2088
EdSn-026	--	3570 ± 100 BP	GaK-2089
EdSn-027	--	1750 ± 90 BP	GaK-2090
EdSn-035	--	6250 ± 110 BP	GaK-2091
EdSo-014	--	1050 ± 80 BP	GaK-2092
EdSo-018	--	4490 ± 100 BP	GaK-2093
EdSo-022	--	3640 ± 100 BP	GaK-2094
EdSo-034	--	4860 ± 100 BP	GaK-2095
EdSo-037	--	1130 ± 80 BP	GaK-2096
EdSp-006	--	770 ± 140 BP	GaK-2097
EdSp-009	--	1170 ± 90 BP	GaK-2098
EdSp-011	--	1470 ± 90 BP	GaK-2099
EdSp-022	--	1610 ± 80 BP	GaK-2100
EdSp-033	--	1140 ± 60 BP	GaK-2101
EeSq-001	Betty Cove	1180 ± 120 BP	AECV-887
EeSq-001	Betty Cove	1360 ± 100 BP	AECV-888
EeSq-001	Betty Cove	1640 ± 90 BP	AECV-889
EeSu-001	Fort Rupert	5275 ± 110 BP	S-145
EeSu-005	O'Connor	2540 ± 150 BP	GaK-3901
EeSu-005	O'Connor	2690 ± 90 BP	GaK-4918
EeSu-005	O'Connor	2900 ± 90 BP	GaK-4917
EeSu-008	Bear Cove	4180 ± 90 BP	WSU-2140

Site #	Site Name	Normalized Age[2]	Laboratory #
EeSu-008	Bear Cove	4360 ± 90 BP	WSU-2138
EeSu-008	Bear Cove	8020 ± 110 BP	WSU-2141
EeSu-013	Glenlion River	2760 ± 70 BP	AECV-1678 Cc[3]
EeSu-013	Glenlion River	3480 ± 80 BP	AECV-1671 C[3]
EeSu-013	Glenlion River	3640 ± 80 BP	AECV-1672 C[3]
EeSu-013	Glenlion River	3670 ± 80 BP	AECV-1674 Cc[3]
EeSu-013	Glenlion River	3890 ± 80 BP	AECV-1673 C[3]
EfSq-002	Hopetown	1610 ± 130 BP	GaK-7345
EfSq-002	Hopetown	2370 ±100 BP	GaK-7346
EfSq-002	Hopetown	2470 ± 120 BP	GaK-7344

[1] From *Canadian Archaeological Radiocarbon Database* (Archaeological Survey of Canada n.d.).
[2] Radiocarbon dates are expressed as years Before Present, where "present" = AD 1950.
[3] The dates from EeSu-013 are not normalized, and so are actually slightly older than indicated.

Mitchell (1988, 1990; Matson and Coupland 1995) has developed a simple cultural sequence for the Johnstone Strait region, and the pertinent details of this sequence are summarized below in Table 4. Mitchell (1989) has asserted that the later part of this sequence reflects an initial occupation of the region by a Salishan-speaking population which was displaced to the south and north by expansion of people from the west coast and northern part of Vancouver Island, who became the Kwakwaka'wakw. In many ways, Mitchell's cultural-replacement model is echoed by the southerly displacement of the Salish-speaking K'ómoks communities by Laich-Kwil-Tach people in the 18th and 19th centuries.

Table 4. Cultural Sequence for the Johnstone Strait Region[1].

Culture Type	Date Range	Representative Sites	Diagnostic Artifacts
Queen Charlotte	2500 BP - Contact	Betty Cove (EeSq-001); O'Connor (EeSu-005); Hopetown (EfSq-002);	Flat-topped hand mauls Stone discs Hammerstones Irregular & shaped abrader stones Ground stone celts Unilaterally barbed bone points Unilaterally barbed, non-toggling bone harpoons Bone composite toggling harpoon valves Bone bipoints and singlepoints Bone splinter awls Ulna tools Whalebone bark beaters

Culture Type	Date Range	Representative Sites	Diagnostic Artifacts
			Bone spindle whorls Bone blanket or hair pins Sea mussel shell celts and knives
Obsidian	5000 - 2500 BP	Echo Bay (EeSo-001); O'Connor; Bear Cove (EeSu-008); Hopetown	Leaf-shaped flaked stone points Few formed flake tools, but obsidian microflakes are abundant Hammerstones Irregular abrader stones Bone composite toggling harpoon valves Bone bipoints and singlepoints Ulna tools Mussel shell celts and knives
Old Cordilleran; Pebble Tool Tradition[2]	>5000 BP	EdSn-035; Fort Rupert (EeSu-001); Bear Cove	Flaked pebble and cobble tools Leaf shaped flaked stone points

1 Adapted from Mitchell (1988, 1990)
2 Pebble Tool Tradition as defined by R. Carlson (1990).

3.5.3 Site Typology

The Archaeology and Forests Branch has created a site typology that must be used to describe sites when first recorded and submitted to the Branch for documentation and inclusion in the Archaeological Sites Registry. The Branch's site typology is the starting point for this overview study, but a revised site typology was created in order to customize the data for the modelling purposes exclusive to this project. This overview focuses on prehistoric archaeological sites, but **historic sites** have also been documented in the study area. Historic sites, regardless of cultural affiliation, post-date contact with Europeans. Historic sites are included in the overview site database but they are not included in the model. Prehistoric and historic sites are arbitrarily defined based on whether the site can be dated pre or post-1846.

The site typology used by the Archaeology and Forests Branch is based on a hierarchical system of terms that describe different types of features. The terms are modified by various other terms that can be combined in a number of ways. For example the type "Habitation" can be modified by: rock shelter, cave, refuge, platform, or depression. The subtype "depression" can be modified by: rectangular or circular, which can be further modified by: plank house, housepit, mat lodge, sweat lodge, menstrual lodge, or other. To describe a rectangular house depression for the Archaeology and Forests Branch, one would write: Habitation, depression, rectangular, plank house.

The overview site typology is based on describing the physical **features** that comprise an archaeological site. An archaeological site can be comprised of one or several features. Features can be defined as the different types of archaeological resources comprising a site. Table 5 provides the site feature types defined for the overview along with the corresponding Archaeology and

Forests Branch typology name. The site types are also included as a column in the traditional activities table (see Table 2).

Table 5: Archaeological Site Feature Types.

AOA Site Type	Corresponding Archaeology and Forests Branch Site Type
Artifact Scatter	Cultural Material-surface
Midden-village	Cultural Material-subsurface-shell midden
Midden	Cultural Material-subsurface-shell midden
Wetsite	Cultural Material-surface-subsurface-wetsite
Earthwork (trench embankment)	Earthwork-mound
Culturally Modified Tree-western redcedar barkstrip	Cultural Material-surface-CMT
Culturally Modified Tree-yellow cedar barkstrip	Cultural Material-surface-CMT
Culturally Modified Tree-logged feature	Cultural Material-surface-CMT
Fish Trap	Subsistence Feature-fish trap
Fish Weir	Subsistence Feature-fish weir
Human Remains	Human Remains-tree, rockshelter/cave, other
Petroform	Petroform-cairn
Rock Art	Rock Art-pictograph, petroglyph
Canoe Run	Petroform-canoe skid
Quarry	Not Modelled
Trail	Not Modelled

The following list describes the 16 AOA site feature types as listed in Table 5:

- **Artifact Scatter**: Usually comprised of flaked and/or ground stone artifacts, but occasionally associated with fire-altered rocks, especially at small campsites or in eroded contexts. In landward environments, artifact scatters normally represent transitory camps attributable to fishing or hunting activities at some distance from a village. In marine foreshore settings, they can represent either specialized activities such as woodworking and canoe-building associated with nearby villages, or the remnants of ancient sites which have been eroded by marine transgressions.

- **Midden - village**: Middens associated with traditional villages tended to be occupied on a long-term basis over many years. They are distinguished from undifferentiated resource-processing middens by their much larger area, as well as by cultural deposits that can be 4 m or more deep. In addition, some village middens may exhibit ridges of cultural deposits, or deep, rectangular-to-square depressions that mark the former locations of plank houses. In some sites, remnant houseposts or even totem poles may still exist.

- **Midden**: Middens are accumulations of various cultural materials, and represent the physical remains of habitation or resource-harvesting sites. They are the most abundant archaeological remains in marine coastal settings. In this region, middens consist largely of shellfish remains and distinctively-black soil, together with fish, bird, and mammal bones, fire-altered rocks, ash and charcoal, and artifacts. Cultural features such as hearths, pits, and postmoulds are common. Middens were also used as burial places by some First Nations people.

- **Wetsite**: A rare combination of environmental factors can produce a specialized type of waterlogged archaeological deposit known as a wetsite. These sites only occur in permanently-saturated, anaerobic settings. They are renowned for exceptional preservation of ordinarily perishable artifacts, such as basketry, matting, cordage, and wooden implements (e.g., yew-wood wedges). Wetsites are normally associated with still-water environments such as tidal sloughs or backwater channels, often near a village site or other large encampment.

- **Earthwork:** A rare type of cultural feature likely to be restricted to that portion of the study area traditionally (or formerly) occupied by K'omoks or Homalco communities. The earthworks found in this region are semi-circular trench embankments, constructed at villages or special defensive refuges (e.g., Mitchell 1969b). They are always associated with defensive works to protect a community (or communities) from raiding parties from other First Nations.

- **Culturally Modified Tree**: These are trees, especially western red cedar or yellow cedar, intentionally modified by Aboriginal people as part of their traditional use of the forest (Stryd 1997). Two basic kinds of culturally modified trees (CMTs) are present in this region: bark-stripped trees and aboriginally-logged trees. The former result from bark collecting, whereas the latter were produced during the procurement of timber. Aboriginally-logged trees (or simply "logged trees") may either be standing trees and stumps, or fallen logs. Logged trees can be further divided into different types, including: (i) logged stumps of various kinds, (ii) test hole trees, (iii) plank-stripped trees, (iv) plank-stripped logs, and (v) canoe blanks. Nearly all CMTs will occur in old-growth forest stands containing tall, straight-grained, mature cedar trees. Remnants of some CMTs (particularly logged features) may still be present in successional stands that were harvested in the past.

- **Fish Trap:** Low, walled enclosures built of dry-laid boulders and cobbles in foreshore environments; function on their own by trapping inshore-foraging fish on an outgoing tide, or in combination with more elaborate structures (i.e., weirs) at high water (Mobley and McCallum 2001). Fish traps will usually be associated with shingle beaches or at the mouths of creeks.

- **Fish Weir**: Structures (usually wooden) built to capture fish in foreshore environments. They may have been used in combination with stone fish traps, or on their own, particularly in deeper waters. Fish weirs are rare in the archaeological record, but a few are reported from the study area. In the field, fish weirs are defined by the presence of wooden stake remnants across the bottom of tidal sloughs, stream channels, or on river bars.

- **Human Remains**: Refer to the remains of the dead. In this region, First Nations' people buried nearly all of their dead within middens until approximately 1000 years ago. More recently, the dead were interred in above-ground settings at special locations such as caves and bedrock overhangs and on offshore islets near villages. However, low-status members of a community, such as slaves, continued to be interred within middens.

- **Petroform:** In this region, refers either to boulder/cobble cairns (possibly burial-marker features), or low, stone-wall constructions that superficially resemble fish traps. The latter will always be found in the uppermost intertidal zone or in saltmarsh environments above the high water mark. It has been hypothesized that these features were small "garden plots" to encourage the growth of economic plants (Deur 2000). In contrast, cairns are fairly frequent burial markers to the south in the Strait of Georgia, where they signify Coast Salish mortuary practises that typically post-date about 1000 years ago.

- **Rock Art**: Consist of rock paintings (pictographs) or rock carvings/etchings (petroglyphs). In this region, pictographs are typically found on bedrock outcrops, while petroglyphs are often found on large boulders. Rock art is frequently associated with very steep shorelines and sometimes with traditional trails, as well as locations of strong spiritual significance.

- **Canoe Run:** Features constructed for beaching canoes on rocky shores, canoe runs typically appear as elongate sections of foreshore from which large cobbles and boulders have been removed – often stacked in low walls to each side. Canoe runs are only found on coarse shingle or rocky shores.

- **Quarry:** As a source of lithic raw materials for stone tool manufacture, quarries are extremely rare sites in this region. Most rocks suitable for tool-making were easily collected from rocky beaches or river bars, but some valued materials were very localized and special expeditions had to be mounted to obtain them. Of particular significance in this regard is obsidian, a black volcanic glass that was highly favoured during earlier times in this region (Mitchell 1988, 1989). The source of the Johnstone Strait obsidian has yet to be identified (R. Carlson 1994), but its abundance in this region implies that a local source must be present.

- **Trail**: Routes used in pre-Contact or historic times to provide portages between waterways or landward access to resource-procurement areas. Many existed as well-worn paths on the landscape, but older or less-travelled trails may still be discernable as linear distributions of other archaeological sites along former routes.

3.5.4 Site Frequency and Distribution

Though the Johnstone Strait region has not been as intensively investigated as elsewhere on the South Coast of B.C., a regional inventory of archaeological sites was conducted by Donald Mitchell (University of Victoria) between 1966 and 1969 (Mitchell 1969). Mitchell's survey resulted in the identification and recording of 675 sites. Several additional sites have been recorded more recently, typically in response to proposed development projects. According to the Provincial Heritage Register Database (PHRD), a total of 189 archaeological sites had been recorded within the study area by January 2001 (Figure 6). The nature, frequency, and distribution of all prehistoric archaeological resources are discussed below and presented in Table 6.

The total number of sites does not match the numbers of site records in the PHRD, because several archaeological features can occur at a single site (for example, a midden site where CMTs and burials are also present). In the accompanying table, each different feature is treated as if it were a single site. In this way, the total number of archaeological features is greater than the number of recorded sites.

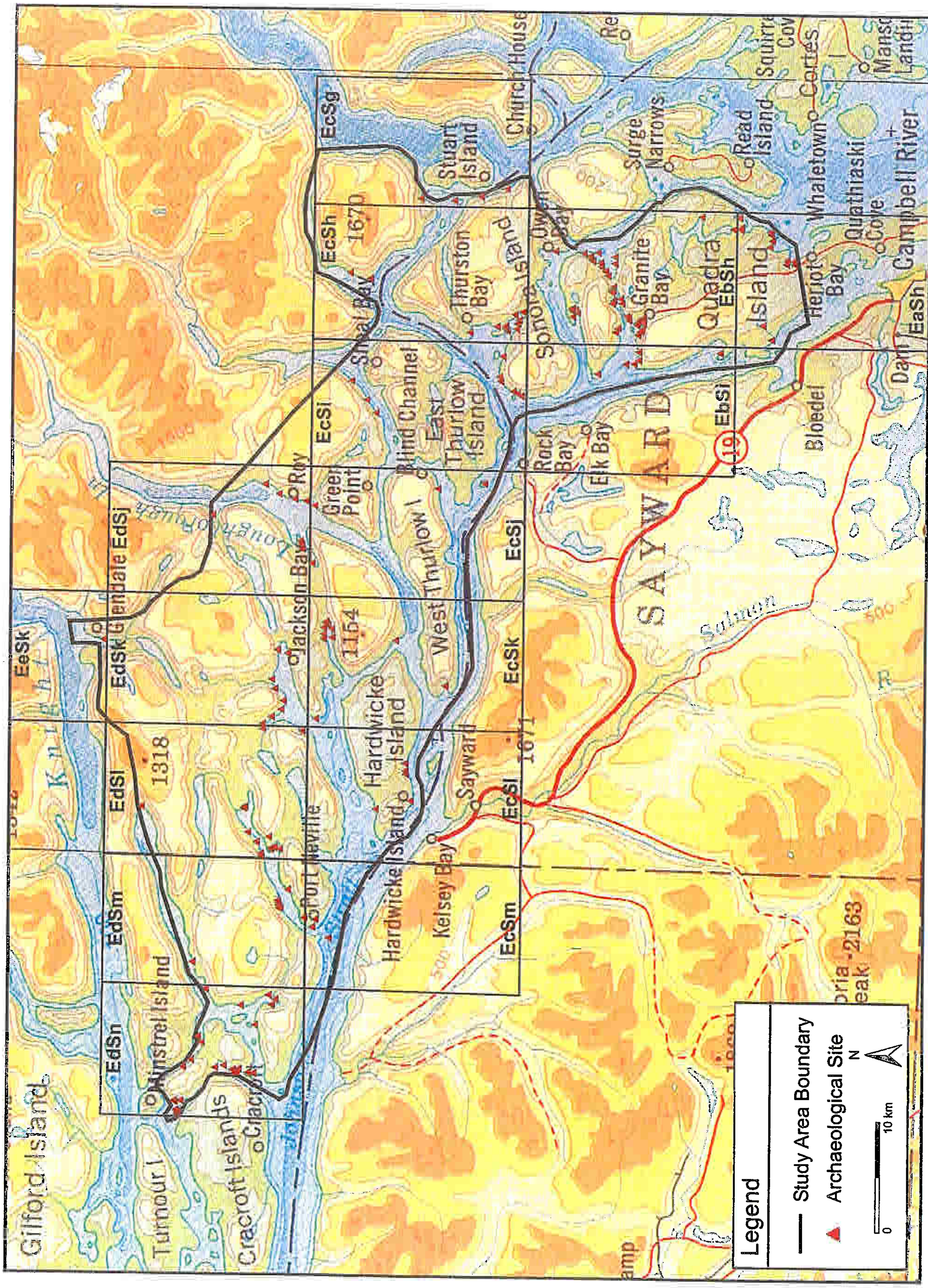

Figure 6. Location of recorded archaeological sites and Bordon grid within the Study Area (1:500,000).

Table 6. Archaeological Sites in Study Area by Revised Site Feature Type.

Type	Borden Block																Σ[1]
	EaSh	EbSh	EbSi	EcSg	EcSh	EcSi	EcSj	EcSk	EcSl	EcSm	EdSj	EdSk	EdSl	EdSm	EdSn	EeSk	
Artifact Scatter	--	2	--	2	3	--	--	--	--	--	2	2	--	--	4	--	**15**
Canoe Run	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	**1**
CMT–BS[2]	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	**1**
CMT-Log[3]	--	--	--	--	--	--	--	1	--	--	--	--	1	--	--	--	**2**
Earthwork	1	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	**3**
Fish Trap	--	--	--	--	--	--	--	--	--	--	--	--	2	--	2	1	**5**
Fish Weir	--	1	--	--	--	--	--	--	--	--	--	1	1	--	--	--	**3**
Human Remains	--	1	--	1	--	1	2	--	2	1	--	1	--	--	--	--	**9**
Midden	2	34	5	3	11	5	4	6	2	1	7	6	8	5	21	1	**121**
Midden-Village	3	9	--	--	2	--	--	--	--	--	--	2	--	--	3	--	**19**
Petroform	1	2	--	2	2	--	--	--	--	--	--	--	--	--	--	--	**7**
Rock Art	--	1	2	--	1	7	2	3	5	--	1	1	3	4	2	--	**32**
Wetsite	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1**
Other[4]	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	**2**

[1] Totals may exceed total of 189 sites in study area, because more than one type of archaeological remain could be present at a single site.
[2] = Culturally modified tree - barkstrip
[3] = Culturally modified tree - aboriginally logged
[4] This category includes a cave and an isolated dugout canoe.

3.6 Biophysical

A review of the biological and physical context of the study area was conducted in order to understand the general biophysical constraints that may have affected past human use of the landscape, and to highlight the specific relationship of resources to settlement and subsistence patterns. This research was essential for identifying the biophysical variables that are related to archaeological potential and could be incorporated in the GIS digital coverages of the study area. The research included a review of the (1) general biophysical classification of the study area, (2) the systems used for classifying landforms and aquatic features, and (3) the distribution and abundance of specific floral and fauna that were important subsistence resources.

The AOA study area includes many islands situated within the Johnstone Strait region and adjoining Mainland areas. Cortez, Maurelle, and Stuart Islands, and most of Quadra Island are excluded at the southern end of the study area, while West Cracroft and Turnour Islands lie beyond its western extremity. On the Mainland, the study area boundary runs through the centre of Call Inlet, excludes Loughborough Inlet north of Heydon Bay and most of Phillips Arm, and includes the east side of Frederick Arm and the south side of Estero Basin.

3.6.1 Biogeoclimatic Zone

In order to classify the environments in B.C., the Ministry of Forest developed the biogeoclimatic ecosystem classification system [BEC (Meidinger and Pojar 1991)]. The BEC system provides a framework for the presentation of information concerning the physical landscape, climatic processes and their classification. The BEC system has three levels of integration: regional, local, and chronological (Meidinger and Pojar 1991:Figure 3). The BEC also combines three levels of classification: zonal, vegetation, and site (Meidinger and Pojar 1991:17). At the regional level, a regional zonal climate is defined and it reflects the plant and animal communities present. Biogeoclimatic units represent classes of ecosystems under the influence of the same regional zonal climate. Biogeoclimatic zones are further divided into subzones and variants, depending on the degree of diversity present within the regional zonal pattern.

Nearly all of the study area is located within the Coastal Western Hemlock (CWH) zone, which occurs at low to middle elevations west of the coastal mountains along the entire B.C. coast, and also covers most of Vancouver Island (Ministry of Forests Research Branch 1994; Pojar, *et al.* 1991:96). The CWH zone occupies elevations from sea level to 900 m. Localized settings on the Mainland coast are in the Mountain Hemlock zone (MH), which usually denotes the subalpine zone above the CWH.

Within the AOA study area, the following biogeoclimatic subzones and/or variants are present:

- **CWH Dry Submaritime Subzone** (CWHdm): Forests in this subzone are dominated by Douglas-fir, western hemlock, and western red cedar; salal and red huckleberry are the most important understorey species, while vine maple, bracken, Oregon-grape, and sword fern are less abundant (Pojar, Klinka and Demarchi 1991a). Lands in this subzone have warm, relatively dry summers and moist, mild winters with little snowfall (Green and Klinka 1994). In the study area, this subzone is limited to low-elevation settings on Hardwicke Island, around Loughborough Inlet, on Frederick Arm, and in Estero Basin (Ministry of Forests Research Branch 1994).

- **CWH Submontane Variant, Moist Maritime Subzone** (CWHmm1): This subzone covers higher elevation forests on the islands within Johnstone Strait (Ministry of Forests Research Branch 1994). Forests are dominated by western hemlock, with lower frequencies of amabilis fir, Douglas-fir, and western red cedar. The understorey is dominated by red huckleberry and Alaskan blueberry, with lesser amounts of salal and Oregon-grape (Pojar, Klinka and Demarchi 1991a). This subzone has moist, mild winters and cool, relatively dry summers (Green and Klinka 1994).

- **CWH Submontane Variant, Very Wet Maritime Subzone** (CWHvm1): This subzone is distinguished by a wet, humid climate with cool summers and mild winters with little snow (Green and Klinka 1994). Forests are dominated by western hemlock and amabilis fir, with lower frequencies of western red cedar (Pojar, Klinka and Demarchi 1991a). There is normally a well-developed understorey of red huckleberry and Alaskan blueberry, but salal can be common in some settings. This subzone is found on East Cracroft Island and at low elevations on most of the Mainland Coast portion of the study area (Ministry of Forests Research Branch 1994).

- **CWH Montane Variant, Very Wet Maritime Subzone** (CWHvm2): This subzone is of localized distribution in the study area, predominantly found above the CWHvm1 on the Mainland Coast (Ministry of Forests Research Branch 1994). It has cool, short summers and cool winters featuring substantial snowfall. Forests are dominated by western hemlock and amabilis fir, while western red cedar, yellow cedar, and mountain hemlock are found in lower frequencies. The last two tree species become more common with increasing elevation (Green and Klinka 1994). Again, red huckleberry and Alaskan blueberry are the most important understorey species.

- **CWH Very Dry Maritime Subzone** (CWHxm2): In the TFL 47 study area, this subzone is widespread on at lower elevations on Quadra, East and West Thurlow, and Sonora Islands (Ministry of Forests Research Branch 1994). It is characterized by warm, dry summers and moist, mild winters with relatively little snowfall (Green and Klinka 1994). Zonal forests are dominated by Douglas-fir, accompanied by western hemlock and lesser amounts of red cedar (Pojar, Klinka and Demarchi 1991a). The most important shrubs are salal, Oregon-grape, and red huckleberry, with lower frequencies of swordfern and bracken (Green and Klinka 1994).

- **MH Windward Variant, Moist Maritime Subzone** (MHmm1): This subzone defines high-elevation environments found above the CWHvm2, and is distinguished by long, wet cold winters with heavy snowfall, and short, cool moist summers (Green and Klinka 1994). Forests are dominated by mountain hemlock and amabilis fir, and smaller amounts of yellow cedar and western hemlock. Alaskan blueberry and oval-leaved blueberry are the most common understorey shrubs, while black huckleberry is present at lower frequencies (Pojar, Klinka and Demarchi 1991b). In the TFL 47 AOA study area, this subzone is quite localized, being restricted to high-elevation settings between the head of Call Inlet and Glendale Cove, between Tom Brown and Heydon Lakes, in the Franklin Range west of Loughborough Inlet, and south and east of Frederick Arm and Estero Basin (Ministry of Forests Research Branch 1994).

Western hemlock (*Tsuga heterophylla*) is most often the dominant tree species present in zonal CWH forests. Other common tree species present include: western red cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*) in drier environments, amabilis fir (*Abies amabilis*), Sitka spruce (*Picea sitchensis*) in shoreline settings, and yellow cedar (*Chamaecyparis nootkatensis*) at higher elevations. Within the MH zone, along with some of the tree species present in the CWH zone, mountain hemlock (*Tsuga mertensiana)* is also present, and yellow cedar is more common.

Associated with the aforementioned trees species is a shrub layer consisting of false azalea (*Menziesia ferruginea*), various blueberries including Alaskan and oval-leafed blueberry (*Vaccinium alaskaense, V. ovalifolium*), red and evergreen huckleberry (*Vaccinium parvifolium, V. ovatum*), salal (*Gaultheria shallon*), and tall Oregon-grape (*Mahonia aquifolium*) on drier sites. The associated herb layer is often rather sparse, but consists of deer fern (*Blechnum spicant*), swordfern (*Polystictum munitem*), false lily-of-the-valley (*Maianthemum dilatatum*), bunchberry (*Cornus canadensis*), and twinflower (*Linnaea borealis*). The moss layer consists of mainly step and flat moss (*Hylocomium splendens*, *Plagiothecium undulatum*).

3.6.2 Ecosection

The ecosection/ecoregion system is used by biological scientists throughout North America to classify different types of environmental units. Demarchi, *et al* (1991) is the most concise description of this system for British Columbia. The ecoregion classification system is based on macroclimatic and large-scale physiography. Ecosections are the smallest units of a provincial ecoregion classification system developed to provide a systematic method for showing the small-scale ecological relationships in the province. Each ecosection represents an area with minor physiographic and macroclimatic variation, creating an area of broad ecological uniformity.

The entire AOA study area is situated within the Outer Fjordlands ecosection of the Pacific Ranges Ecoregion (Demarchi, *et al*, 1991). The Pacific Ranges Ecoregion is the southernmost expression of the Coast Mountains in B.C., and is distinguished by high, rugged mountains (Demarchi, *et al*, 1991). The Outer Fjordlands, one of four constituent ecosections of the Pacific Ranges, is characterized as an area of low but rugged relief, comprised of numerous islands and steep-sided inlets east of Johnstone Strait (proper) and Seymour Narrows (Demarchi, *et al*, 1991:96).

To assess relationships between different kinds of settings at a micro-environmental scale, the Wildlife & Wildlife Habitat Inventory (Terrestrial Information Branch, Ministry of Sustainable Resource Management) has developed Terrestrial Ecosystem Mapping (TEM). The TEM represents a digitized database of several kinds of environmental data, of which physiography, surficial and bedrock geology, and vegetation patterns are most significant for developing an archaeological potential model. A manual describing the standards for TEM data in B.C. has been prepared by the Ecological Data Committee (2000), and is available from the provincial government on the Internet at www.gov.bc/rib/wis/tem/index.

3.6.3 Landforms

The landforms that are of interest to archaeological potential modelling include those formed by geomorphic processes that deposited sedimentary materials onto the landscape, such as glacial, fluvial (rivers), lacustrine (lake), colluvial (gravitational), and aeolian (wind) processes. Some of these deposits (such as well-drained terraces) are favourable for human use and archaeological site preservation, and others (such as active flood channels) are not.

Other landforms result from organic processes, such as bog and wetland deposits, or from volcanic activity, such as deposits of vitreous (glassy) basalt and obsidian from which raw materials for stone tools were obtained. The information on the classification and distribution of landforms was obtained through review of Geological Survey of Canada maps and surficial geology maps. The following discusses specific aspects of certain landforms pertinent to this study. Landform information was also obtained from TEM data.

3.6.3 Bedrock and Surficial Geology

Bedrock geological mapping of the TFL 47 study area has not been extensive, but an early survey of the region was published by the Geological Survey of Canada prior to WW1 (Bancroft 1913) and more recent work has been compiled by Roddick, Muller and Okulitch (1979). According to Roddick, Muller and Okulitch (1979), most of the rocks on the Mainland portion of the study area, as well as much of Hardwicke Island, East and West Thurlow Islands, Sonora Island, and the northern part of Quadra Island are comprised of undated rocks of the Coast Plutonic Complex (quartz diorite, granodiorite, and diorite). An extensive area on the west side of Quadra Island, as well as very localized areas at the seaward margin of West Thurlow and Hardwicke Islands, and on the Mainland at the entrance to Port Neville, is characterized by the Upper Triassic-aged Karmutsen Formation (basalt and pillow lavas). Lastly, some localized exposures of undated metamorphic rocks (schist and "gneiss of amphibolite grade") are found near the northern end of Sonora and East Thurlow Islands, and on Loughborough Inlet.

None of the rock types identified within the study area would have been particularly attractive to Aboriginal people seeking lithic raw materials for stone tool-making. In particular, the formations present are not a suitable environment for the occurrence of obsidian, a critical lithic material from which the Middle Prehistoric (i.e., 5000-2500 BP) Obsidian Culture Type takes its name. Further, local sources of slate – the most important lithic material in later times – are not present, and would have had to be acquired from locations to the south in the Strait of Georgia.

The map produced by Roddick, Muller and Okulitch (1979) does not deal with unconsolidated surface sediments of Pleistocene or Holocene origin. Information about surface sediments is important for assessing archaeological potential, because habitation sites are almost always found on well-drained, fine-textured sediments. Further, few archaeological sites of any kind are associated with poorly-drained soils – except wetsites and archaeological remains associated with intertidal settings.

Existing mapping of surficial materials in this region is not widely distributed and could not be reviewed as part of this overview assessment. However, such information was considered as one of the modelled variables influencing archaeological potential, and coverage was obtained via the TEM.

3.6.5 Slope

"Slope" is a critical variable for archaeological potential modelling, as it strongly influences the distribution of many kinds of sites. In particular, habitation sites such as middens, and subsistence features such as fish traps and/or fish weirs, are almost always found in settings that are level or nearly level. In contrast, rock art – especially pictographs – are almost always found in situations with very steep or even vertical slopes. Similarly, cave burials will only be found where very steep terrain is present. Lastly, some kinds of sites, notably CMTs, are quite independent of slope.

In this AOA slope is expressed in degrees. Slope data was made available through the existing TEM data. Slope was expressed in the same manner for both the CMT and non-CMT models.

3.6.6 Aquatic Features

Included in this category are all waterbodies, streams, and wetlands. Although a number of systems for classifying these aquatic features exist, the major system which was reviewed for this project was developed for the B.C. Forest Practises Code operating guidelines (Ministry of Forests 1995). The Forest Practices Code classifies streams according to the presence or absence of fish (or fish potential), and average stream width. Lakes and wetlands are classified on the basis of size. In addition, TFL provided a map of all known salmon-bearing streams which was digitized by Range an Bearing, and was incorporated into the potential model development process.

3.6.7 Fauna and Flora

In terms of wildlife, Pojar, *et al.* (1991:105) state that the CWH zone probably has the most diversity and abundance in habitat elements, which leads to a corresponding diversity in the types of fauna present. The land, sea, and skies of the Johnstone Strait are inhabited by numerous species of animals in varying degrees of abundance, that were and are readily available food sources. First

Nations' people developed a land and sea use system that enabled them to successfully harvest these abundant resources. Though not exhaustive, the following list identifies the most important foodstuffs available to First Nations communities in the study area: (1) black-tailed deer, Roosevelt elk, black bear, grey wolf, cougar, marten, mink, land otter, raccoon, and weasel are the most common terrestrial mammals; (2) sea mammals present include: California and Steller's sea lion, harbour seal, northern fur seal, dolphins, harbour porpoise, orcas, and sea otter (present but rare); (3) bird species represent the varying environments available including the forest, foreshore, and marine waterways – breeding colonies of marine bird are associated with offshore islands or islets; (4) marine fish species include herring, salmon, lingcod, halibut, flatfish, flounder, and rockfish, and (5) shellfish and marine invertebrates are readily available on the foreshore, and include bay mussels, various species of clams and cockles, whelks and chitons, sea urchins, barnacles, octopus, sea cucumbers, and cockles.

3.7 Digital Data

Because a GIS-based model of archaeological potential must rely exclusively on mapped biophysical and landscape features, an important step in the AOA methodology was obtaining relevant biophysical data mapped in a digital format. Using this digital data, map layers or coverages can be built for each set of biophysical features which are applied to the GIS.

As illustrated in Figure 7 the following steps were involved in building the digital coverages for the study area:

- **Step 1**: Acquisition of existing digital data;
- **Step 2**: Digitization of additional coverages;
- **Step 3**: Translation and review of coverages;
- **Step 4**: Classification of features;
- **Step 5**: Analysis and review of association between sites and features; and
- **Step 6**: Definition of feature buffers.

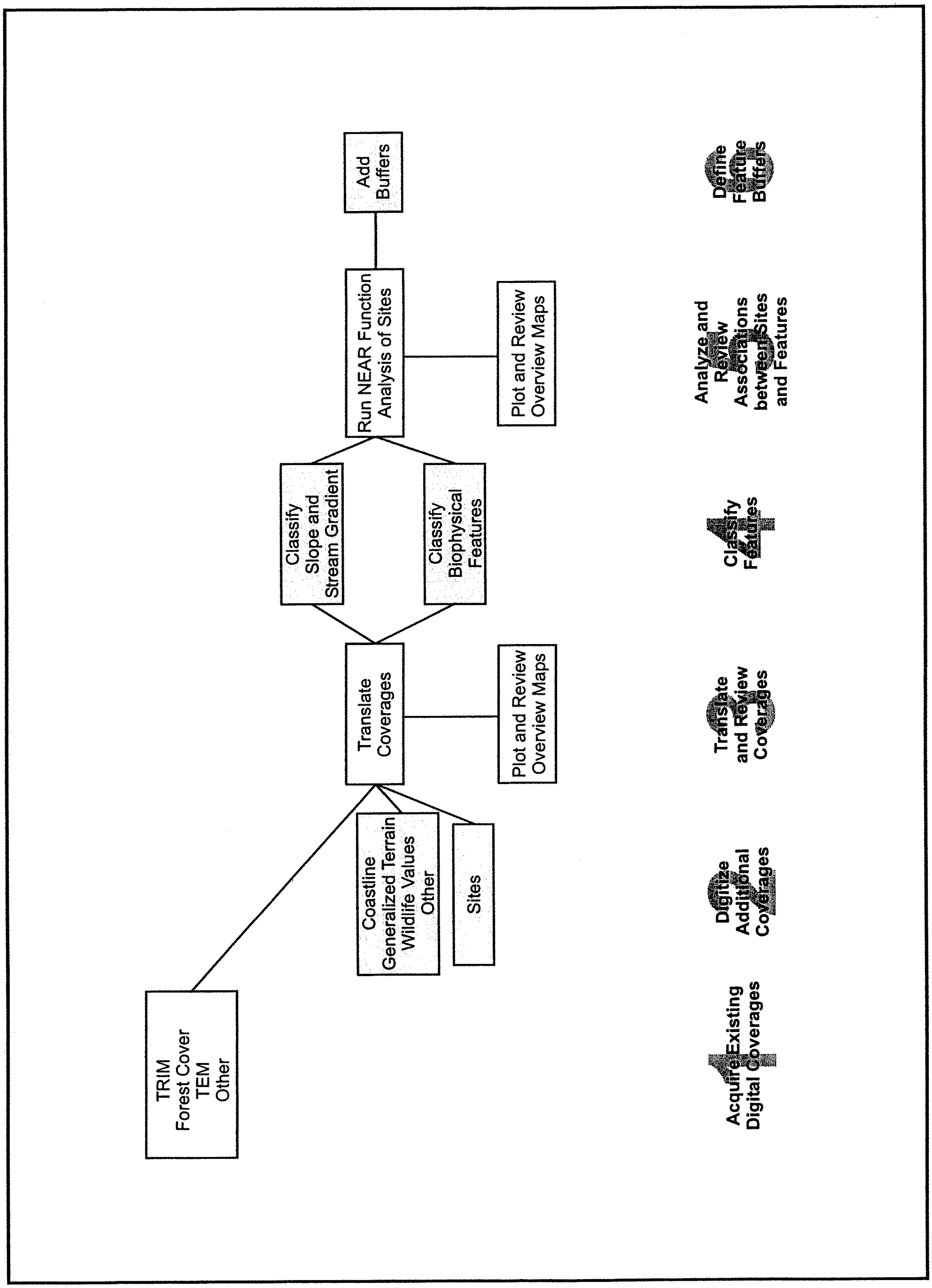

Figure 7. Schematic Diagram of Digital Data Acquisition and Classification.

3.7.1 Data Acquisition and Translation (Steps 1 through 3)

In order to develop an understanding of the suitability of various landscapes for past human use in the study area, several cultural and biophysical variables were chosen as the foundation for building the model and analysis. These variables are described below in terms of their data sources, how they were entered into the GIS, and how they were modified for use in the model. The base maps used were B.C. Ministry of Crown Lands TRIM maps in digital form (scale=1:20,000). These represented base mapping data for the model as well as a medium for plotting and entering data to be digitized.

The types of biophysical features identified as having significance for archaeological potential included: slope, aquatic features, certain landforms, and specific vegetation stands. Most of the biophysical data required for the model were available from existing digital sources (Figure 7, Step 1). However, in a number of cases it was necessary to manually digitize specific features or data from existing paper maps or from information plotted onto maps. In addition to biophysical data and archaeological sites, known salmon streams were manually plotted and digitized as separate coverages (Figure 7, Step 2). The resulting coverages are detailed in Tables 6 and 7.

- **Landforms**: Information on specific geomorphological landforms was derived from the TEM data made available to Arcas from TFL. Coastlines were derived from TRIM data. Originally, an attempt was made to differentiate between varying types of beaches present along the shoreline, but there was limited success in pulling this information from marine charts.

- **Slope**: Slope coverage was derived from TEM data. The two models in this overview had different needs for slope. Therefore, different ranges of slope degrees were developed for the two models.

- **Aquatic Features**: These features were available from TRIM sources. In the case of streams, single and double-lined streams were used. Indefinite and intermittent streams were excluded from the non-CMT model because they were considered to have low potential for fish values. TFL provided a map showing all of the known salmon streams present within the study area, and this data was digitized and utilized in the modelling process. All water bodies classified as lakes in TRIM were used.

- **Vegetation**: In order to model for CMTs, forest cover data was acquired. Of most importance was the classification of old growth red and yellow cedar stands. Some forest cover data was also available via TEM.

- **Archaeological Sites**: Originally it was anticipated that retrieving the known archaeological sites for the study area would be a simple procedure in which the appropriate files would be retrieved from MoF and all sites recorded and digitized for the Golder AOA would be seamlessly incorporated into the model. Unfortunately, this was not the case. It took some time for the data from MoF to be retrieved and cleaned up.

Those sites recorded and sent to the Archaeology and Forests Branch after completion of the Golder AOA were plotted on TRIM maps and digitized. All sites were plotted as points.

3.7.2 Feature Classification (Step 4)

Once the digital coverages were assembled, they were checked to see if further classification was necessary (Steps 4 through 6, Figure 7). Classification of these features focused on criteria which were assumed to be meaningful to past human activities, with an emphasis on their subsistence resource potential. However, pre-existing systems for the classification of features were used wherever possible. In particular, classification criteria were kept consistent with the Forest Practises Code.

3.7.3 NEAR Analysis and Definition of Feature Buffers (Steps 5 and 6)

For some feature categories, the area enclosed by their polygons was used in the modelling (for example, slope). For others such as coastal, river, and lakes shoreline, it is the area around or adjacent to the feature where associated traditional activities took place, and therefore, where archaeological potential exists. For these latter features, decisions must be made as to how far away from the feature's margin the archaeological potential extends. This involves setting **buffers** of varying widths, a common task carried out in most GISs. A feature could be assigned one or more buffer, with each successive buffer reflecting greater constraints (lower potential) for traditional activities. By creating a series of buffers, they can be used in the model to predict differing levels of archaeological potential at varying distances to different features.

Buffer width decisions were initially based on a combination of information collected during the background research, and from previous field experience in the study area. Determining the number and width of buffers for each feature was a difficult task. In most cases, the first buffer on a feature is intended to capture those activities which occur immediately adjacent to that feature. For example, salmon fishing stations occur immediately adjacent to specific aquatic features. However, ethnographic and historic records do not provide explicit information describing the distances at which most traditional activities, and associated sites, occur in relation to specific features. Two factors were initially considered when setting buffer widths:

- Certain features in themselves would rate higher than others (i.e., streams with salmon potential versus intermittent streams with no fish potential).
- Certain features were known to have a strong association with archaeological remains (i.e. certain aquatic features and particular landforms).

These preliminary buffers were tested against the distribution of known archaeological sites. A function available in ArcInfo (the GIS employed in this overview), called NEAR, allows for multiple measurements from points to various landscape features. This analysis helps to determine the effectiveness of various buffer widths and highlighted situations where a widening or a narrowing of a buffer was necessary. This information was then fed back into the model development process.

Several features were assigned multiple buffers to indicate varying degrees of archaeological potential within certain distances of the feature (see Table 8). For example, a salmon bearing stream has six buffers. The first buffer (between 0-25 m from the stream) has the highest potential to support activities that would leave archaeological evidence, while the other buffers (26-500 m from the stream) have more moderate potential.

For features characterized as polygons (i.e. forest cover), it is often the area within the polygon that contributes to the potential and a buffer is not required. For features characterized as points and/or lines (i.e., trails) the point and/or line was assigned a single buffer. Archaeological sites were characterized as points. They were buffered to protect the surrounding terrain, which might contain as-yet undiscovered archaeological resources. It also helped in some instances to compensate for sites whose exact location could not be determined with reasonable confidence.

Table 7. Site Type and Associated Variables.

Arcas Archaeological Site Type, Output Code, and Simplified Logical Statement	**Variable**
Artifact Scatter (TYP1):	Coastline ≤ 100 m Freshwater lake (L1, L2, L3) ≤ 50 m Fish stream/river (S1, S2, S3, S4) ≤ 100 m Non-fish stream (S5) ≤ 50 m Non-fish stream (S6) ≤ 25 m Slope ≤ 20° Aspect (South, East/West, North) Trail ≤ 25 m Biogeoclimatic zone (Alpine Tundra) Surface material (fluvial, lacustrine, marine)
Midden-village (TYP2)	Coastline ≤ 100 m Fish stream/river (S1, S2, S3, S4) ≤ 100 m Slope ≤ 10° Aspect (South, East/West, North) Surface material (fluvial, lacustrine, marine)
Midden (TYP3)	Coastline ≤ 100 m Freshwater stream/river (S1, S2, S3, S4, S5) ≤ 100 m Slope ≤ 20° Coastline characteristic (gravel, shingle, sand)
Wetsite (TYP4)	Coastline, S1, S2 fish stream present Slope ≤ 5° Surface material (fluvial, marine, lacustrine)
Earthwork (trench embankment) (TYP5)	Slope ≤ 10° Midden-village ≤ 100 m Surface material (fluvial, marine)

Arcas Archaeological Site Type, Output Code, and Simplified Logical Statement	**Variable**
Culturally Modified Tree-western redcedar barkstrip (TYP6)	Age class 5 Height class 3 Slope ≤ 45° Coastline ≤ 300 m Fish stream/river (S1, S2, S3, S4) ≤ 500 m Distance up fish stream/river (S1, S2, S3, S4) ≤ 2000 m Elevation ≤ 550 m above sea level Lakeshore (L1, L2, L3) ≤ 100 m Biogeoclimatic zone/subzone (CWH) Species = western red cedar
Culturally Modified Tree-yellow cedar barkstrip (TYP7)	Age class 5 Height class 3 Slope ≤ 45° Coastline ≤ 300 m Fish stream/river (S1, S2, S3, S4) ≤ 500 m Distance up fish stream/river (S1, S2, S3, S4) ≤ 3000 m Lakeshore (L1, L2, L3) ≤ 100 m Elevation ≤ 800 m above sea level Species = cy Biogeoclimatic zone/subzone (MH, CWHvm2, CWHvh1, CWHvh2, CWHmm2, CWHwh2)
Culturally Modified Tree-logged feature (TYP8)	Species = western redcedar Age class 8 Height class 3 Slope ≤ 45° Coastline ≤ 300 m Fish stream/river (S1, S2, S3, S4) ≤ 500 m Distance up fish stream/river (S1, S2, S3, S4) ≤ 2000 m Lakeshore (L1, L2, L3) <= 100 m Elevation ≤ 550 m above sea level Biogeoclimatic zone/subzone = CWH
Fish Trap (TYP9)	Fish stream/river (S1, S2, S3, S4) ≤ 100 m Salmon run past and/or present Coastline characteristic (shingle, cobble)
Fish Weir (TYP10)	Fish stream/river (S1, S2, S3) Stream gradient ≤ 5° Salmon/eulachon run past and/or present
Human Remains (TYP11)	Offshore islet ≤ 5 ha Freshwater stream/river (S1, S2, S3, S4, S5) <= 500m Slope ≥ 70° Coastline ≤ 100 m Species class = Sitka spruce Biogeoclimatic zone/subzone (CWHvh2, CWHwh1, CWHwh2, CWHds2) Age class ≥ 5 Midden-village ≤ 500 m Surface material (rock)

Arcas Archaeological Site Type, Output Code, and Simplified Logical Statement	**Variable**
Petroform (TYP12)	Biogeoclimatic zone/subzone (Alpine Tundra) Slope 0° Mouth of stream/river (S1, S2) Presence of saltmarsh
Rock Art (TYP13)	Coastline ≤ 50 m Slope ≥ 70° Surface material (rock) Lakeshore (L1, L2, L3) ≤ 50 m Mouth of stream/river (S1, S2) Midden-village/ Midden ≤ 500 m Slope ≤ 5° Coastline characteristic (boulder)
Canoe Run (TYP14)	Adjacent to coastline Midden-village/ Midden ≤ 50 m Slope ≤ 5° Coastline characteristic (boulder, cobble, shingle)
Quarry	Not modelled
Trail	Not modelled

Table 8. Input Grids.

Coverage-General		**Coverage-specific**	**Definition**	**Code**
TEM	Biogeoclimatic	Zone	1 = AT	BGZ
		Subzone/Site Series	1 = mmp	BGS
	Terrain	Primary Surficial Materials	1 = fluvial (F) 2 = lacustrine (L) 3 = marine (W) 4 = bedrock (R) 5 = glaciofluvial (FG) 6 = glaciolacustrine (LG)	MT

Coverage-General	Coverage-specific	Definition	Code
	Slope Classes	1 = 0° 2 = 1-5° 3 = 6-10° 4 = 11-20° 5 = 21-45° 6 = 46-69 7 = 70° or greater	SLO
	Elevation	1 = 0-550 m 2 = 551-800 m	EL
	Aspect	1 = 0-45° 2 = 45°-135° 3 = 135°-225° 4 = 225°-315° 5 = 315°-360°	AS
	Islet	1 = 0-5 Ha	IS
Marine/Aquatic Classification	Streams	1 = 0-25 m 2 = 26-50 m 3 = 51-100 m 4 = 101-250 m 5 = 251-500 m 6 = 501-1000 m	SSALM (Salmon present)
		1 = 0-50 m 2 = 51-100 m 3 = 101-500 m	STR (No-salmon present)
	Lakes	1 = 0-50 m 2 = 51-100 m	LSALM
	Coastline	1 = 0 m 2 = 1-50 m 3 = 51-100 m 4 = 101-300 m 5= 301-1000 m	COA1
		1 = 0-2000 m 2 = 2001-3000 m	COA2

Coverage-General	Coverage-specific	Definition	Code
Forest Cover	Western Redcedar	0 = Absent 1 = Present	RC
	Yellow Cedar	0 = Absent 1 = Present	YC
	Sitka Spruce	0 = Absent 1 = Present	SS
	Wetland	0 = Absent 1 = Present	WET
	Age Class	5 = 81-100 6 = 101-120 7 = 121-140 8 = 141-250 9 = 251+	AC
Sites	Midden	1 = 0-50 m 2 = 51-250 m 3 = 251-500	ARC1
	Midden-village	1 = 0-50 m 2 = 51-100 m 3 = 101-250 m 4 = 101-500 m	ARC2
	Other Archaeology Sites	1 = 0 – 250 m	ARC3

3.8 Model Building, Review, and Application

3.8.1 Model Building

Several components already described elsewhere in this document were developed and reviewed in a sequence that would ultimately produce a final model of mapped potential for archaeological resources. Figure 8 illustrates in schematic form the six sequential steps of the model building. The six steps to the modelling sequence are:

- **Step One**: Identify traditional activities (Table2);
- **Step Two**: Identify archaeological site types that result from these activities (Table 2);
- **Step Three**: Identify associated archaeological evidence (Table 2);

- **Step Four**: Identify typical locations where these activities/sites should be found (Tables 2, and 7);
- **Step Five**: Identify biophysical feature types typically present at those localities (Tables 2 and 7); and
- **Step Six**: Define model statements by combining these individual features into a set of aggregates ranging from loosely constrained (High potential) to highly constrained (Low potential).

The final step in the model building process involved the definition, for each site type, of a series of model statements, or "logical statements", which form the instructions to the GIS for modelling the landscape. These statements (an example is shown in Figure 9), which are basically "if-then" statements, identify the specific combinations of biophysical features associated with each site type, and they assign the overall potential value to each cell. The first statement shown in Figure 9 can be translated as:

IF .... a setting is located on a slope [SLO] of 0-45 degrees **and** within 0-50 m of the coastline [COA1], or 0-100 m of a salmon stream [SSALM], or 0-100m of a non-salmon bearing stream [STR], or 0-50 m of a lake with salmon [LSALM], **and** with an aspect [AS] of 1 or an aspect not equal to 2-4 and slope less than or equal to 20 degrees **and** primary surficial materials [MT] that are not bedrock,

THEN .... that setting has moderate potential [=2] for an artifact scatter [TYP 1].

A similar set of model statements was defined for each of the 14 site types used in the CMT and non-CMT models. Each statement represents a unique combination of features which result in a specific level of potential for a particular site type or set of site types. A site type can receive a range of values or scores depending on the strength of the combination of the biophysical variables. The most favourable setting or combination of features received the highest potential rating for that site type, and for each setting with greater constraints or fewer favourable features, the potential rating was reduced.

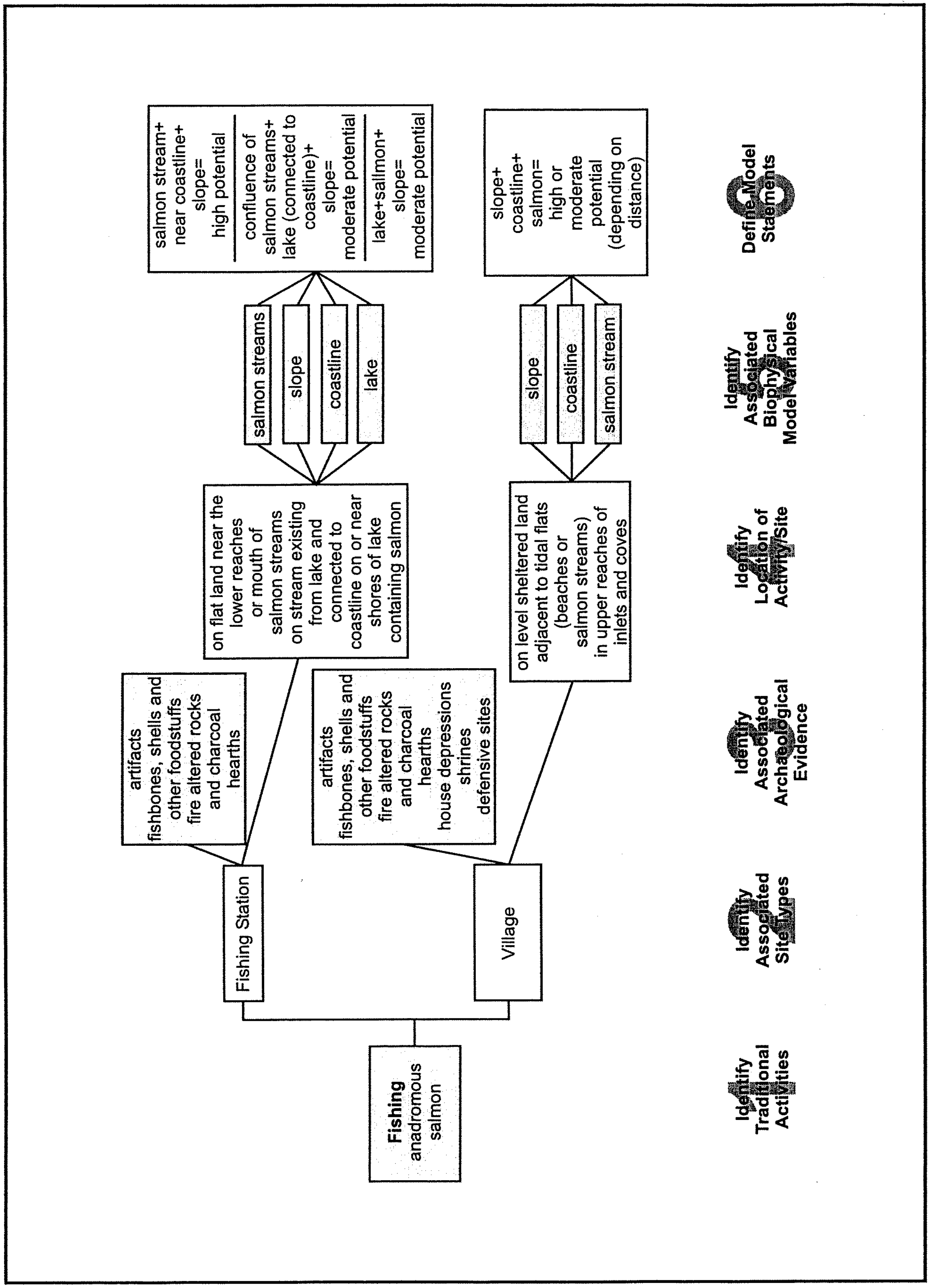

Figure 8. Schematic Diagram of Model Building.

TYPE 1: ARTIFACT SCATTER

1) Primary Surficial Materials (PSM) = fluvial (F), lacustrine (L), marine (M), glaciofluvial (FG), or glaciolacustrine (LG)
AND
Aspect ≠ N OR Aspect = N and Slope = 0-10°
AND
Distance to fish-bearing stream = 0-100m
AND
Distance to Coastline = 0-1000m OR Distance to fish-bearing lake = 0-50m, OR Distance to coastline = 0-100m
AND
Elevation = 0-550 m
AND
Slope = 0-45°

2) Biogeozone = Alpine Tundra
AND
Distance to fish-bearing lake = 0-50 m OR Distance to any stream = 0-100m
AND
Slope = 0-10°

3) PSM = F, L, M, FG, or LG
AND
Distance to fish-bearing stream = 0-100m or Distance to fish-bearing lake = 0-50m or Distance to coastline = 0-100m
AND
Slope = 0-10°

TYPE 2: MIDDEN VILLAGE

1) Distance to coastline = 0-100m
AND
Distance to fish-bearing stream = 0-100m OR Distance to non fish-bearing stream = 0-50m OR Distance to fish-bearing lake = 0-50m
AND
Elevation = 0-550m
AND
Slope = 0-10°

TYPE 3: MIDDEN

1) PSM = M
AND
Distance to coastline = 0-50m
AND
Slope = 0-20°

2) PSM = F, L, M, FG, or LG
AND
Distance to fish-bearing stream = 0-100m
AND
Distance to coastline = 0-1000m
AND
Slope = 0-10°

TYPE 4: WETSITE

1) PSM = F, L, M, FG, or LG
AND
Distance to coastline = 0-1m OR Distance to fish-bearing stream = 0-25m
Slope = 0-50°

TYPE 5: EARTHWORK

1) Distance to recorded archaeological site = 0-100m
AND
PSM = F, M, or FG
AND
Slope = 0-10°

TYPE 6: CMT BARKSTRIP, WESTERN REDCEDAR

1) Age class (AC) = 81-250 years old
AND
Species composition (SC) = presence of western redcedar
AND
Slope = 0-45°
AND
Distance to coastline = 0-300m OR Distance to fish-bearing lake = 0-100m

2) AC = 81-250 years old
AND
SC = presence of western redcedar
AND
Slope = 0-45°
AND
Distance to coastline = 0-300m OR Distance to fish-bearing stream = 0-100m

TYPE 7: CMT BARKSTRIP, YELLOW CEDAR

1) AC = 81-250 years old
AND
SC = presence of yellow cedar
AND
Slope = 0-45°
AND
Distance to coastline =0-300m OR Distance to fish-bearing lake = -100m
AND
Elevation = 0-800m

2) AC = 81-250 years old
AND
SC = presence of yellow cedar
AND
Slope =0-45°
AND
Distance to coastline =0-3000m
AND
Distance to fish-bearing stream = 0-500m
AND
Elevation = 0-800m

TYPE 8: ABORIGINALLY LOGGED CMTS

1) AC = 250 years old or greater
AND
SC = presence of western red cedar
AND
Slope = 0-45°
AND
Distance to coastline = 0-300m OR Distance to fish-bearing lake = 0-100m
AND
Elevation = 0-550m

2) AC = 250 years old or greater
AND
SC = presence of western redcedar
AND
Slope = 0-45°
AND
Distance to coastline = 0-2000m
AND
Distance to fish-bearing stream = 0-500m
AND
Elevation = 0-550m

TYPE 9: FISH TRAP

PSM = F, FG, or LG
AND
Distance to coastline =0-1m
AND
Distance to fish-bearing stream = 0-100m
AND
Slope = 0-5°

TYPE 10: FISH WEIR

Distance to fish-bearing stream = 0-1m
AND
Slope = 0-5°

TYPE 11: HUMAN REMAINS

Distance to recorded archaeological site = 0-500m
AND
Distance to coastline = 0-100m
AND
Distance to fish-bearing stream = 0-1000m OR Distance to any stream = 0-500m
AND
Slope = more than 69°

TYPE 12: PETROFORM

PSM = F, M, or FG
AND
Distance to coastline = 0-50m
AND
Wetlands = present
AND
Distance to fish-bearing stream =0-25m
AND
Slope =0°

TYPE 13: ROCK ART

Distance to recorded archaeological site = 0-500m
AND
PSM = F, L, M, FG, or LG
AND
Distance to coastline = 0-50m OR Distance to fish-bearing lake = 0-50m OR Distance to fish-bearing stream = 0-25m

TYPE 14: CANOE RUN

PSM = F, L, M, FG, or LG
AND
Distance to recorded archaeological sites = 0-100m
AND
Distance to coastline = 0-1m
AND
Slope = 0-5°

Figure 9. Logical Statements Used in the Overview Model.

Because the area covered by the study area is comprised of 20 TRIM mapsheets, two test areas comprised of 1:20,000 scale TRIM mapsheets were chosen from within the study area order to permit a manageable review of the preliminary application of the non-CMT and CMT models. Not only did the test areas provide a close-up view of the results at a reasonably large scale, but they also made computer processing tasks less onerous due to the lower volume of data involved. Obvious problems with the model could be detected, and revisions could be made to the model prior to its application to the entire study area. The test areas were also useful for reviewing the digital coverages of selected biophysical variables. Figure 10 indicates the location of the test areas within the study area.

- Test Area 1: TRIM sheet 92K.051 - This test area is representative of the "Mainland" environment including inland waterways, large fresh water lakes, and interior rivers (Topaze Harbour, Lapan Creek and Seabird Lake), plus several small lakes. Figure 2 is a photograph of Jackson Bay which is located within Test Area 1.

- Test Area 2: TRIM sheet 92K.034 - This test area is representative of an "Island" environment with examples of coastline, creeks draining into the ocean (St. Aubyn Creek), and inland Lakes (St. Aubyn Lake). Figure 4 is a photograph of Sonora Island which is located within Test Area 2.

The model was applied to these test areas on three separate occasions, and the results were outputted in paper and digital form. The results were reviewed to ensure that the GIS coverages were accurate and that the model was correctly applied. Errors in the GIS coverage and model statements were identified and corrected, and in some cases buffer widths were adjusted. When the modelled output met all expectations, the model was run against the entire study area.

3.8.2 Variable Coverages and GIS Modelling Outputs Review

During the preliminary stages of the project, and as new input data became available in digital format, hardcopy displays were produced for review. This allowed for error checking as well as assessing whether or not individual variables were being captured correctly. The same procedure was used in the initial modelling exercises, where the model statements were applied to the database records for the two test areas, and the results subsequently output in digital and paper form for review and revision.

3.8.3 Application of the Model to the Test Areas

Before applying the models to the test areas, each digital coverage (GIS map layer) was divided into a 30 m grid, creating millions of map 'cells' across the study area. As discussed earlier, this project used a grid based GIS modelling technique that allowed for each 30 x 30 m square to be updated based on the presence or absence of features at that location. When all coverages were added together each resulting grid cell would show:

- The presence or absence of each feature and, in some cases, the specific type of feature;
- The results of testing for the combination of features and assigning a value to one or more of the traditional activity fields; and
- The highest value achieved for all TYP fields; this value becomes the overall potential value for this location.

The GIS created a database containing the codes for all the features present for each cell in all of the digital coverages used in the model, and then it applied the model statements to each database record. The results of this process were then used to classify the area into different classes of non-CMT and CMT archaeological potential.

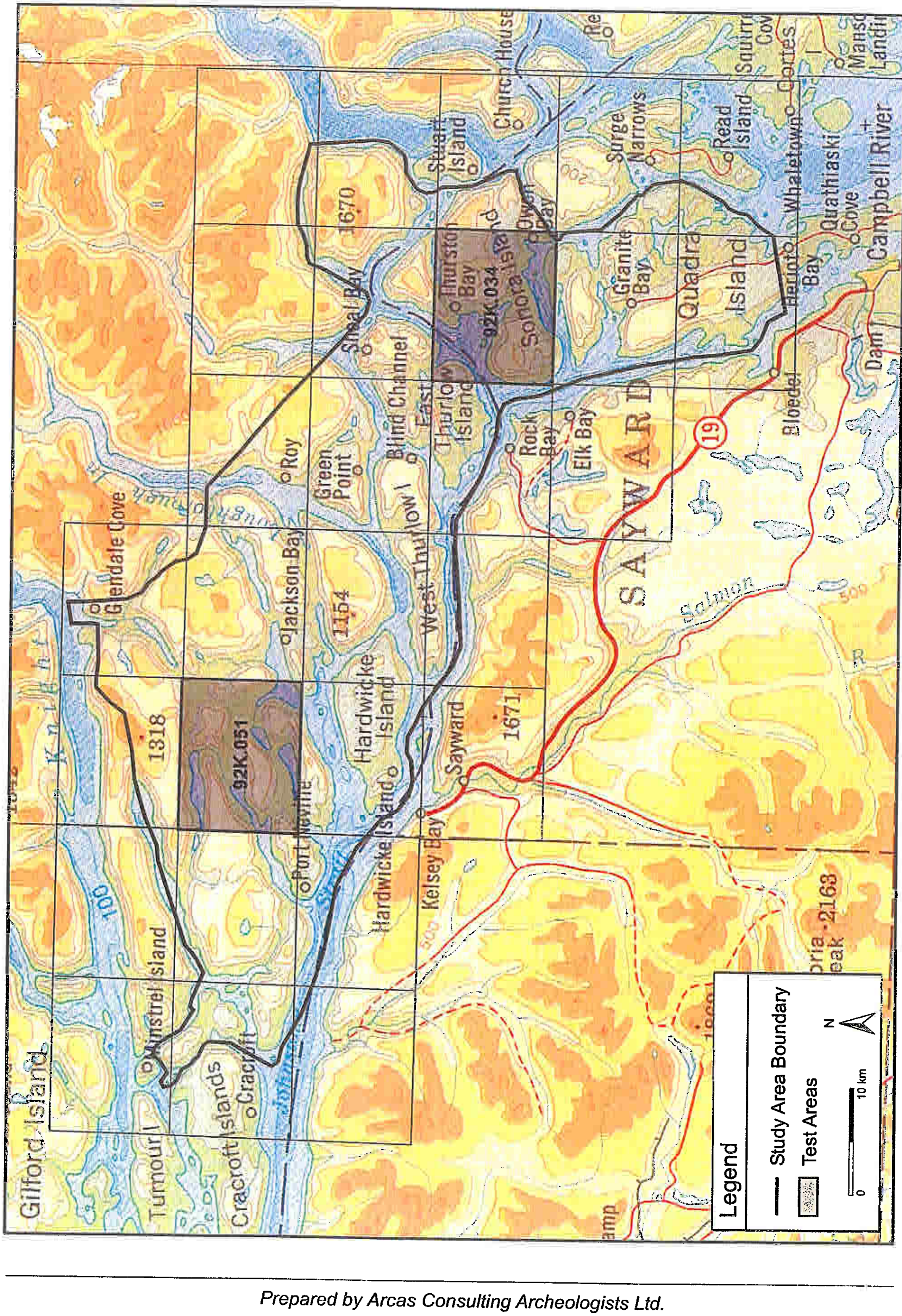

Figure 10. Location of test areas within the Study Area (1:500,000).

Once a test run was completed, the output for each of the test areas was examined. The levels of CMT and non-CMT potential and known site locations were visually reviewed as a quick guide to the model's effectiveness. Figures 11 and 12 provide examples of how the non-CMT and CMT models translated visually within the test areas. Following each review, a request for changes was sent to Range & Bearing. When the modelled output met all expectations, the model was run against the entire study area and the results were mapped on a large scale map of the entire study area.

3.8.4 Groundtruthing of the Model in the Test Areas

From the onset of this project it was agreed by both TFL and Arcas that, if at all possible funds should be made available for the inclusion of a groundtruthing component in the AOA. While groundtruthing is not required for an AOA, it is an extremely valuable tool in that it brings together the office work that culminates in the theoretical model and compares it to the physical reality of the study area. Groundtruthing can provide valuable feedback that can be used to make the archaeological potential model even more powerful.

A budget was approved for the groundtruthing component of the AOA in 2001. An attempt was made in March 2001 to commence with a preliminary groundtruthing component but fieldwork was cancelled due to poor weather conditions. Groundtruthing commenced in earnest February 2002. Arrangements were made prior to the fieldwork for representatives from the HTS and Homalco First Nations to participate in the fieldwork. In total, six days (February 11-14, 18-19) were spent groundtruthing, with a seventh day (February 15) thwarted due to fog and poor visibility. Weather conditions dictated the parameters concerning where fieldwork could take place, particularly areas that could not be visited due to snow. The core crew consisted of Heather Pratt (Arcas), Gerald Joseph (Homalco First Nation), and Ted Lewis (HTS). Darren Matilipi (HTS) assisted on two days when Ted Lewis was not available. TFL personnel also assisted on an as-needed basis and included: Colin Buss, Byron Basso, and Peter Schare.

Groundtruthing took place within the two previously mentioned test areas as they were subjected to a preliminary version of the model prior to the rest of the study area, and any newly gathered data could be fed back into the model, run on the test areas, and the results easily analysed because there would be a greater familiarity with the test areas after fieldwork completion.

Groundtruthing methodology depended upon travel situations, weather conditions, and staffing. Rather than running systematic quadrants or transects, the fieldwork was conducted judgementally. Traverses were planned and discussed with the crew prior to fieldwork in order to allow for input from people who were experienced working in the area and knowledgeable about actual field conditions. Known archaeological sites in the study areas were re-visited when possible in order to confirm the accuracy of the modelling variables used in representing the physical environment for particular archaeological feature types.

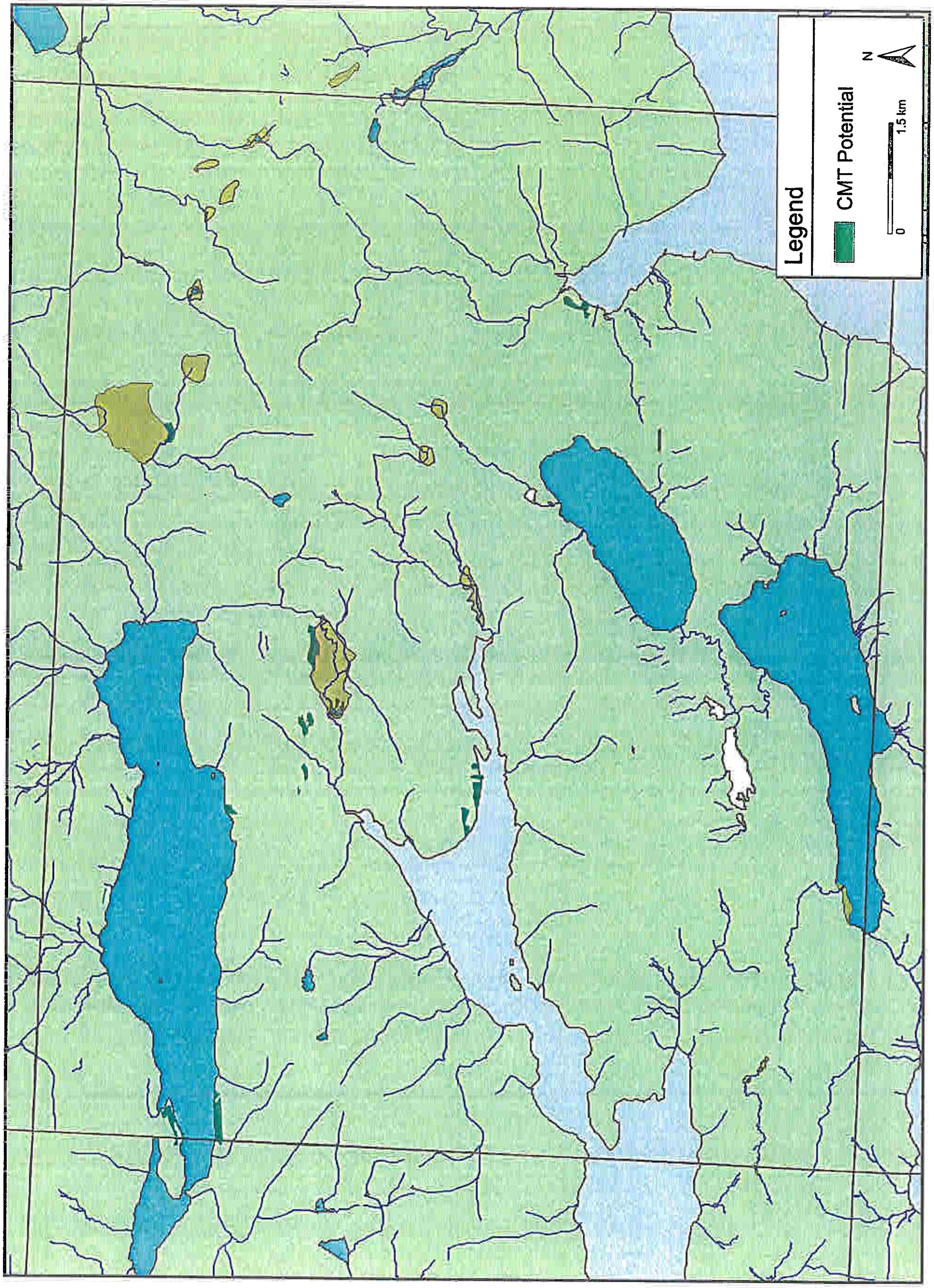

Figure 12. Jackson Bay (92K.051) Modeled for CMT Archaeological Resource Potential (1:75,000).

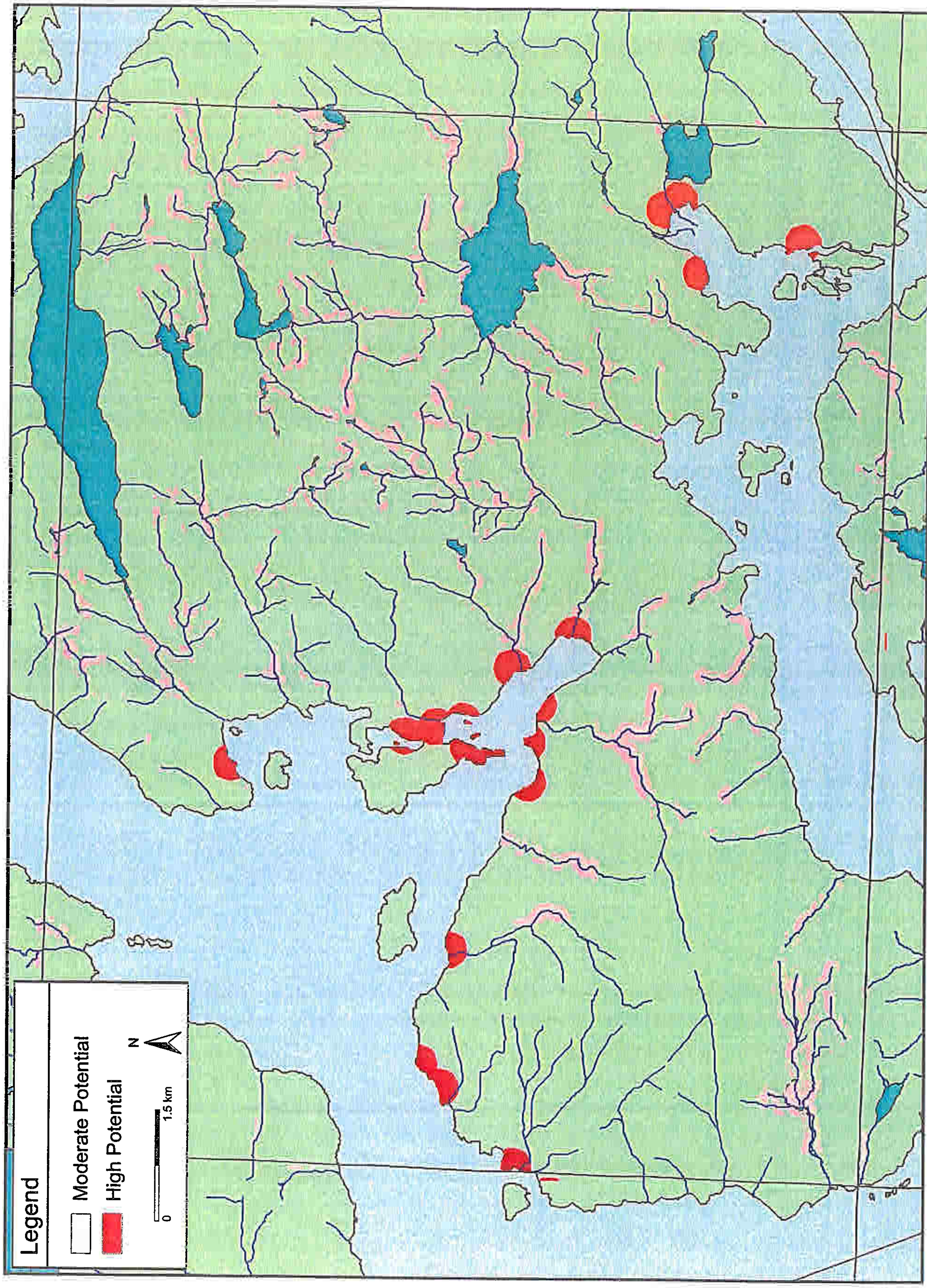

Figure 11. Sonora Island (92K.034) Modeled for Non-CMT Archaeological Resource Potential (1:75,000).

The purpose of the groundtruthing component was threefold: 1) verification as to the accuracy of the baseline data used in the model; 2) verification of the modelling assumptions; and 3) verification of modelling results. These three objectives were met with varying degrees of success.

Due to the relatively limited size of this AOA (in comparison to most other large-scale AOAs), and the availability of well-defined digital data from TFL, there were no significant differences in the digital baseline data and the actual physical ground observed in the study area. One advantage of working with only one licensee was that digital data came from one source and that source had already ascertained any problems with the data and rectified those problems prior to the data being used as baseline data for the AOA. A significant amount of time was saved by not having to coalesce several different digital data sources and confirm the data source accuracy.

The verification of modelling assumptions was also fairly successfully met. As discussed in the following paragraphs, the significance of slope, aspect, and nearness to salmon streams were confirmed to be highly significant based on observations made in the field. In general, slope and weather are the greatest constraints on where people could live on the coast. Once those constraints were dealt with, available food resources could be assessed and utilized accordingly.

The groundtruthing component took place during the preliminary stages of modelling and it was not until after groundtruthing had finished that the final stages of modelling creation were completed, making it difficult to verify the final CMT and non-CMT model results. Ideally, a second round of groundtruthing after the model revisions would have been desirable. Funding limitations and time constraints made such an endeavour impossible.

One day of fieldwork was devoted to getting a sense of the "big picture" or macro environments present throughout study area. To achieve this goal, a helicopter was rented from VIH Campbell River and Colin Buss of TFL kindly acted as a guide for an aerial tour of the study area. One advantage to helicopter overflights is the ability to cover a significant amount of ground in a minimal amount of time. The entire study area was easily covered in one day, including the landing of and groundtruthing of shoreline and forest at Port Neville, the mouth of Read Creek, and Kanish Bay. The aerial overflight path (Figure 13) covered all portions and macro environments of the study area including a fly over of any known significant patches of old growth western redcedar and cypress present in the study area. The general impression of the landscape is one in which climate dominates. People's activities have always been controlled by the weather on the coast and in places where the effect of weather (wind in particular) can be minimized, there will be greater potential for finding evidence of people having lived there in the past. The importance of aspect was emphasized in the study area and through the use of TEM data, it could be included in the model.

Three days of fieldwork were spent in and around Jackson Bay which is an extremely interesting area in terms of its prehistory, history, and ecology. The first day one of the fieldwork focused on walking an area of mostly second growth forest north of Jackson Bay and south of Tom Browne Lake (Figure 14). A small patch of old growth western redcedar is present near Shannon Lake and bark-stripped CMTs had been recently recorded in the area. No new CMTs were observed but a patch of previously unknown old growth western redcedar was observed south of Tom Browne

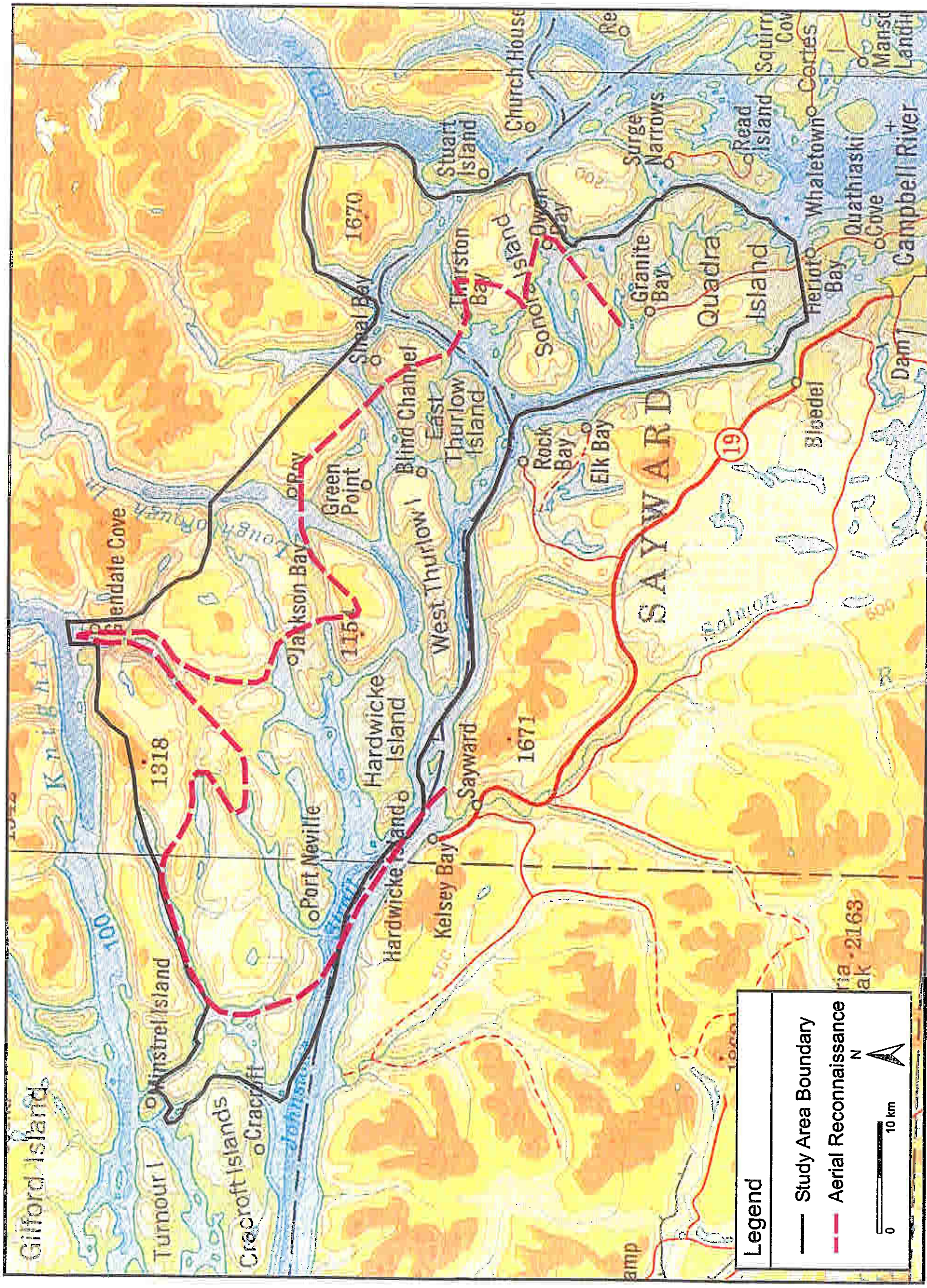

Figure 13. Study Area, showing aerial reconaissance (1:500,000).

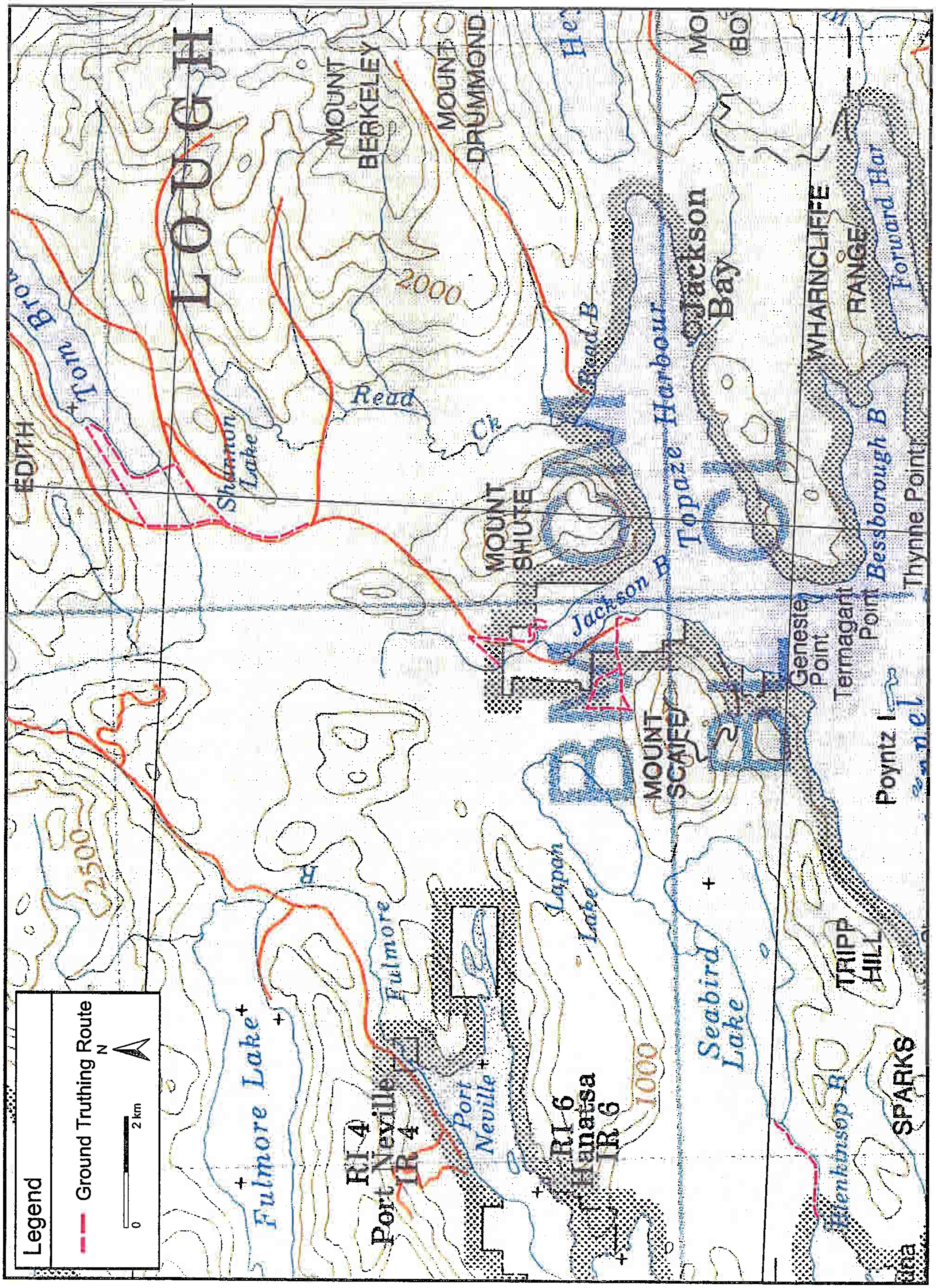

Figure 14. Jackson Bay (92K.051), showing ground truthing (1:100,000).

Lake. Inland midden sites are not well known or documented archaeologically and it was hoped that groundtruthing the forested area north of Jackson Bay would provide some insight as to the potential for inland midden sites or artifact scatters.

The Jackson Bay area is a place of great spiritual significance to the descendents of the Lekwiltok people as their oral histories tell how they came to first exist in Jackson Bay after a great flood. It is apparent that the area supports high archaeological potential due to the presence of salmon streams, gentle slope, and the presence of other foodstuffs in adequate supplies to support a village. Unfortunately, the relationship of CMTs to the village sites present in Jackson Bay and at Read Creek cannot be ascertained as there is little old growth western redcedar present in the area, but that which remains can be considered to have high potential for the presence of CMTs.

The morning of the second day of fieldwork in Jackson Bay focused on an area of old growth western redcedar near the existing Jackson Bay camp and several previously recorded CMTs. In the afternoon, a walk around the north shore of Jackson Bay indicated high potential for the presence of archaeological resources based on the presence of a significant fish creek (with an associated previously recorded fish trip) and moderate slope from the shoreline back for several metres throughout the area.

The third day of groundtruthing in Jackson Bay did not focus on the shoreline or the forest. Instead, the focus was on an area of great interest but poorly known in terms of its archaeological significance. The survey commenced at the shore of Seabird Lake which is a large freshwater lake connected to the ocean via Bareside Bay. From the lakeshore, the crew walked most of the bank of the Tuna River which flows from Seabird Lake to Bareside Bay. The Tuna River is easy to walk as it is associated with gently sloping terrain in most places. A previously recorded fish trap is present at the point where the river flows into Bareside Bay, but it was not clearly visible due to high tide. The river would be a natural travel corridor for travelling from Bareside Bay towards Seabird Lake, Lapan Lake and ultimately Jackson Bay. No old growth western redcedar was in this area.

Groundtruthing indicated that the preliminary CMT model based on TEM was not working very successfully. Patches of old growth western redcedar that had been observed near Shannon Lake and between Jackson Bay and Lapan Lake were not being captured by the original model as areas having moderate-to-high CMT potential and yet CMTs were present in both areas. Furthermore, the extent of second growth forest makes it clear that any patches of remaining old growth western redcedar should be given full attention and surveyed for CMT potential.

Groundtruthing confirmed the significance of slope to the non-CMT and CMT model. The original non-CMT model was discovered to be remiss in that many areas of relatively gentle slope associated with salmon streams (such as the Tuna River) were not showing significant potential and yet in the field it was apparent that such areas had moderate to high archaeological resource potential. Much of the study area is constrained by steep slope. In those areas where slope is gentler, there is much greater archaeological potential.

Two days of groundtruthing were conducted on Sonora Island (Figure 15). The first day commenced at the shore of Barnes Bay. The shoreline from Barnes Bay to St. Aubyn's creek was traversed including a short section of St. Aubyn's creek bank. The walk back to Barnes Bay proceeded along a built Mainline which provided for some opportunities to observe the mostly second growth forest present in the area. Two possible bark-stripped western redcedar trees were observed in a patch of possible old growth southeast of Barnes Bay. At this time, no CMTs have been recorded for Sonora Island, but it is not known whether anyone has actually looked for them. Due to the drier climate, western redcedar would never have been common on Sonora, but it would have been present. There are stands of old growth cypress present in higher elevations on the island. It had been hoped that one of these cypress stands could be traversed during fieldwork, but snow prevented this from happening.

Transportation on Sonora Island was not available, making any fieldwork more challenging than usual. With this in mind, the second and final day of groundtruthing on Sonora Island involved chartering a boat to navigate the entire shore of the Island. While it had been hoped that some CMT traverses could be conducted, this was not the case. As with the Jackson Bay situation, any old second growth or old growth western redcedar present on the Island would be considered to have moderate to high archaeological potential unless proven otherwise. The boat trip allowed the crew to observe many areas of the Island including the Homalco Reserve (Mushkin IR 5/5A), Thurston Bay (including an extremely interesting lagoon feature), Cameleon Harbour, Binnington Bay where a large village site is located, Young Passage where several pictographs are recorded but only one was relocated, and Discovery Passage. Sonora Island has never been fully inventoried and there is still much work to be done. Weather and its effects on the Island could be easily observed based on the presence or absence of midden sites. In most cases, where it was determined that aspect, slope, and the prevailing winds were favourable, one could see evidence of past occupation.

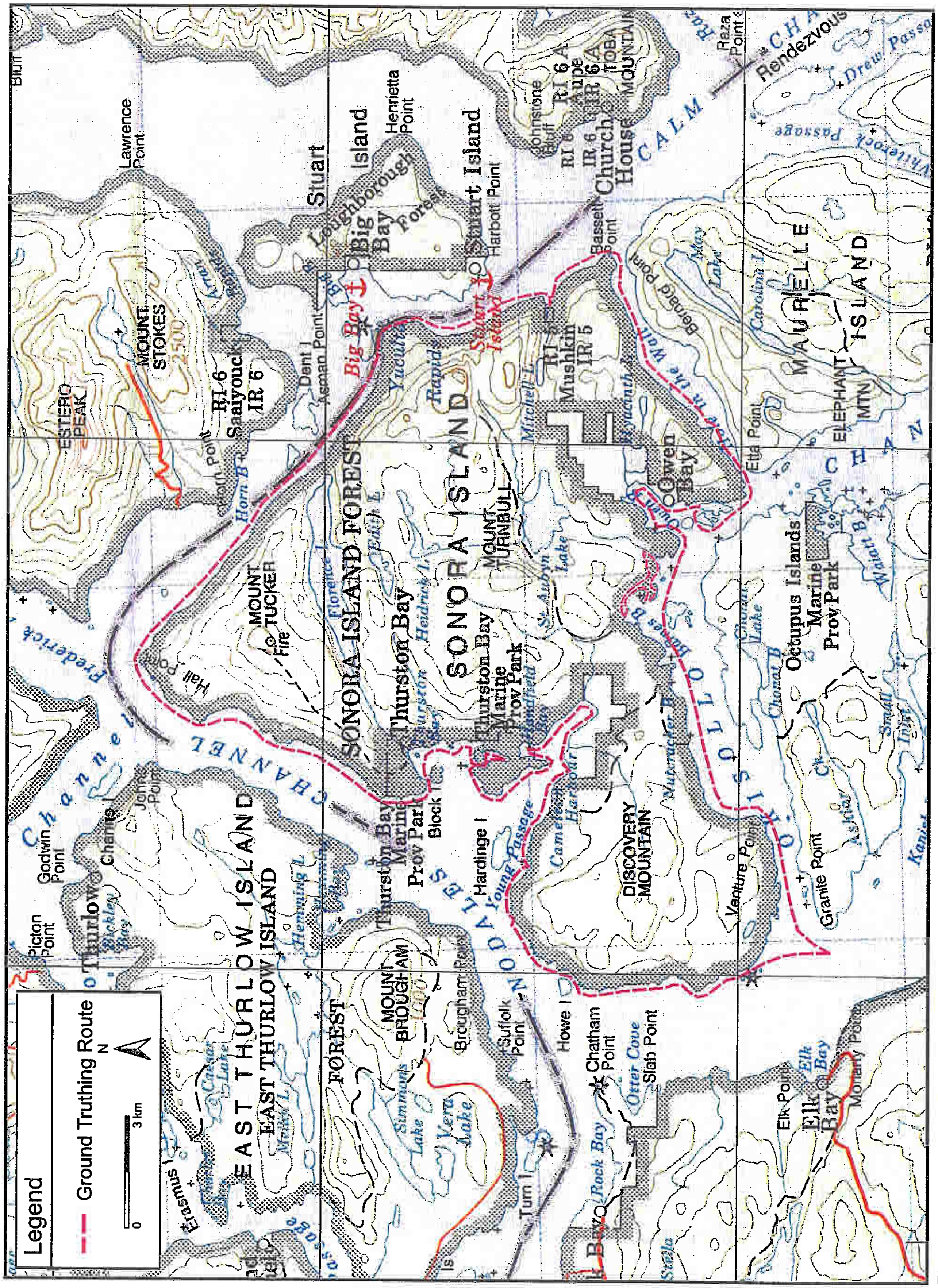

Figure 15. Sonora Island (92K.034), showing ground truthing via boat (1:150,000).

4.0 RESULTS OF ARCHAEOLOGICAL POTENTIAL MAPPING

4.1 Model Results

The GIS model used in the overview classified the entire study area into three classes of non-CMT potential: Class 1 (High potential, Low constraint); Class 2 (Moderate potential, Moderate constraint); and Class 3 (Low potential, High constraint). As well, two classes of CMT potential were used: Moderate-to-High, and Low. These classes are described in Section 2.2. "Potential" refers to the potential that a portion of the landscape has for supporting the types of traditional land use activities that would have resulted in the formation of archaeological resources. Overall for non-CMT archaeological resource potential, .95% of the overview area was modelled as having Class 1 potential, .50% was modelled as having Class 2 potential, and 98% was modelled as having Class 3 potential. Approximately .13% of the overview area was modelled as having Moderate-to-High CMT potential and 99.87% was modelled as having Low CMT potential (see Tables 9 and 10).

High potential areas are the most favourable for such activities, and therefore have the highest probability of containing archaeological sites. Although the highest overall density and frequency of archaeological sites should be found in Class 1 areas, sites are not necessarily present at all points within these areas. Conversely, Class 3 areas have the lowest probability of containing archaeological sites, and the lowest overall site density and frequency are expected in these areas. However, it is important to keep in mind that low potential areas do not have 'zero' potential, and archaeological sites may be present in Class 3 lands. Moreover, because significant archaeological data gaps exist, the distribution of currently recorded archaeological sites should not be considered as representative of the study area as a whole.

Table 9. Study Area Breakdown by Non-CMT Potential Class.

Potential Class (Non-CMT)	Area (in hectares)	Percent of Total Area
1 (High)	2,018.24	0.95%
2 (Moderate)	1,049.07	0.49%
3 (Low)	208,991.67	98.56%
Total	212,058.98	100%

Table 10. Study Area Breakdown by CMT Potential Class.

Potential Class (CMT)	Area (in hectares)	Percent of Total Area
Moderate-to-High	276.13	0.13%
Low	211,782.85	99.87%
Total	212,058.98	100%

As shown in Table 9, 1.5% of the terrain in the study area falls in areas classified as Moderate to High potential for non-CMT archaeological resources, and .13% of the terrain falls in areas classified as having Moderate-to-High potential for CMT archaeological resources. Currently it is difficult to compare these results with other overviews because this is the first GIS overview of a coastal landscape on the east side of Vancouver Island. It does not make sense to compare with the Golder AOA as that is the AOA under revision and no other AOAs have been undertaken since the Golder AOA.

4.2 Overall Modelling Limitations

The following limits to the models have been noted:

- Modelling with TEM data met with only limited success as it was difficult to ascertain whether TEM definitions were similar to those used for the AOA. For example, the variable "Soil Drainage" was used in modelling for the presence of several non-CMT archaeological resources. While checking the preliminary results it became apparent that the TEM definition of drainage categories (well drained for example), was different than that used for the modelling statements;
- Attempting to model for CMT potential using TEM data was inconclusive and abandoned after the first stage due to the inability of the model to accurately predict the presence of CMTs in second growth stands;
- The second generation CMT model was run using the traditional non-TEM data and the results for this model were also less than stellar. Some of the study area did not have associated TEM data and attempting to mix TEM and non-TEM data proved less than satisfactory. The challenges of modelling in a predominantly second growth forest became quite apparent;
- Some features which may affect archaeological potential were not used due to a lack of data or GIS limitations;
- Insufficient palaeoenvironmental information is available for modelling environmental change over time;
- Insufficient site distribution data is available to confidently determine width of feature buffers;
- Accuracy of recorded site plotting is insufficient to allow confident assessment of site/slope associations; and
- The reliance on limited ethnographic and historic sources for modelling land use may not accurately reflect all precontact land use activities.

4.3 Data Gaps

While this study has benefited from the work done for previous overviews, and from a continuing improvement in the availability and quality of digital data, data gaps were encountered which imposed certain limitations to the archaeological potential model. Each of these presented particular problems for the modelling process; some were resolved during the project, and others remain to be addressed in future studies of this nature. The following sections discuss the various data gaps encountered.

4.3.1 Archaeological Inventory

To facilitate resource management and land use decision making, it is important to be able to predict a landscape's potential for containing archaeological resources with reasonable certainty. The development of a good model is partially dependent on the availability of information about archaeological sites in a wide range of locations and types in order to better understand the level of constraint present. The information used to build the model should come from all parts of the study area, should represent all geographical settings within the area, and should not be biased towards certain types of archaeological sites.

Our review of the current state of knowledge about the geographic distribution of archaeological resources in the study area identified three gaps thought to be significant in the development of a good model. These are: incomplete geographic coverage in the existing archaeological site inventory; emphasis on particular site types and archaeological resources in the inventory; and deficiencies in available archaeological site information and recording procedures. Each of these perceived data gaps will be discussed below.

Large parts of the study area have not been systematically inventoried for archaeological resources. With the exception of a few forestry-oriented assessments including an overall lack of inland survey. Exceptions are a few forestry-oriented assessments. Consequently, inland archaeological sites are inadequately represented in the current inventory. Furthermore, our understanding of the nature, frequency, spatial distribution, and antiquity of inland prehistoric archaeological resources is inadequate and hinders our ability to predict inland site locations.

Most of the archaeological surveys carried out in the study area have focused on shoreline surveys and as a result some types of archaeological resources are not well represented in the current site inventory. These include: forest utilization sites, burial sites of various kinds, intertidal lithic scatters, intertidal 'wetsites', wooden weirs in creek estuaries, defensive sites, inland camps and resource sites, sites associated with ancient landforms such as raised marine beaches, all types of prehistoric subtidal remains, and nearly all types of historic archaeological sites. Prior to 1991, locations containing CMT resources were not entered in the B.C. Archaeological Site Inventory. As a result, most archaeologists did not formally record CMT locations as archaeological sites, and many CMT sites identified in the past remain formally unrecorded.

It is important that the archaeological site inventory be complete, accurate, and current. Although this is an idealized situation, and no inventory ever totally attains these standards, the present inventory has some deficiencies that should be addressed. Sites identified before 1980 were not usually recorded to contemporary standards and often lack information required by today's recording standards. Secondly, some fields on the B.C. Archaeological Site Inventory Forms have been recorded inconsistently. Thirdly, as GIS-based resource mapping continues to become an important tool in archaeological resource planning, it is crucial that the UTM information recorded on B.C. Archaeological Site Inventory Forms be based on not only the North American Datum of 1927 (NAD 27) as presently used, but also on the North American Datum 1983 (NAD 83) used on TRIM maps which form the digitized base mapping for most contemporary archaeological overviews.

In addition, the likelihood that the results of the present overview will be treated as definitive in future land use decision making is a concern that should be addressed. Because of the gaps that exist in the information currently available for archaeological resources of the overview area, the present digitized maps and associated digital files should be considered initial rather than final statements of archaeological potential within the study area. As the inventory of known archaeological sites and associated landscapes is expanded, it will be important to update the overview. The overview is a preliminary study which will need to be periodically revised and groundtruthed.

4.3.2 Digital Mapping Information

This study attempted to model for the presence of CMT potential in second growth forest using the biogeoclimatic zone data present in TEM. Preliminary attempts at such modelling met with little success and was abandoned. Instead, the study resorted to the traditional use of TRIM and forest inventory data. Nevertheless, we feel that due to the unique circumstances of this study area (most of it containing second growth forest), modelling for CMT potential in second growth stands using TEM data should be attempted again, with the creation of a model exclusively for CMT potential in second growth forest. It was hoped that this study would be the first to successfully model CMT potential in second growth stands, but the required TEM data was not available for part of the study area. The decision was therefore made to use existing forest cover data, rather than TEM data.

Information concerning fire history and accurate forest inventory are known to exist for the study area but they were not available for this project in a digital format. Such data should be digitally available in order for the next generation of CMT modelling to take place.

Unfortunately, due to budgetary and digital constraints it was not possible in this study to analyse the distribution of recorded archaeological sites in each archaeological potential class for the entire study area. This is a data gap that should be addressed if further funds are made available.

Areas with potential for canoe portages could not be modelled because the GIS was not able to pick out and separate these areas with the data currently available.

Mountain goat hunting and intertidal gardening plots for silver weed are traditional activities known to have taken place in the study area, but were not modelled due to insufficient data coverage at this time.

While preparing the second generation CMT logical statements, it was discovered that Height Class (HC) had to be removed from the logical statements because some old growth polygons had HC = 0 which removed those polygons from having CMT potential. It is not known why Height Class data was missing, but it should be addressed.

It had been the intent of part of this study's intent to utilize as much as possible of the digital data from the Golder AOA as possible in order to simplify the revised AOA process. It was anticipated that digitized trails for the study area would be included in the original AOA data, but this was not the case, as only two trails are recorded and digitized for the study area and trails can be considered a data gap.

As previously discussed in Section 3.1, communication between the HTS and Arcas concerning access to the digital TUS information compiled by the HTS for its asserted traditional territories took place but no information exchange was agreed to at that time. Eventually, the amalgamation or joint use of the TUS data and the AOA data will make the AOA that much more powerful and it is hoped that further conversation concerning this outcome will continue between TFL and the HTS.

4.3.3 Data Gap Recommendations

The following recommendations are made in order to address these data gaps. A general recommendation as to future dealings with data gaps is provided in Section 5.3 of this report.

Archaeological Inventory

- To address the deficiencies in archaeological inventory data, we recommend that TFL and/or the MoF initiate an application for a systematic archaeological inventory of the overview area, particularly poorly represented inland portions.

Digital Mapping Information

- We recommend that prior to any future overview projects in British Columbia involving digital forest cover data, the location and condition of the data be clearly documented before project initiation in order to avoid cost overruns and time delays.

- The issue of modelling for CMT resources in harvested areas needs to be addressed. We recommend that the forest stand type of harvested areas be included in the digital forest cover data.

- The issue of modelling for CMT resources using accurate TFL forest inventory data and forest fire history needs to be addressed. We recommend that the TFL forest inventory and fire history be included in the digital forest cover data.

- The issue of missing Trail data and TUS data should be discussed between the HTS and TFL in the hopes that an agreement can be made concerning information sharing. If successful, such a framework should be used to commence discussion with the Homalco First Nation and the possibility of future information sharing protocols.

5.0 RESOURCE MANAGEMENT AND RECOMMENDATIONS

5.1 Archaeological Resource Protection

Archaeological resources are protected under the *Heritage Conservation Act* (1995), which is administered by the Archaeology and Forests Branch (Ministry of Sustainable Resource Management). Provisions of the *Act* apply whether archaeological resources are located on public or private lands. Archaeological resources are protected through designation as "Provincial heritage sites" under section 11 of the *Act*, or through automatic protection under section 13 of the *Act* by virtue of being of particular historic or archaeological value. The *Act* protects a site from damage, alteration or removal if: the site was used or occupied prior to 1846; it is reasonable to assume, in the absence of absolute (i.e., calendar) dates, that the site was used or occupied prior to 1846; the site is a burial place, aboriginal rock painting, or aboriginal rock carving, regardless of age; the site is on a schedule of heritage sites that are of particular spiritual, ceremonial, or other cultural value to an aboriginal people with whom the Province has entered into a formal agreement regarding the conservation and protection of heritage sites.

A person may not alter, that is, change in any manner, a Provincial heritage site or an archaeological site protected under section 13 of the *Heritage Conservation Act*, without a permit issued by the Minister or designate under sections 12 or 14, or an order issued under section 14, of the *Act*. The *Act* affords considerable discretionary authority in determining if, and under what circumstances, such permits are to be issued.

A section 12 permit is also known as a site alteration permit and it authorizes the holder to alter an archaeological site when the alteration is not part of a heritage inspection. A forest utilization sites comprised of CMTs cannot be altered without a site alteration permit unless the CMTs post-date 1846. It can be difficult to determine the age of a CMT without altering it in some way and this cannot be done unless a heritage inspection permit has been obtained. Examples of alterations to CMTs that could be authorized under a section 12 permit include: felling of standing CMTs, disturbing or moving CMT logs and stumps during yarding, removal of felled CMTs from the timber harvesting area, and the milling of CMTs. Alterations under a section 12 permit cannot be initiated until an archaeological impact assessment (see below for a definition) has been completed, reviewed and approved by the Archaeology and Forests Branch.

5.2 Archaeological Resource Management

The management of archaeological resources is the responsibility of the Archaeology and Forests Branch of the Ministry of Sustainable Resource Management (MSRM) on all provincial lands, both public and private. On public forest lands, archaeological resource impact management is shared by the MSRM and the MoF. The MSRM encourages and facilitates the protection and conservation of the province's archaeological resources through the Archaeological Impact Assessment and Review Process. Studies are initiated under this process in response to development proposals which involve land alterations that potentially endanger archaeological resources. The process is described in the *British Columbia Archaeological Resource Management Handbook* (Apland and Kenny 1995a) issued by the MSRM, whereas the *British Columbia Archaeological Impact Assessment Guidelines* (Apland and Kenny 1995b), also issued by the MSRM, provides guidance to the studies conducted under this process.

On public forest lands, the MSRM and the MoF share the responsibility for integrating archaeological resources and other cultural heritage resources into forest development plans. The roles and responsibilities of both parties is defined in *The Ministry of Small Business, Tourism, and Culture, and Ministry of Forests Protocol Agreement on the Management of Cultural Heritage Resources* (Revised October 1996). The need to address the management of cultural heritage and archaeological resources in forestry operations is clearly stated in the *Forest Act*, and the *Forest Practices Code of British Columbia Act* requires the inclusion of cultural heritage resources in both strategic and operational planning.

The *British Columbia Archaeological Impact Assessment Guidelines* define several kinds of studies that can be carried out in response to proposed developments:

- Archaeological Overview Assessment (AOA)
- Archaeological Impact Assessment (AIA)
- Archaeological Impact Management (AIM)

An AOA has been previously defined in Section 1.0 of this report. An AOA can be undertaken for large planning areas such as the study area, or for small development locations such as a proposed subdivision or new road alignment. The results from an AOA can be used to guide subsequent AIAs.

An AIA involves an inventory and impact assessment of a proposed development area. It is often required where the need for one has been identified in an AOA study, but can be ordered without an overview being conducted, especially in locations perceived as having "high site potential." An AIA usually addresses the full range of archaeological resource types possible in a development area. An AIA includes an archaeological resource inventory of the development area through a field survey (examination) of all or part of the area, evaluation of the significance of any archaeological resources present, assessment of potential impacts to resources present by proposed development, and recommendations for measures to manage adverse impacts (if any). The field survey often involves subsurface testing to determine if buried archaeological resources are present.

Archaeological impact management (AIM) involves the implementation of measures to manage adverse impacts to archaeological resources and are set out by the Archaeology and Forests Branch. Usually these measures are intended to avoid or reduce impacts. Other impact management options include data recovery through excavation, tree ring dating of CMTs, and monitoring of construction activities. Lastly, monitoring of development activities is sometimes ordered to ensure correct implementation of mitigative recommendations.

5.3 Archaeological Resource Management Recommendations

The results of the overview are presented in terms of three classes of archaeological resource potential for non-CMT resources: Class 3 (Low potential), Class 2 (Moderate potential), and Class 1 (High potential). The archaeological resource potential for CMT resources is expressed as either Low or Moderate-to-High potential (the potential classes were defined in Section 2.2). On paper maps, CMT potential is indicated by hatchered lines overlying the coloured non-CMT potential classes. The classes are mapped digitally across the study area.

All proposed developments should be reviewed to determine if any archaeological studies are required under the Archaeological Impact Assessment and Review Process (see above). The following is a list of management actions in response to a proposed development in the study area. A specific management recommendation concerning First Nations consultation has not been incorporated into the following management recommendations, but, TFL is responsible for consultation with all First Nations who have an identified interest in the proposed study area, and that this consultation should take place in a manner acceptable to all involved parties:

Non-CMT Resource Potential:

- If a proposed development is planned in an area with **Class 3 Potential (low)**, and no conflicts or concerns are demonstrated, then it is recommended that no further archaeological management actions take place. If conflicts or concerns are demonstrated, then it is recommended that the proponent consider the need for an in office review, PFR, or AIA in consultation with the First Nations, MoF, and the Archaeology and Forests Branch.

- If a proposed development is planned in an area with **Class 2 Potential (moderate)**, the recommended management action is: an in office review, or a PFR of the development area to identify the presence or absence of micro-features and assess their effect on the Moderate archaeological potential assigned to the area by the overview. If micro-features can be identified on air photos or maps then an in-office review is recommended. If these features are not present on air photos or maps then a PFR is recommended. We also recommend that the PFR be conducted under a heritage inspection permit.

- If a proposed development is planned in an area with only **Class 1 Potential (high)** present, the recommended management action is: an AIA of the development area under a heritage inspection permit.

- If a proposed development is planned in an area with a combination of **Class 3 and 2 Potential, or Class 2 and 3 Potential**, the recommended management action is for that of the highest class present, to be applied to the entire proposed development area, with the possibility for adjustments to the management action based on a field review.

CMT Resource Potential

- If a proposed development is planned in an area with **Low CMT Potential**, the recommended management action if no conflicts or concerns are demonstrated, is that no further archaeological management actions take place. If conflicts or concerns are demonstrated, then it is recommended that the proponent decide on the need for an in office review, PFR, or an AIA in consultation with the First Nations, MoF, and the Archaeology and Forests Branch.

- If a proposed development is planned in an area with **Moderate-to-High CMT Potential**, the recommended management action is: a PFR in order to identify the presence or absence of CMTs. Where the PFR identifies CMTs, a subsequent AIA may be required. The need for an AIA should be determined in consultation with the MoF and the Archaeology and Forests Branch.

- If a proposed development contains areas with potential for both CMT and non-CMT resources the recommended management action is that a PFR or AIA be conducted under a heritage inspection permit, depending on the level of non-CMT potential.

- Due to the problems associated with the CMT model, if a proposed development contains old growth western redcedar and/or yellow cedar, the recommended management action is that an in office review should be applied to the development using the CMT modelling criteria to ascertain whether a PFR should be conducted in order to identify the presence or absence of CMTs. Where the PFR identifies CMTs, a subsequent AIA may be required.

The results of an AIA must be reported to the Archaeology and Forests Branch, who will review the assessment and forward recommendations for the management of possible impacts to archaeological resources to the development proponent or regulatory agencies. It is possible that some impacts will be so severe that a development cannot proceed, but more frequently the development can proceed if design or development plans are modified to avoid or reduce adverse impacts.

As discussed in the above recommendations, a reconnaissance assessment can consist of a variety of activities. The main purpose of the reconnaissance is to "fine tune" the archaeological potential assessment for the development area, using detailed information that was not practical or available for use in the overview model development. Such information could include: aerial photographs, topographic and biophysical mapping at scales larger than 1:20,000, revised or more detailed forest stand data, and information about traditional use sites provided by First Nation communities. A reconnaissance assessment might include the previously discussed PFR as defined in the *British Columbia Archaeological Impact Assessment Guidelines*. A PFR could consist of a simple overflight or windshield survey of the development area, or pedestrian "ground-truthing" of the development area to accurately assess its archaeological resource potential. Shovel testing is sometimes needed during a PFR to confirm site potential. If so, such a PFR must be conducted in accordance with a Heritage Inspection Permit issued by the Ministry of Sustainable Resource Management, pursuant to section 14 of the *Heritage Conservation Act*.

The reconnaissance assessment will result in recommendations either to conduct a full AIA or to carry out no further archaeological investigations for a particular development area. If no AIA is recommended, the reconnaissance assessment usually completes the archaeological work required for that development. The results of the reconnaissance assessment should be reported (see below).

5.4 Application of Overview Results

This overview was initiated and designed specifically for forestry planning. However, the results are equally applicable to management planning related to all forms of development in the study area, as well as to archaeological research and traditional use studies. We recommend that the model results be applied during development planning by all government ministries, government agencies, and industries responsible for overseeing or initiating land-altering activities, including Ministry of Forests, Ministry of Environment, Ministry of Transportation and Highways, BC Lands, BC Parks, forestry licensees, mining companies, and tourism operators.

All proposed land-altering developments should be reviewed to determine if (and what type of) archaeological studies are required. The CMT and non-CMT potential classes are mapped digitally across the entire study area, and are available in the form of digital files or paper maps from the Ministry of Forests, or TFL Johnstone Strait Operation Area.

For the application of the overview results in forestry planning, we recommend that the steps indicated in Table 11 be followed. TFL is primarily responsible for overseeing the application of the overview in forestry planning.

Table 11. Recommended Steps for Application of Overview Results in Forestry Planning.

Step	Required Action
1	Identify the mapsheets for areas where proposed forestry developments (including roads, gravel pits, cutblocks, silviculture areas, etc) are located.
2	Obtain the appropriate digital files and/or paper maps.
3	Using the digital or paper archaeological potential maps as an overlay on the development plan, determine the archaeological potential of the area affected by the proposed developments.

Step	Required Action
4	Determine the appropriate archaeological management action(s) for each development area or portion thereof (see Archaeological Management Recommendations).
5	Obtain additional information necessary for determining the appropriate archaeological work in consultation with the MoF and relevant First Nations.
6	Where required, engage an archaeologist to conduct a field assessment or further research.
7	Document results of all archaeological fieldwork or research so that future revisions to the model can be made.
8	Determine the appropriate management actions for identified archaeological resources in consultation with the MoF, the Archaeology and Forests Branch, and the First Nations.

5.5. Model Revisions and Recommendations

The TFL AOA presents a second attempt at a GIS-based archaeological resource potential assessment of the Johnstone Strait Operation Area. The overview results are partially limited by the digital information available for developing the potential model. Data gaps, with recommendations for addressing those gaps, are presented in Section 4.4. As new information becomes available through future archaeological studies, digitization of new datasets, and from First Nations communities, it is important that the model be revised, and that the revised model be applied to the overview. With this in mind, it is recommended that:

- TFL makes a commitment to a yearly review in order to assess the model's success. The review should be conducted by a committee comprised of representatives from the First Nation communities, MoF, the Archaeology and Forests Branch, and an appropriate archaeologist. The model should be revised when, in the opinion of the review committee, there is sufficient new information to require such a revision. This review and revision process would be subject to the availability of funding.

- The Archaeology and Forests Branch and the MoF support initiatives and studies required to address the data gaps identified in this overview; and

- Any revisions to the model be done under the direction or in consultation with the aforementioned review committee.

It is anticipated that AIAs for proposed forestry developments will be a critical source of information required to revise the model used in this overview. However, certain kinds of information about a development area need to be documented during an AIA if this information is to be of value for revising the model. In order to evaluate the model, each development area should be assessed in the field in terms of the criteria used by the model to determine potential. It will then be possible to compare archaeological potential as predicted by the model with archaeological potential as assessed in the field. Investigators also can use other criteria to assess potential, and these additional criteria could be included in future versions of the model. To ensure that the correct information is collected, it is recommended that:

- TFL require archaeologists undertaking PFR, or AIA assessments of proposed forestry developments within the Johnstone Strait Operation Area to complete, as part of the assessments, a form evaluating archaeological potential of the development area, in terms of the criteria used in the model plus any other relevant criteria. The form should be designed by the Archaeology and Forests Branch, be made available to TFL, and be attached to reports submitted to the Archaeology and Forests Branch.

In the past, reconnaissance assessments of proposed development areas, particularly timber harvesting blocks, were reported orally, or reported briefly in writing to the proponent, often in the form of a memorandum. These reports are seldom forwarded to the Archaeology and Forests Branch or, in the case of forestry developments, to the MoF. As a result, few archaeologists are aware of these reconnaissance assessments. To further complicate the matter is the introduction of CMT inventory projects and questions as to who will be responsible for compiling and reviewing the information gathered from future CMT inventories. To ensure that reconnaissance data are available to assist in the development of archaeological potential models, it is recommended that:

- The Archaeology and Forests Branch (and MoF, with respect to provincial forest lands) require that the results of all PFR and CMT inventory assessments be reported in writing and submitted to the Archaeology and Forests Branch.

- The Forest District should compile and maintain a list of all AIAs, PFRs, and CMT inventories conducted in the district. All reports should be kept on file at the district office.

6.0 REFERENCES

Ames, Kenneth M. and Herbert D.G. Maschner

1999 *The Peoples of the Northwest Coast: Their Archaeology and Prehistory.* Thames and Hudson, London and New York.

Apland, Brian and Ray Kenny

1995a *British Columbia Archaeological Resource Management Handbook.* Ministry of Sustainable Resource Management, Archaeology and Forests Branch, Victoria B.C.

1995b *British Columbia Archaeological Impact Assessment Guidelines.* Ministry of Sustainable Resource Management, Archaeology and Forests Branch, Victoria B.C.

Arcas Consulting Archeologists

1994a *Archaeological Resource Overview for the Kamloops LRMP.* Report on file, Heritage Resource Centre, Ministry of Community, Aboriginal, and Women's Services, Victoria B.C.

1994b *Archaeological Inventory and Impact Assessment, Alder Island, Broughton Archipelago, B.C.* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

1995 *Berry Island Archaeological Inventory and Impact Assessment, Broughton Archipelago, B.C.* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

1997a *Okanagan Timber Supply Area Archaeological Overview Assessment.* Report on file, Heritage Resource Centre, Ministry of Community, Aboriginal, and Women's Services, Victoria , B.C.

1998a *GIS Modelling of Archaeological Potential for the Northern Nuu-chah-nulth Hahoulthees, 1998.* Report on file, Heritage Resource Centre, Ministry of Community, Aboriginal, and Women's Service, Victoria B.C.

1998b *GIS Modelling of Archaeological Potential: Chilcotin Forest District, 1998.* Report on file, Heritage Resource Centre, Ministry of Community, Aboriginal, and Women's Service, Victoria B.C.

Archaeological Survey of Canada

n.d. *Canadian Archaeological Radiocarbon Database.* Electronic document accessible on the Internet at www.canadianarchaeology.com/radiocarbon/card/card.htm.

Bancroft, J. Austen

1913 *Geology of the Coast and Islands between the Strait of Georgia and Queen Charlotte Sound,* *B.C.* Canada, Department of Mines, Geological Survey, Memoir No. 23. Ottawa.

Barnett, Homer G.
1955 *The Coast Salish of British Columbia.* University of Oregon Monographs, Studies in Anthropology No. 4. Reprinted 1975 by Greenwood Press, Westport, Connecticut.

Berry, J.
1997 *Introduction to GIS Modelling and Application Issues Workshop.* Workbook prepared by Berry and Associates/Spatial Information Systems, Inc., Fort Collins Colorado.

Boas, Franz
1909 *The Kwakiutl of Vancouver Island.* American Museum of Natural History, Memoirs 8(2), Publications of the Jesup North Pacific Expedition 5(2): 301-522. New York.

1921 Ethnology of the Kwakiutl (Based on Data Collected by George Hunt) [2 parts]. *35th Annual Report of the Bureau of American Ethnology for the Years 1913-1914*: 43-1481.

1925 *Contributions to the Ethnology of the Kwakiutl.* Columbia University, Contributions to Anthropology, No. 3. New York.

1934 *Geographical Names of the Kwakiutl Indians.* Columbia University, Contributions to Anthropology, No. 20. New York.

Borden, Charles E.
1952 A uniform site designation scheme for Canada. *Anthropology in British Columbia* 3: 44-48.

Capes, Katherine H.
1964 *Contributions to the Prehistory of Vancouver Island.* Idaho State University Museum, Occasional Papers, No. 15.

Carlson, Catherine C.
1979 The early component at Bear Cove. *Canadian Journal of Archaeology* 3: 177-194.

Carlson, Roy L.
1990 Cultural antecedents. In *Handbook of North American Indians, Volume 7, Northwest Coast,* edited by W. Suttles, pp. 60-69. Smithsonian Institution, Washington, D.C.

1994 Trade and exchange in prehistoric British Columbia. In *Prehistoric Exchange Systems of North America,* edited by T.G. Baugh and J.E. Ericson, pp. 307-326. Plenum Press, New York.

Chapman, Margo W.
1972 Salvage excavations at two coastal middens. In *Salvage '71: Reports on Salvage*

Archaeology Undertaken in British Columbia in 1971, edited by R.L. Carlson, pp. 59-84. Simon Fraser University, Department of Archaeology, Publication No. 1. Burnaby, B.C.

1982 Archaeological investigations at the O'Connor Site, Port Hardy. In *Papers on Central Coast Archaeology,* edited by P. Hobler, pp. 63-132. Simon Fraser University, Department of Archaeology, Publication No. 10. Burnaby, B.C.

Codere, Helen
1990 Kwakiutl: Traditional Culture. In *Handbook of North American Indians, Volume 7, Northwest Coast*, edited by W. Suttles, pp. 359-377. Smithsonian Institution, Washington, D.C.

Demarchi, D., R. Marsh, A. Harcombe and E. Lea
1990 The Environment. In, *The Birds of British Columbia, Volume 1, Introduction: Nonpasserines, Loons through Waterfowl,* edited by R. Campbell, N. Dawe, I. McTaggart-Cowan, J. Cooper, G. Kaiser, and M. McNall, pp. 55-144. Royal British Columbia Museum and Environment Canada, Canadian Wildlife Service, Royal British Columbia Museum, Victoria B.C.

Deur, Douglas
2000 Report on the Dating of Rock Features at DhSk-12, Under BCAB Permit #1999-160. Report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Drucker, P.
1951 The Northern and Central Nootkan Tribes. *Bureau of American Ethnology, Bulletin 144.* Smithsonian Institution, Washington, D.C.

Ecological Data Committee
2000 *Standard for Terrestrial Ecosystem Mapping (TEM) - Digital Data Capture in British Columbia: Ecosystem Technical Standards & Database Manual. Version 3.0.* Available on the Internet at www.for.gov.bc.ca/ric/Pubs/teEcolo/temcapture/index.htm.

Fladmark, Knut R.
1986 *British* Columbia *Prehistory.* Archaeological Survey of Canada. National Museum of Man. Ottawa.

Galois, Robert
1994 *Kwakwaka'wakw Settlements, 1775-1920: A Geographical Analysis and Gazetteer.* UBC Press, Vancouver.

Golder Associates Ltd.

1999 *An Archaeological Overview of the Central Coast LRMP Area, Golder Associates, June 1999.* Report submitted to Ministry of Forests. Copy on file at the Heritage Resource Centre, Victoria, B.C.

Green, R.N. and Karel Klinka
1994 *A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region.* Ministry of Forests, Land Management Handbook No. 28. Victoria.

Ham, Leonard C. and D. Geordie Howe
1983 *Report of the 1983 Archaeological Investigations on Nimpkish Indian Reserve No. 3.* Consultants' report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Holland, S.
1976 *Landforms of British Columbia: A Physiographic Outline.* B.C. Department of Mines and Petroleum Resources, Bulletin 48. Victoria, B.C.

I.R. Wilson Consultants
1993 Excavations at EeSu 13 Port Hardy, Vancouver Island Permit 1992-92. Consultants' report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Kennedy, Dorothy I.D. and Randy Bouchard
1990 Northern Coast Salish. In *Handbook of North American Indians, Volume 7, Northwest Coast*, edited by W. Suttles, pp. 453-475. Smithsonian Institution, Washington, D.C.

Matson, R.G. and Gary Coupland
1995 *Prehistory of the Northwest Coast.* Academic Press, San Diego.

Meidinger, Del and Jim Pojar (editors)
1991 *Ecosystems of British Columbia.* Ministry of Forests, Research Branch, Special Report Series No.6. Victoria.

Millennia Research
1990 *Archaeological Impact Assessment of a Planned Subdivision on Stuart Island, B.C.* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Ministry of Forests
1995 *Riparian Management Area Guidebook.* Electronic document available on the Internet at www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/riparian/Rip-toc.htm#top.

Ministry of Forests, Research Branch
1994 *Biogeoclimatic Units of the Vancouver Forest Region* [Map Sheets 3, 4 and 5]. Ministry of Forests, Research Branch. Victoria.

Mitchell, Donald H.

1969a Site survey in the Johnstone Strait region. *Northwest Anthropological Research* 3: 193-216.

1969b Excavations at two trench embankments in the Gulf of Georgia region. *Syesis* 1(1): 29-46.

1979 Excavations in the Hopetown Village Site (EfSq-2) in the Knight Inlet area of British Columbia. In *Annual Report for the Year 1976: Activities of the Provincial Archaeologist Office for B.C. and Selected Research Reports,* edited by B.O. Simonsen, pp. 87-99. Victoria.

1981 Test excavations at randomly selected sites in eastern Queen Charlotte Strait. In *Fragments of the Past: British Columbia Archaeology in the 1970's,* edited by K.R. Fladmark, pp. 103-123. *B.C. Studies* 48.

1988 Changing patterns of resource use in the prehistory of Queen Charlotte Strait, British Columbia. In *Prehistoric Economies of the Pacific Northwest Coast,* edited by B.L. Isaac, pp. 245-290. Research in Economic Anthropology, Supplement 3, J.A.I. Press, London and Greenwich.

1989 Changing Fortunes: Kwakiutl - Salish Frontiers of the Central Northwest Coast. In *Development of Hunting-Fishing-Gathering Maritime Societies along the West Coast of North America,* edited by A. Blukis-Onat. Reprint Proceedings, Volume IIIC, the Circum-Pacific Prehistory Conference, Seattle, Washington, August 1-6, 1989. Washington State University Press, Pullman.

1990 Prehistory of the coasts of southern British Columbia and northern Washington. In *Handbook of North American Indians, Volume 7, Northwest Coast*, edited by W. Suttles, pp. 340-358. Smithsonian Institution, Washington, D.C.

Mobley, Charles M. and W. Mark McCallum

2001 Prehistoric Intertidal fish traps from central Southeast Alaska. *Canadian Journal of Archaeology* 25(1&2): 28-52.

Pojar, J., K. Klinka and D.A. Demarchi

1991a Coastal Western Hemlock Zone. In *Ecosystems of British Columbia*, edited by D. Meidinger and J. Pojar, pp. 95-112. Ministry of Forests, Research Branch, Special Report Series No.6. Victoria.

1991b Mountain Hemlock Zone. In *Ecosystems of British Columbia*, edited by D. Meidinger and J. Pojar, pp. 113-124. Ministry of Forests, Research Branch, Special Report Series No.6. Victoria.

Roddick, J.A., J.E. Muller and A.V. Okulitch

1979 *Fraser River, British Columbia - Washington, Sheet 92* [map]. Geological Survey of Canada, Map 1386A. Ottawa.

Stryd, Arnoud H.
1997 Culturally *Modified Trees of British Columbia: A Handbook for the Identification and Recording of Culturally Modified Trees.* Ministry of Forests/Vancouver Forest Region, Nanaimo, B.C.

Simonsen, Bjørn O.
1988a *Results of a Heritage Impact Assessment Study at Jackson Bay (Topaze Harbour).* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

1988b *Results of a Heritage Impact Assessment of Helmcken Island, Southern Johnstone Strait, B.C.* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Somogyi-Czimazia, John
1990 *Report on the 1988 Archaeological Salvage Excavation at the Sondrup Site (EeSu 39) at Port Hardy, B.C.* Report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Wilson, I.R.
1989a *Heritage Resource Impact Assessment of Proposed On-Shore Developments, Betty Cove, Bonwick Island.* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

1989b *Test Excavations at EeSq 1, Betty Cove, Bonwick Island.* Consultant's report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

Wilson, Ian R., Randy Bouchard and Dorothy Kennedy
1992 Archaeological Regional Overview Vancouver Island. Consultants' report on file, Heritage Resource Centre, Ministry of Community, Aboriginal & Women's Services, Victoria.

APPENDIX I

TFL FOREST LTD. JOHNSTONE STRAIT OPERATION AREA REVISED AOA MODELLING STUDY REPORT

SUMMARY

Introduction

In 2004, Arcas Consulting Archeologists (Arcas) was engaged by TFL Forest Ltd. (TFL) to undertake a revision of the Johnstone Strait Operation Area Archaeological Overview Assessment (AOA). TFL wished to refine and revise the Arcas overview model originally created in 2002. TFL also wished to approach the Hamatla Treaty Society (HTS) office and again request permission to use the Traditional Use Study (TUS) data on hand for the overview study area in order to incorporate the digitize TUS data into the archaeological potential model. Furthermore, TFL wished to add West Cracroft and East Cracroft Islands to the original overview study area.

As with the 2002 overview, the purpose of the present study is to assess and map the archaeological potential within the revised study area which covers 93,800 hectares consisting of TFL 47. The study area encompasses a portion of the asserted traditional territories of the K'ómoks, Kwiakah, Tlowitis, Wei Wai Kai, and Wei Wai Kum First Nations.

This report is not considered to be a stand alone document. It builds on the original 2002 overview report and adds further information where necessary or discusses pertinent changes from the original study. Otherwise, readers are referred to the original report, to which this document is appended, for background information regarding the original research.

Objectives and Methods

Along with the original objectives of the 2002 study, this overview was intended to address two additional objectives:

- revise the original study area to include both West and East Cracroft Islands; and
- Discuss with the HTS office the possibility of having some access to available digital TUS data for the study area in order to incorporate this information into the logical statements.

Access to Information

The results of this overview are presented on digital maps showing different classes of archaeological potential and known archaeological site locations with attached database. The digital data is held by TFL Forest Ltd., Johnstone Strait Operation. Requests for access to digital data or paper printouts of digital plot files should be directed to TFL. Paper copies of this report were distributed to: TFL Forest Ltd., Madrone Environmental Services Ltd., Hamatla Treaty Society, and Arcas.

Results

Two different models were used to classify the archaeological potential of the study area. One model focused on archaeological sites other than CMTs. This model met with varying degrees of success. The second model focused on the potential for the presence of CMTs and the results were much improved from the 2002 results. On the paper maps, non-CMT archaeological potential is indicated by red polygons for lands considered to have high archaeological potential and yellow polygons for those considered to have moderate archaeological potential, the CMT model results are indicated by green hatchered lines that overlay the non-CMT colours.

CREDITS

Project Manager	Heather Pratt, MA
Data Coordination	Heather Pratt Don Davis, TecFor Technology Group Ltd.
Model Development	Heather Pratt
Archaeological Site Mapping	Don Davis
GIS Services	Don Davis
Report Drafting	Ann O' Sullivan

ACKNOWLEDGEMENTS

Arcas would like to thank TFL Forest Ltd., Johnstone Strait Operation for their ongoing support and the opportunity to conduct this overview. We would also like to thank Madrone Environmental Services LTD., and the Hamatla Treaty Society. This project was funded via monies provided by the Forest Investment Account.

Besides thanking TFL in general for their ongoing support of the two AOA projects, we would like to thank Ken Kaps and Peter Share specifically for their continued support of this project.

Other people who deserve special acknowledgement are Dee Cullon who once again acted as a liaison between Arcas and the HTS and was able to guide Arcas through the request and use of HTS TUS data. Shirley Johnson of the HTS also provided help and data throughout the project. Doug Reeve of Madrone was responsible for overseeing the project on behalf of TFL and he was both helpful and informative on this, his first AOA project.

Arcas would like to also acknowledge Ted Lewis (Wei Wai Kai First Nation) and Darren Matilipi (Tlowitis First Nation) for their participation in the groundtruthing component of this project. It was once again a pleasure to work together and have the opportunity to explore their traditional territories as a team. Tom Sewid and his boat Gla Lis were absolutely integral to the groundtruthing component of this project. Tom was able to coordinate overnight accommodations for us when the winds were blowing, and also contributed his considerable knowledge and experience about the asserted traditional territories and their archaeological history. He was also an incredible and knowledgeable guide to the physical aspects of the study area. The opportunity to work side-by-side over four days of groundtruthing resulted in a great deal of learning and discussion about the past. It was an incredible and memorable trip that all people of the "Ground truthing Tribe" thoroughly enjoyed and will remember. **Gilakasla!**

Although the expertise of many individuals has contributed to making this project what it is, the professional opinions expressed in this report are those of the author and not necessarily those of any individual groups or institutions involved with the study. Arcas is solely responsible for the contents of this report, including any errors, omissions, or shortcomings.

APPENDIX TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

This report describes the methods and results of a revised **Archaeological Overview Assessment** (AOA) for TFL 47, located within the Johnstone Strait Operation Area managed by TFL Forest Ltd, Johnstone Strait Operation (TFL). This AOA was conducted in order to revise and refine an earlier AOA model developed by Arcas Consulting Archeologists (Arcas) to which this document is appended.

The terms of reference for the present project incorporated West and East Cracroft Islands within the study area, and also incorporated the Traditional Use Study (TUS) data from the Hamatla Treaty Society (HTS), if the request for this information was granted. As with the 2002 AOA, the results of this study consist of a series of digital maps and digital files which reside with TFL Forest Ltd, Johnstone Strait Operation office.

The primary objective of this overview is the same as described for the 2002 study which was to map the relative archaeological potential of the study area. The overview research was conducted by Arcas with the assistance of Don Davis of Tecfor (GIS services). This overview was funded by the Forests Investment Account. TFL Forest Ltd., Johnstone Strait Operation, was the lead partner on the project and Madrone Environmental Services Ltd coordinated the project on behalf of TFL.

1.1 Study Area

The study area consists of those lands within TFL 47 of TFL's, Johnstone Strait Operation Area (Figure 1). The study area extends from the northern tip of Quadra Island to West Cracroft Island, and is approximately 93,800 hectares in area, which is significantly less than the study area covered by the 2002 AOA project. None of the study area includes lands on Vancouver Island. The study area is entirely located within the Campbell River Forest District.

As described in the original AOA report, there is considerable environmental and cultural diversity in the study area, with the same environmental settings present in both study areas although the revised study area is smaller. Figures 2, 3, 4, and 5 provide a general impression of the revised study area.

1.2 Study Team

The individual members of the study team are listed on the Credit Sheet. Overall project management, documentary research, direct consultation, model development and review, and reporting were the responsibility of Arcas staff. Don Davis (TecFor) was subcontracted to provide digitized coverages for the model developed by Arcas.

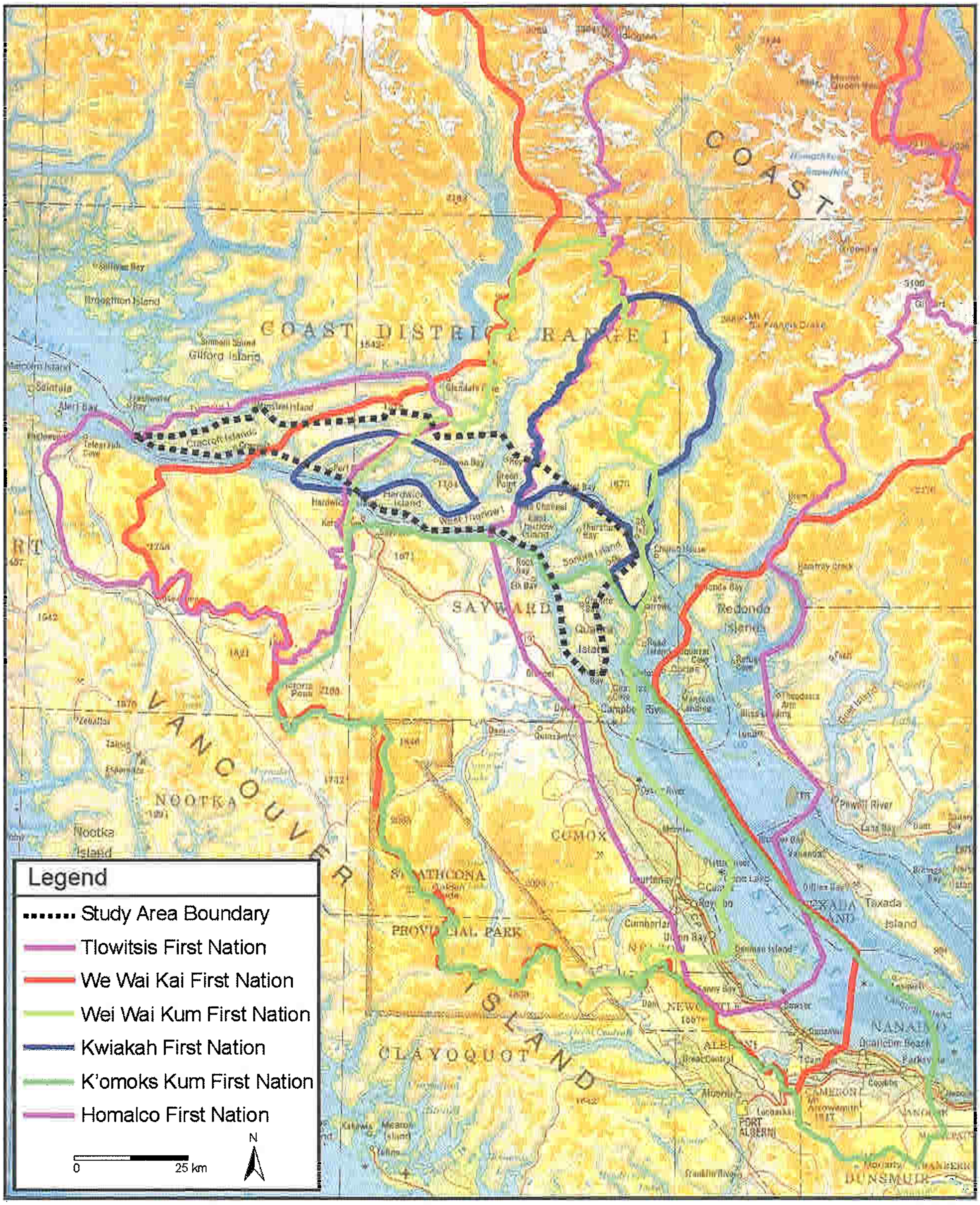

Figure 1. Location of Study Area, showing traditional territories of First Nations Communities (1:1,250,000).

Figure 2. Westcracroft Island (92L.058).

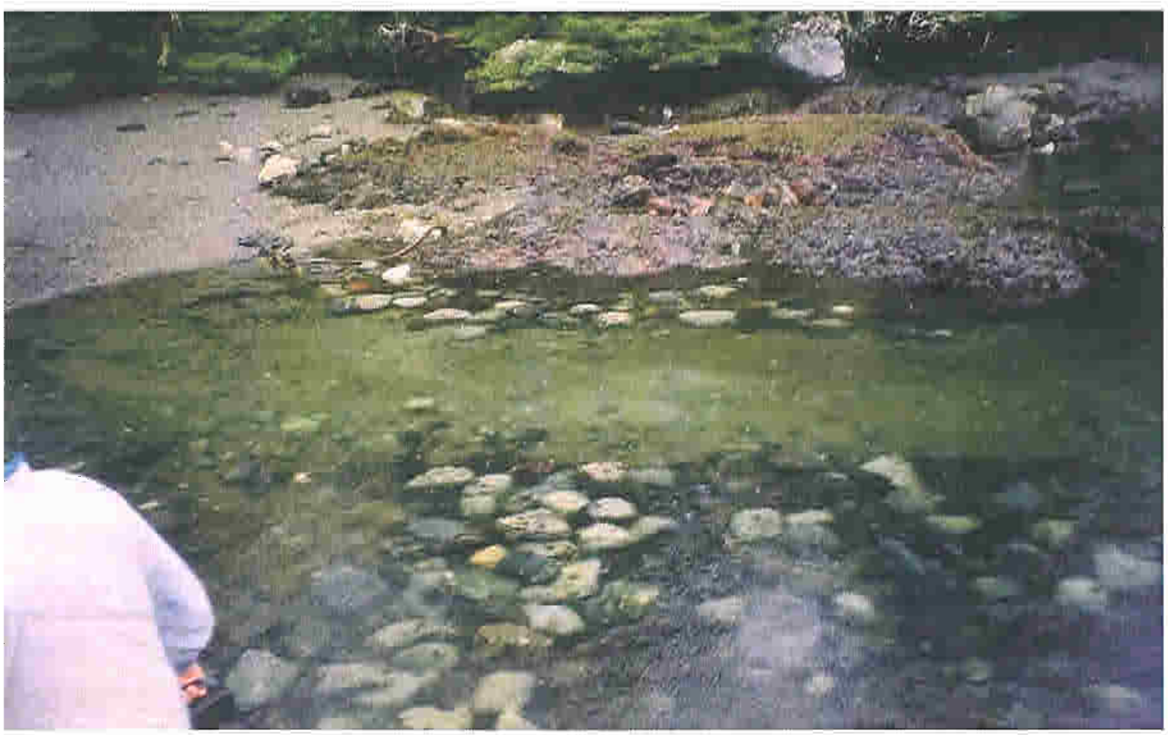

Figure 3. Westcracroft Island: possible canoe run (unrecorded).

Figure 4. Port Neville (92K.051).

Figure 5. Petroglyph Site EdSm-001, Port Neville.

2.0 ARCHAEOLOGICAL POTENTIAL MODELLING APPROACH

A GIS was used for the revisions to the earlier archaeological potential model because this study is intended to "piggy back" onto the significant amount of GIS modelling already done for the 2002 overview. The most significant change to the GIS model was its incorporation of the digital TUS data gathered by the HTS. While the ethnographic record, past field experience, and documented archaeological site distribution are critical sources of information, the addition of the digital TUS data-base significantly enhances the local knowledge base previously acquired.

The present overview research developed two distinct GIS models that are applied in conjunction with each other to assess the potential for archaeological resources over the landscape of the study area. One model focused solely on the potential for **culturally modified trees (CMTs)**. The revised CMT model adopted for this overview predicts the archaeological potential for CMTs within the physical landscape, and predominantly focuses on cedar trees greater than 100 years of age. This reasoning is carried over from the original overview research, and assumes that a forest utilization site often reflects traditional use of that location over a long period of time. Therefore, if a particular setting was used 100 years ago, then it is also likely to have been used 200 years ago as well. In contrast, a conscious decision was made to not attempt a model for CMT occurrences in second growth stands, as previous attempts to accomplish this goal had not been particularly successful.

The second GIS model was developed to predict the potential for non-CMT archaeological resources and the potential for their presence on the landscape. Traditionally, a non-CMT model is the primary focus of most overview projects, but past experience has shown that non-CMT focused modelling does not adequately capture lands exhibiting potential only for CMTs. Nevertheless, the distinct CMT and non-CMT archaeological resource models are intended to work in conjunction with one another in the GIS model.

During the preliminary stages of this study, it was decided that another attempt would be made to model for CMT potential using Terrestrial Ecosystem Mapping (TEM) which had been recently completed for the TFL Johnstone Strait Operation Area. TEM data for the previous AOA had been successfully incorporated into the non-CMT model but unfortunately, this class of data did not integrate successfully into the CMT potential model. For the purpose of this study it was believed that maybe TEM could be used to predict lands where CMTs may have occurred in the past but were no longer present due to historic European logging and settlement.

2.1 Potential Classes

The two models developed for the revised overview study employ slightly different approaches to potential, as discussed below. Both approaches were originally developed and utilized during the previous overview. The following information was also presented in the 2002 overview report written by Arcas.

Non-CMT Resource Potential

Three levels of potential are proposed for non-CMT archaeological resources:

- **Class 1 (High potential, Low constraint)**: This is the highest level of archaeological resource potential. The highest density of archaeological sites, and the greatest range in archaeological site types, is expected for this class. Few or no constraints on use of the landscape are presented by the macro-features. The micro-features are not expected to increase the level of constraints (decrease potential).

- **Class 2 (Moderate potential, Low constraint)**: A moderate-to-high site density and range of site types is expected. This level has some constraints presented by macro-features, but is expected to have areas where micro-features either increase or decrease the level of constraint.

- **Class 3 (Low potential, High constraint)**: A low density of sites and only a few site types is expected. This level has a high degree of constraints resulting from macro-features, and is not expected to have micro-features which decrease the level of constraint (which would increase the level of potential).

CMT Resource Potential

In terms of CMT potential the landscape was regarded as exhibiting either Low or Moderate-to-High potential. It was determined that if the most important macro-features used for modelling (i.e. forest cover, slope, and distance to water) fell within predefined parameters, Moderate-to-High potential for CMTs could be assessed. A preliminary field reconnaissance (PFR) or in-office review would clarify whether or not the micro-topographic landscape features present would increase or decrease the level of constraint and the resulting level of potential.

2.2 Review of Previous Modelling Attempts

This revised GIS model adopted for this study continues the deductive approach of the original overview. “Constraint modelling” has been used successfully in the past and was employed for this study as well. The original Arcas GIS model was revised for the present overview to provide a better modelling outcome, and incorporate the HTS digital TUS data-base which was previously unavailable. Access to any new digital information was regarded as beneficial. Furthermore, it was expected that revising the study area boundary and considering only TFL 47 lands within the study area, would result in a more seamless fit to the digital data, and allow another opportunity to develop and run a successful CMT potential model.

3.0 AOA METHODOLOGY

3.1 First Nations Consultation

TFL discussed the possibility of Arcas revising the 2002 overview in the summer of 2004. A preliminary meeting was arranged between the HTS and Arcas to seek permission to use digital TUS data for the revised GIS model. The HTS asked that the request be placed in writing so that it could be submitted to Chief and Council which occurred shortly thereafter and approval was obtained in the fall of 2004. Don Davis was able to communicate with the HTS in order to obtain the TUS data, which was then overlaid onto the overview study area and incorporated into the logical statements as they were revised.

A community meeting has been scheduled by the HTS on March 17th 2005, to provide an opportunity for people from the various HTS communities to gather and learn more about the results of the revised overview research. As well as the start-up meeting and the community meeting, ongoing communications between Arcas and the HTS was conducted through Dee Cullon, and included phone calls and email correspondence.

3.2 Other Consultation

The GIS-based modelling, map-database linkages, data-set formatting, creation, and implementation, TUS data incorporation, and final digital end products was subcontracted to Don Davis of TecFor. Don provided his previous experience of working with TFL data along with his input concerning matters relating to GIS and GIS modelling. Don's experience with and understanding of TEM was of considerable value to this project.

3.3 Background Research

The background research component of this overview was essentially completed in the context of the 2002 overview project, and the data previously assembled was readily available and incorporated into this project. The following sections discuss any changes from the original Arcas overview that occurred during the present project.

3.3.1 Site Frequency and Distribution

Changes to the study area boundary greatly reduced the number of archaeological sites to be considered. As of November 1st, 2004, 96 sites had been recorded within the study area. Figure 6 and Table 1 summarize information about these sites. As with the original overview, the total number of archaeological sites does not match the numbers provided in the Provincial Heritage Register because several archaeological features can occur together within a single recorded site. Each type of archaeological feature recorded from a particular site is treated as if it was a single site and listed in Table 6 accordingly.

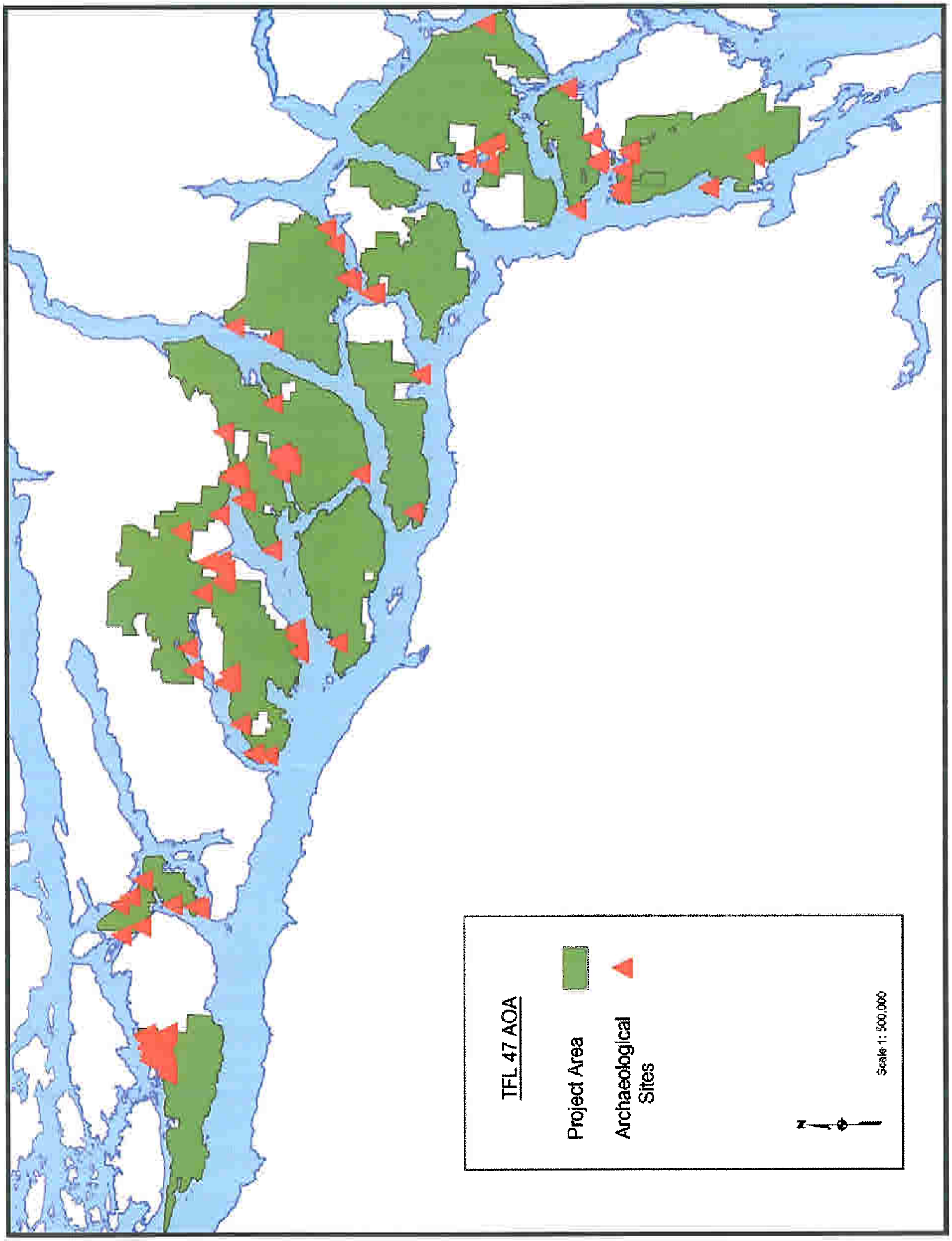

Figure 6. Recorded archaeological sites in the study area (1:500,000).

Table 1. Archaeological Sites in Study Area by Revised Site Feature Type.

Type	Borden Block																Σ[1]
	EaSh	**EbSh**	**EbSi**	**EcSg**	**EcSh**	**EcSi**	**EcSj**	**EcSk**	**EcSl**	**EcSm**	**EdSj**	**EdSk**	**EdSl**	**EdSm**	**EdSn**	**EdSo**	
Artifact Scatter	--	1	--	--	--	--	--	--	--	--	--	1	--	--	--	--	**2**
Canoe Run	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	**1**
CMT–BS[2]	--	--	--	--	--	--	--	--	--	1	--	1	2	1	--	--	**5**
CMT-Log[3]	--	--	--	--	--	--	--	1	--	--	--	1	5	--	--	--	**7**
Earthwork	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0**
Fish Trap	--	--	--	--	--	--	--	--	--	--	--	--	2	--	1	--	**3**
Fish Weir	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	**1**
Human Remains	--	1	--	--	--	1	--	--	--	--	--	--	--	--	--	1	**3**
Midden	--	4	3	1	4	3	2	6	1	--	1	7	5	1	7	18	**63**
Midden-Village	--	3	--	--	--	--	--	--	--	--	--	1	--	--	--	--	**4**
Petroform	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**1**
Rock Art	--	--	1	--	--	3	1	4	4	--	--	1	1	--	1	--	**16**
Wetsite	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	**0**

[1] Totals may exceed total of 96 sites in study area, because more than one type of archaeological remain could be present at a single site.
[2] = Culturally modified tree - barkstrip
[3] = Culturally modified tree - aboriginally logged

3.3.2 Biophysical

The new study area includes West and East Cracroft Islands, but excludes Call Inlet. There were no additional biophysical constraints resulting from these additions and subtractions.

3.3.3 Slope

For the purpose of this AOA slope, is expressed in percentages. Slope information was obtained from TFL by Don Davis at the beginning of this project using TEM data. Slope was expressed as percentage for both the CMT and non-CMT models.

3.3.4 Data Acquisition and Translation

As illustrated in Figure 7 of the 2002 AOA report, building the digital coverages for the GIS-based model is an important part of the overview process. The revised overview used British Columbia Geodetic Survey (BCGS) maps that are independent of TRIM which was the mapsheet grid used for the 2002 overview. TFL created their own digital map base in 1988 and it was agreed that Arcas would use this system for the present project. The resulting coverages are identified in Tables 2 and 3.

- **Landforms**: Derived from the TEM data made available to Arcas from TFL. Coastlines were provided by TFL.

- **Slope**: Derived from the provincial TRIM data, Digital Elevation Model (DEM) with the slope classes generated from the model using ArcGRID. The two models developed for this overview had different slope parameters. Therefore, different ranges of slope degrees were employed for the two models.

- **Aquatic Features**: These features were available from TRIM. In the case of streams, single and double-lined streams were used. Indefinite and intermittent streams were excluded from the non-CMT model because they were considered to have low potential for fish values. The original TFL map showing known salmon streams and utilized for the 2002 modelling process was incorporated into this study as well. All water bodies classified as lakes in TRIM were used.

- **Vegetation**: In order to model for CMTs, forest cover data was acquired from TFL. Of most importance was the classification of old growth red and yellow cedar stands. Some forest cover data was also available via TEM.

- **Archaeological Sites**: The Archaeology and Registry Services Branch provided Don Davis with a digital copy of all sites recorded within the study area. All sites were plotted as points.

Table 2. Site Type and Associated Variables.

Arcas Archaeological Site Type, Output Code, and Simplified Logical Statement	**Variable**
Artifact Scatter (TYP1)	Coastline ≤ 50 m Freshwater lake (FSZ, L1, L2, L3) ≤ 50 m Fish stream/river (S1, S2, S3, S4) ≤ 50 m Non-fish stream/river (S5, S6) ≤ 50 m Slope ≤ 50% Aspect (South, East/West, North) Surface material (fluvial, lacustrine, marine)
Midden-village (TYP2)	Coastline ≤ 200 m Fish stream/river ≤ 500 m Non-fish stream ≤ 500 m Slope ≤ 30% Aspect (South, East/West, North) Surface material (fluvial, lacustrine, marine) Distance to Traditional Use Site ≤ 300 m Salmon run past and/or present
Midden (TYP3)	Surface material (fluvial, lacustrine, marine, glaciofluvial, glaciolacustrine) Coastline ≤ 100 m Fish stream/river ≤ 500 m Freshwater stream/river ≤ 500 m Slope ≤ 30% Distance to Traditional Use Site ≤ 300 m Salmon run past and/or present
Wetsite (TYP4)	Coastline ≤ 25 m Fish stream/river ≤ 25 m Non-fish stream ≤ 25 m Slope ≤ 20% Surface material (fluvial, marine, lacustrine) Distance to Archaeology Site ≤ 250 Distance to Traditional Use Site ≤ 100 Salmon run past and/or present
Earthwork (trench embankment) (TYP5)	Slope ≤ 20% Distance to Archaeology Site ≤ 250 m Surface material (fluvial, marine, glaciofluvial)
Culturally Modified Tree-western redcedar barkstrip (TYP6)	Age class ≥ 100 Slope ≤ 100% Coastline ≤ 1000 m Fish stream/river ≤ 500 m Non-Fish stream/river ≤ 500 m Distance up Fish stream/river ≤ 3000 m Distance up stream/river ≤ 3000 m Elevation ≤ 600 m above sea level Lakeshore ≤ 250 m Species = western redcedar Salmon run past and/or present

Arcas Archaeological Site Type, Output Code, and Simplified Logical Statement	Variable
Culturally Modified Tree-yellow cedar barkstrip (TYP7)	Age class ≥ 100 Slope ≤ 100% Coastline ≤ 500 m Fish stream/river ≤ 500 m Non-Fish stream/river ≤ 500 m Distance up fish stream/river ≤ 3000 m Distance up stream/river ≤ 3000 m Lakeshore ≤ 250 m Elevation ≤ 800 m above sea level Species = cypress Salmon run past and/or present
Culturally Modified Tree-logged feature (TYP8)	Species = western redcedar Age class ≥ 100 Slope ≤ 100% Coastline ≤ 1000 m Non-Fish stream/river ≤ 500 m Fish stream/river ≤ 500 m Distance up Non-Fish stream/river ≤ 2000 m Distance up Fish stream/river ≤ 2000 m Lakeshore ≤ 250 m Elevation ≤ 600 m above sea level Salmon run past and/or present
Fish Trap (TYP9)	Coastline = 1 m Fish stream/river ≤ 100 m Non Fish stream/river ≤ 100 m Salmon run past and/or present Surface material (fluvial, marine, glaciofluvial, glaciolacustrine)
Fish Weir (TYP10)	Coastline ≤ 50 m Fish stream/river ≤ 25 m Non Fish stream/river ≤ 25 m Lakeshore ≤ 25 m Slope ≤ 20% Salmon run past and/or present
Human Remains (TYP11)	Slope ≥ 100% Coastline ≤ 100 m Species class = Sitka spruce Age class ≥ 100 Surface material = bedrock Distance to Archaeology Site ≤ 500 m Distance to Traditional Use Site ≤ 300 m
Petroform (TYP12)	Coastline = 1m Slope ≤ 10% Surface material (fluvial, marine, glaciofluvial) Mouth of stream/river ≤ 25 m

Arcas Archaeological Site Type, Output Code, and Simplified Logical Statement	Variable
Rock Art (TYP13)	Coastline ≤ 50m Slope ≥ 100% Surface material = bedrock Lakeshore ≤ 25 m Fish stream/river ≤ 50 m Non Fish stream/river ≤ 50 m Salmon run past and/or present Distance to Archaeological Site ≤ 500 m Distance to Traditional Use Site ≤ 300 m Surface material = anything but bedrock
Canoe Run (TYP14)	Coastline ≤ 50 m Distance to Archaeological Site ≤ 100 m Slope ≤ 10% Surface material (fluvial, lacustrine, marine,)

Table 3. Input Grids.

Coverage-General		Coverage-specific	Definition	Code
TEM	Terrain	Primary Surficial Materials	1 = fluvial (F) 2 = lacustrine (L) 3 = marine (W) 4 = bedrock (R) 5 = glaciofluvial (FG) 6 = glaciolacustrine (LG)	SURFM1
		Slope Classes	1 = 0 – 10% 2 = 10 - 20% 3 = 20 - 30% 4 = 30 - 40% 5 = 40 - 50% 6 = 50 - 60% 7 = 60 - 70% 8 = 70 - 80% 9 = 80 - 90% 10 = 90 -100% 11 = 100 - 110%	SLOPE_CODE
		Elevation	1 = 0 - 100 m 2 = 101 - 200 m 3 = 201 - 300 m 4 = 301 - 400 m 5 = 401 - 500 m 6 = 501 - 600 m 7 = 601 - 700 m 8 = 701 - 800 m	RANGE_CODE

Coverage-General	Coverage-specific	Definition	Code
	Aspect	0 = Flat 1 = N 2 = NE 3 = E 4 = SE 5 = S 6 = SW 7 = W 8 = NW	ASPECT_COD
Marine/Aquatic Classification	Streams	1 = 0 - 25 m 2 = 26 - 50 m 3 = 51 - 100 m 4 = 101 - 250 m 5 = 251 - 500 m	SSALM (Salmon present)
		1 = 0 - 25 m 2 = 26 - 50 m 3 = 51 - 100 m 3 = 101 - 250 m 4= 251 - 500 m	STR (Salmon absent)
	Lakes	1 = 0 – 25 m 2 = 26 – 50 m 3 = 51 – 250 m	LSALM
	Coastline	1 = 0 - 1 m 2 = 2 - 50 m 3 = 51 - 100 m 4 = 101 - 200 m 5= 201 - 500 m 6= 501 - 1000 m	COA1
		1 = 0 - 2000 m 2 = 2001 - 3000 m	COA2
Forest Cover	Sitka Spruce	0 = Absent 1 = Present	Timber type CN 'S'
	Age Class	5 = 81 - 100 6 = 101 - 120 7 = 121 - 140 8 = 141 - 250 9 = 251+	Age
Sites	Midden	1 = 0 - 50 m 2 = 51 - 250 m 3 = 251 - 500	ARC1

Coverage-General	Coverage-specific	Definition	Code
	Midden-village	1 = 0 - 50 m 2 = 51 - 100 m 3 = 101 - 250 m 4 = 251 - 500 m	ARC2
	Other Archaeology Sites	1 = 0 – 250 m	ARC3
Traditional Use Sites	Point Site	1 = 0 - 100 m 2 = 101 - 200 m 3 = 201 - 300 m 4 = 301 - 1000 m	TUS1
	Polygon Site	1 = 0 - 100 m 2 = 101 - 200 m 3 = 201 - 300 m	TUS2
	Village Site	1 = 0 - 100 m 2 = 101 - 200 m 3 = 201 - 300 m	TUS3

3.3.5 NEAR Analysis and Definitions of Feature Buffers

Previous work concerning feature buffers was done for the 2002 study and proved to be of great value to this study, because buffer-width decisions could be made based on previous experience. The old buffer widths were re-examined and discussed at the onset of this overview. These assumptions were then tested against the distribution of archaeological sites for the revised study area. This NEAR analysis helped to determine the effectiveness of the previous buffer widths. Of particular interest was the data gathered for previously recorded CMT sites and the buffer widths required to more accurately predict CMT locations over the landscape.

The resulting buffer widths are presented in Table 3 of this document and should be compared to Table 8 of the original report. Changes were not significant, but adjustments were certainly made in many cases. The most obvious difference reflects the addition of TUS sites and their accompanying buffers. As with the 2002 overview, archaeological sites and the newly-introduced TUS sites were buffered to protect surrounding terrain which may contain unrecorded archaeological or traditional resources, as well as compensating for sites with imprecisely defined locations.

3.3.6 Model Building

Model building for the revised overview was conducted according to the same steps as the 2002 overview research. Figure 8 of the 2002 report illustrates the sequential steps of model building used for this project.

The final step in model-building is the most important and also the most time consuming. This involves development of a series of "logical statements" which instruct the GIS when modelling the definition for each site type within the landscape. The revised overview models commenced with the series of logical statements created for the 2002 overview, which were modified and improved for this project. The revised logical statements are presented in Figure 7 and are presented in a similar format to the original statements, which are found in Figure 9 of the 2002 overview report.

TYPE 1: ARTIFACT SCATTER

1) Primary Surficial Materials (PSM) = fluvial (F), lacustrine (L), marine (W), glaciofluvial (FG), or glaciolacustrine (LG)
AND
Aspect ≠ N OR Aspect = N and Slope = 0-40%
AND
Distance to fish-bearing OR non-fish bearing stream or Lake = 0-50m
AND
Distance to coastline = 0-50m

Potential = Moderate

2)Aspect ≠ N OR Aspect = N and Slope = 0-30%
AND
Distance to fish-bearing lake OR fish-bearing stream OR non fish-bearing stream OR coastline = 0-100m
AND
Slope = 0-30%

Potential = Moderate

3) PSM = F, L, or W
AND
Aspect ≠ N OR Aspect = N and Slope = 0-40%
AND
Distance to fish-bearing stream OR non fish-bearing stream OR fish-bearing lake OR Distance to coastline = 0-100m
AND
Slope = 0-50%

Potential = Moderate

TYPE 2: MIDDEN VILLAGE

1) PSM = F, L, or W
AND
Distance to coastline = 0-200m
AND
Distance to TUS site = 0–300m
AND
Slope = 0-30%

Potential = Moderate

2) Distance to coastline = 0–200m
AND
Slope = 0-30%
AND
Distance to Arky Site OR TUS site = 0-300m

Potential = Moderate

3) PSM = F, L, or W
AND
Distance to fish-bearing stream OR non-fish bearing stream = 0-500m
AND
Slope = 0-30%
AND
Distance to coastline = 0-200m
AND
Distance to TUS site = 0-300m

Potential = High

TYPE 3: MIDDEN

1) PSM = W
AND
Distance to coastline = 0-100m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-250m
AND
Slope = 0-30%

Potential = Moderate

2) Distance to coastline = 0-100m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-500m
AND
Slope = 0-30%

Potential = Moderate

3) Distance to coastline = 0-100m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-500m
AND
Slope = 0-30%

AND
Distance to TUS site = 0-300m

Potential = Moderate

4) PSM = F, L, W, FG, or LG
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-500m
AND
Distance to coastline = 0-200m
AND
Slope = 0-30%

Potential = High

TYPE 4: WETSITE

1) PSM = F, L, or W
AND
Distance to coastline = 0-50m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-25m
AND
Slope = 0-20%

Potential = Moderate

TYPE 5: EARTHWORK

1) Distance to arky site = 0-250m
AND
PSM = F, W, or FG
AND
Slope = 0-20%

Potential = Moderate

TYPE 6: CMT BARKSTRIP, WESTERN REDCEDAR

1) Age class (AC) = greater than 100 years old
AND
Species composition (SC) = presence of western redcedar
AND
Slope = 0-100%
AND
Distance to coastline = 0-1000m OR Distance to fish-bearing lake = 0-250m
AND
Elevation = 0-600m

Potential = Presence of CMTs

2) AC = greater than 100 years old
AND
SC = presence of western redcedar
AND
Slope = 0-100%
AND
Distance to coastline = 0-3000m
And
Distance to fish-bearing stream OR non fish-bearing stream = 0-500m
AND
Elevation = 0-600m

Potential = Presence of CMTs

TYPE 7: CMT BARKSTRIP, YELLOW CEDAR

1) AC = greater than 100 years old
AND
SC = presence of yellow cedar
AND
Slope = 0-100%
AND
Distance to coastline =0-500m OR Distance to fish-bearing lake = 0-250m
AND
Elevation = 0-600m

Potential = Presence of CMTs

2) AC = greater than 100 years old
AND
SC = presence of yellow cedar
AND
Slope =0-100%
AND
Distance to coastline =0-3000m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-500m
AND
Elevation = 0-600m

Potential = Presence of CMTs

TYPE 8: ABORIGINALLY LOGGED CMTS

1) AC = greater than 100 years old
AND
SC = presence of western red cedar
AND
Slope = 0-90%
AND
Distance to coastline = 0-1000m OR Distance to fish-bearing lake = 0-250m
AND
Elevation = 0-600m

Potential = Presence of CMTs

2) AC = greater than 100 years old
AND
SC = presence of western redcedar
AND
Slope = 0-90%
AND
Distance to coastline = 0-2000m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-500m
AND
Elevation = 0-600m
Potential = Presence of CMTs

TYPE 9: FISH TRAP

PSM = F, W, FG, or LG
AND
Distance to coastline =0-1m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-100m
AND
Slope = 0-20%

Potential = Moderate

TYPE 10: FISH WEIR

Distance to fish-bearing stream OR non fish-bearing stream OR Lake = 0-1m
AND
Distance to coastline = 0-50m
AND
Slope = 0-20%

Potential = Moderate

TYPE 11: HUMAN REMAINS

1) Distance to recorded arky site OR TUS site = 0-300m
AND
Distance to coastline = 0-100m
AND
Slope = more than 100%

Potential = Moderate

2) Distance to recorded arky site OR TUS site = 0-300m
AND
SC = presence of Sitka Spruce
AND
AC = greater than 100 years old
AND
Distance to coastline = 0-100m

Potential = Moderate

TYPE 12: PETROFORM

PSM = F, W, or FG
AND
Distance to coastline = 0-1m
AND
Distance to fish-bearing stream OR non fish-bearing stream = 0-25m
AND
Slope = 0-10%

Potential = Moderate

TYPE 13: ROCK ART

1) Distance to recorded arky site OR TUS site = 0-500m
AND
PSM = F, L, W, or W
AND
Distance to coastline = 0-50m OR Distance to fish-bearing lake = 0-25m OR Distance to fish-bearing stream = 0-50m OR Distance to non fish-bearing stream = 0-50m
AND
Slope = greater than 100%

2) Distance to recorded arky site OR TUS site = 0-500m
AND
PSM = F, L, W, or W
AND
Distance to coastline = 0-50m OR Distance to fish-bearing lake = 0-25m OR Distance to fish-bearing stream = 0-50m OR Distance to non fish-bearing stream = 0-50m

AND
Slope = 0-10%

Potential = Moderate

TYPE 14: CANOE RUN

PSM = F, L, or W
AND
Distance to recorded arky site OR TUS site = 0-300m
AND
Distance to coastline = 0-50m
AND
Slope = 0-10%

Potential = Moderate

Figure 7. Logical Statements Used in the Overview Model.

The lands covered by the study area are portrayed on various portions present on 21 BCGS maps which is equivalent to 21 TRIM maps. There is a significant difference between the study area for the present project and that defined for the 2002 overview, because some lands covered by the original research were removed from consideration in this study as they are no longer in TFL 47.

As with the original project, two test areas within the study area were chosen for an operational test of the CMT and non-CMT models. The models were run for the entire study area everytime the logical statements were revised, but "fine-tuning" of the model was achieved through examination of the model results in the two test areas. Figure 8 indicates the location of the test areas within the study area.

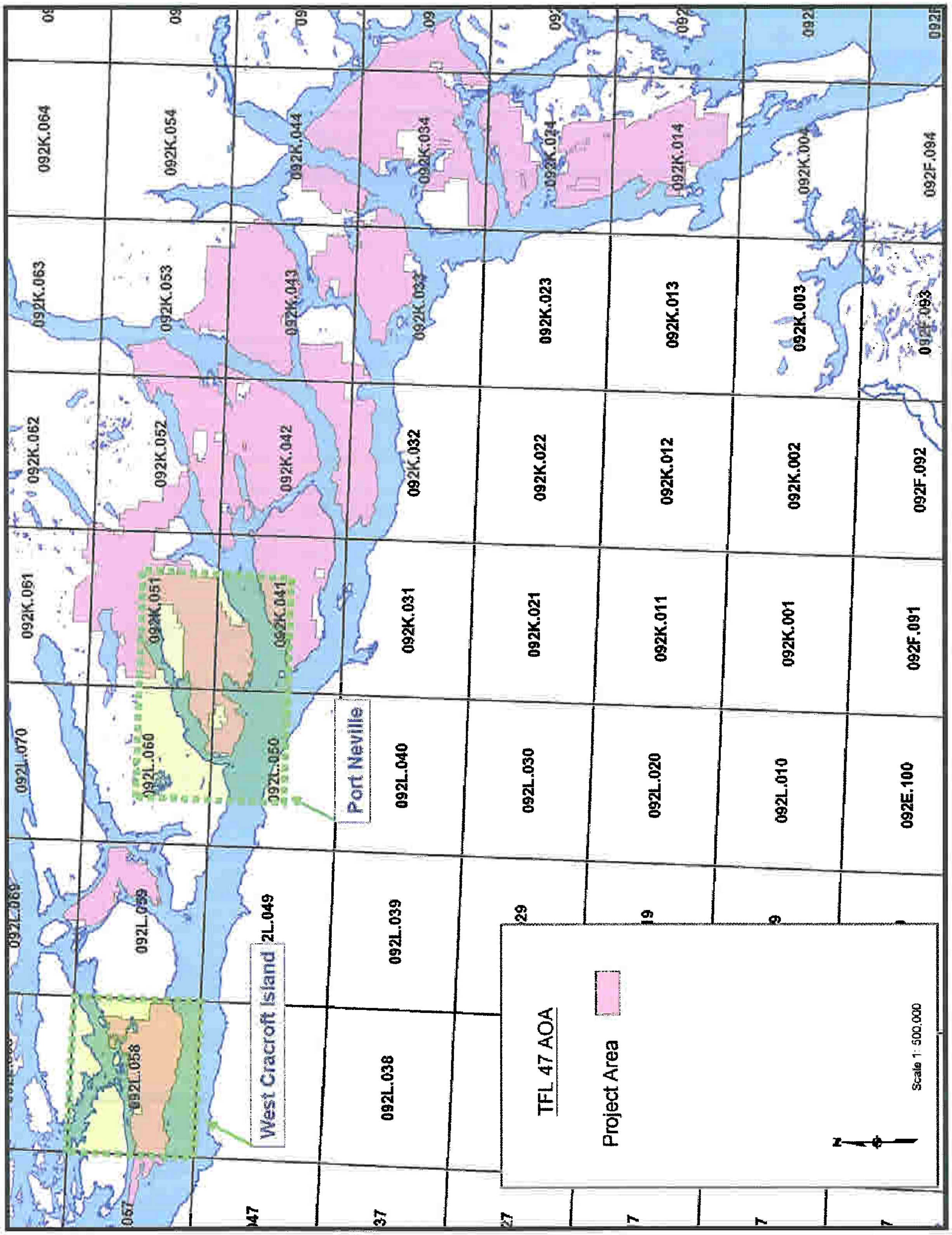

Figure 8. Test area locations within the study area (1:500,000).

Test area 1 is found on map-sheet 092L.058 and is representative of an "Island" environment as previously discussed in Section 3.8.1 of the 2002 overview report. This time the chosen island is West Cracroft. Figure 2 shows part of the shoreline along West Cracroft Island.

Test area 2 is divided among map-sheets 092K.041, 092K.051, 092L.050 and 092L.060, and is representative of an "Mainland" environment as discussed in Section 3.8.1 of the 2002 report. Port Neville and surrounding lands have a rich history of past use and the diversity of resources present were suspected to be helpful for identifying patterns of looking for archaeological resource potential.

The model was applied within the study area on several occasions throughout the present project, and results were outputted in digital format. One set of results was output as paper maps to be used for reference during the groundtruthing component of the project. Errors in GIS coverage and logical statements were identified and corrected on a regular basis. In some cases, the buffer widths were also changed over the course of the project. When the modelled output met with all expectations, the model was run for a final time.

After the model was run, the output for each of the test areas was examined. The levels of CMT and non-CMT potential, and known site locations, were reviewed each time to assess the model's effectiveness. Figures 9 and 10 provide examples of how the two GIS models within the test areas translated visually. When it was agreed that the modelled output for the two test areas appropriately reflected the "real world" situation, the model was run for a final time and the results were recorded digitally for TFL.

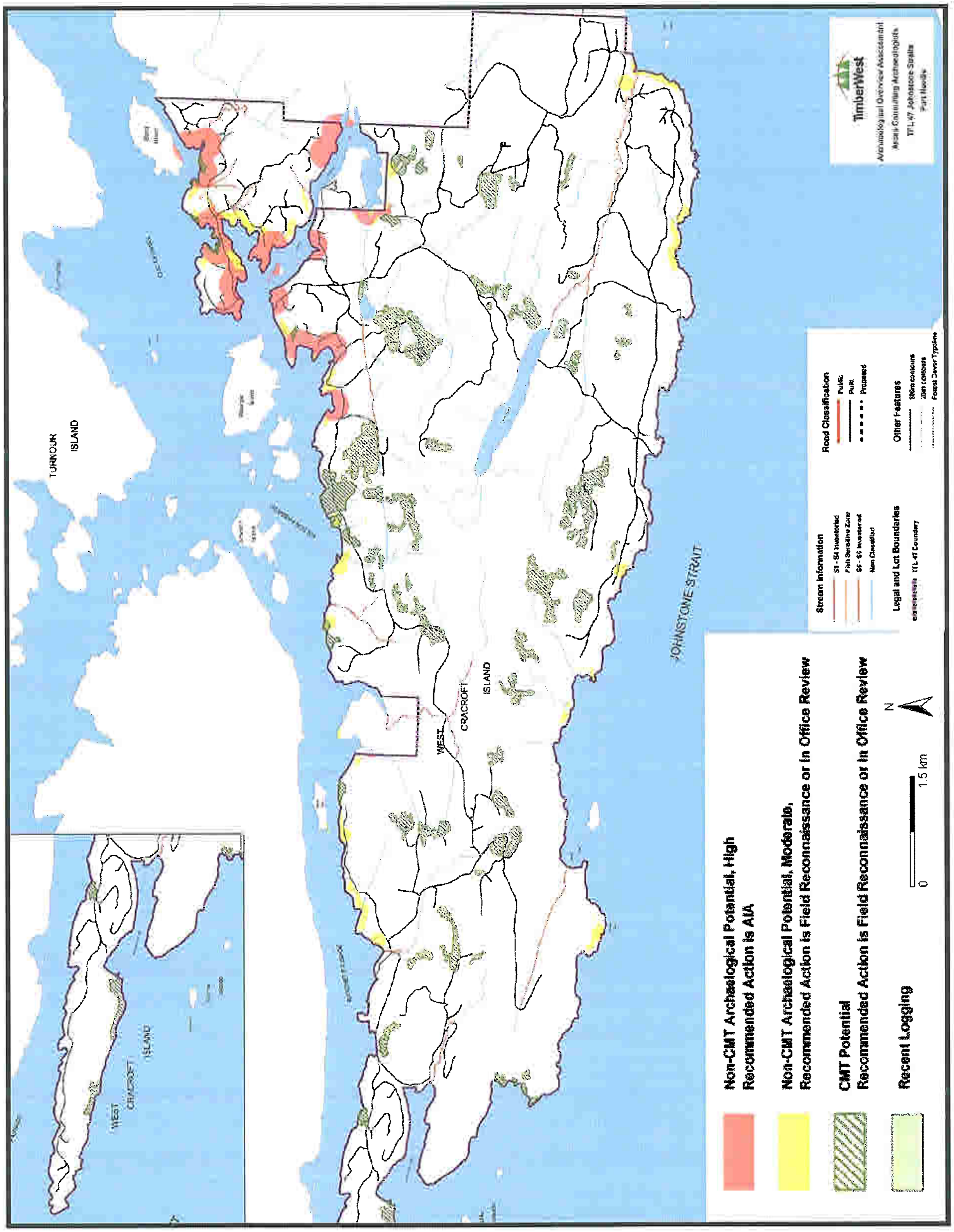

Figure 9. West Cracroft (92.058) modelled for CMT and non-CMT Archaeological Resource Potential (1:75,000).

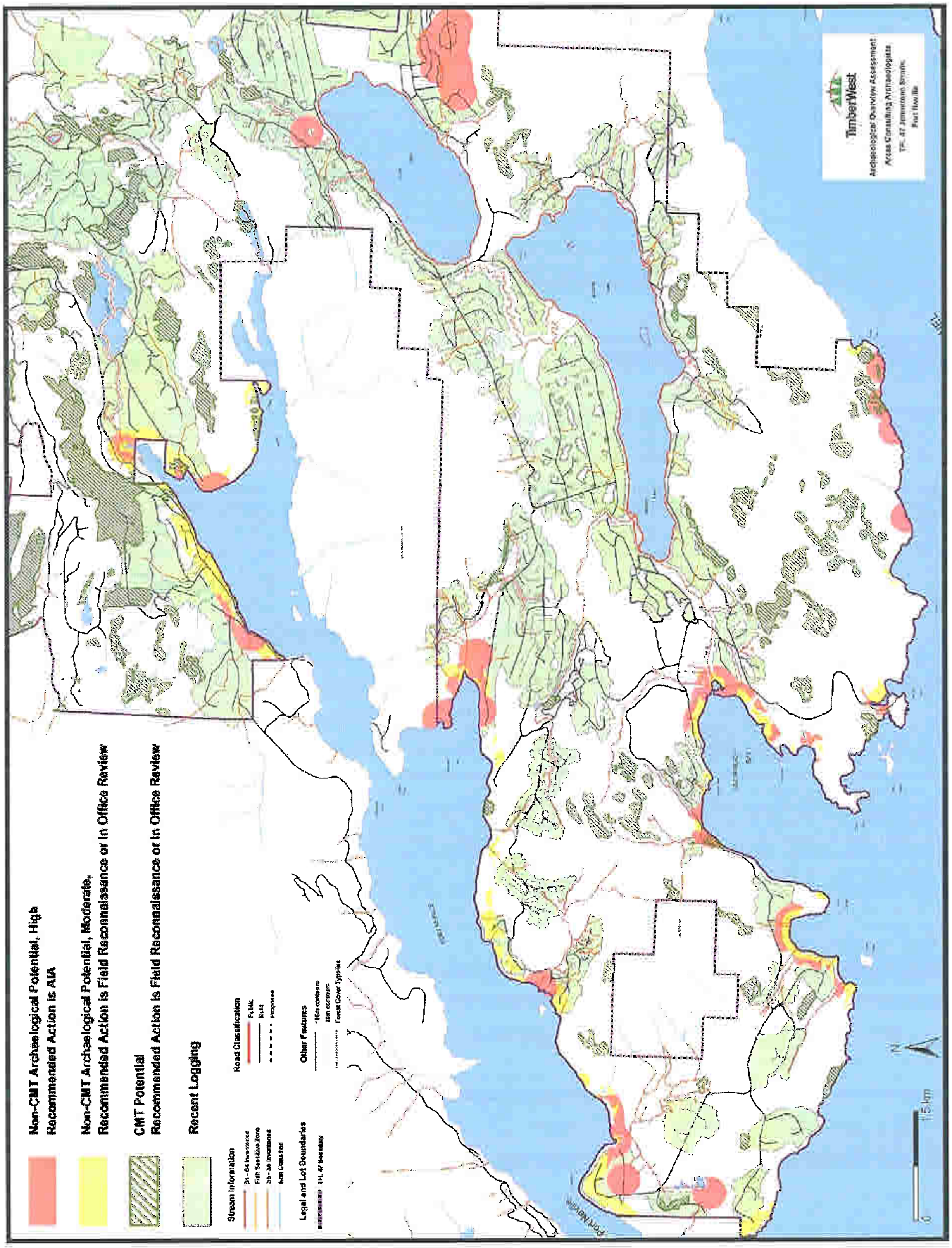

Figure 10. Port Neville (92.051) modelled for CMT and non-CMT Archaeological Resource Potential (1:75,000).

3.3.7 Groundtruthing of Model in Test Areas

When the possibility of revising the 2002 AOA results was discussed between TFL and Arcas, it was agreed that money should be set aside in order to allow for further groundtruthing of the revised model output. It was also agreed that since West and East Cracroft Islands were previously unexplored territory, the groundtruthing component should include time on both Islands. Dee Cullon (HTS) had also expressed an interest in having some of the groundtruthing time spent on West and East Cracroft Islands.

Groundtruthing commenced after the logical statements had been revised and an acceptable outcome had been produced for both the non-CMT and CMT models. Arrangements were made with the HTS to have Darren Matilipi and Ted Lewis participate in the groundtruthing component and Tom Sewid chartered his boat for the fieldwork as well. A total of four days (January 17-20) were spent on the groundtruthing fieldwork. Weather conditions were a particular concern during the fieldwork, notably severe winds. Anticipating poor weather, Tom Sewid arranged for the group to stay in a floating cabin in Potts Lagoon on West Cracroft Island the night of January 17th. The cabin was comfortable and its location well-suited to provide maximum time on and around West and East Cracroft Islands.

Groundtruthing was conducted within the two previously mentioned test areas from Tom Sewid's boat the Gla-Lis. In this way, the test areas were used to "fine tune" the GIS models, as well as allowing for a first hand inspection of West Cracroft Island.

Field methods for the present project differed somewhat from the 2002 groundtruthing work. There was insufficient time to conduct a thorough investigative tour of the two study areas, but it was imperative to spend as much time as possible in the study area, to observe and discuss what was shown in the modelled outputs and what was being observed in the field. It was believed that in order to obtain an accurate impression of the study area and the people who inhabited it for thousands of years, would be illuminating to approach the task from a perspective that would be comparable to the perspective of past peoples. Travelling by boat seemed to be an obvious way to provide that similar perspective.

The purpose of the groundtruthing component was the same as in 2002 and had three objectives: 1) verification of accuracy of baseline data; 2) verification of the modelling assumptions; and 3) verification of the modelling results.

Past experience with TFL's data used for the 2002 study, along with Don Davis's experience and knowledge of the TFL data including TEM, meant that the digital data used for the model is an accurate representation of the physical landscape.

The second phase of groundtruthing demonstrated that modelling assumptions for overview studies on the coast of British Columbia must consider slope and access to water (any kind of aquatic or marine landscape features) as the two most important landscape constraints on archaeological potential. Aside from the two principle constraints, the availability of traditional food resources dictate where and how people could live. Tom Sewid's experience within much of the overview study area was extremely useful, in that he was able to identify lands with archaeological potential and discuss the resources that would have been accessible to ancient people in each location. Knowing what resources were locally available was not always obvious, and Tom's insight on this topic was valuable and had not been used during the 2002 study.

The groundtruthing component took place about half-way through the modelling stages and the results of the fieldwork were incorporated into the final model. Preliminary non-CMT and CMT potential model results were portrayed on 1:20,000-scale maps for the groundtruthing component. The modelled output and the field reconnaissance demonstrated that there are many variables to be taken into consideration when conducting a complex study like this AOA. The complexity of the cultural data is such that relying solely on physical attributes data for information about past cultures will always result in a model that is missing numerous cultural indicators that cannot be linked to a physical data set.

Two days of groundtruthing fieldwork were spent on and around West and East Cracroft Islands (Figure 11). On the first day the crew departed from Sayward on Vancouver Island and travelled to Port Harvey on East Cracroft Island. We then travelled around East Cracroft via Havannah Channel and Chatham Channel to Potts Lagoon. Potts Lagoon is interesting because of its long history of use by both First Nations' and European peoples. The trip was made in typically stormy January weather, reminding the participants that the ancient inhabitants of this region had to be cognizant of the weather, particularly the prevailing winds and ocean currents. In settings where the effects of the prevailing winds were minimized, there were almost always indications of past and/or present occupation of East and West Cracroft Islands. These Islands' proximity to other Islands was discussed, and the daily and seasonal rounds of pre-contact First Nations' people was a key discussion topic throughout the field project. Tom Sewid emphasize that the lands and waters around West and East Cracroft Islands were connected to adjacent areas via the seasonal round, and that resources around West and East Cracroft Islands were abundant, particularly in terms of clam beaches and the fish species that could be taken. The evening of the first day finished in Potts Lagoon at the floating cabin where the crew spent the night.

The morning of the second day revealed weather conditions that were less than ideal. Within Potts Lagoon, the winds were not noticeable, which is a significant indicator of why this locality was/is favourable for habitation. The second day of fieldwork saw the boat and crew travelling from Potts Lagoon along the northern shore of West Cracroft, via Clio Channel and Baronet Pass. The rich resources available in Baronet Pass were discussed, and the high archaeological potential of particular coves and bays was observed. An undocumented archaeological site near Cracroft Point, originally observed by Tom Sewid was visited and it was noted that a local kayaking-touring company had been using the beach and adjacent shoreline for camping, and had adversely impacted the site.

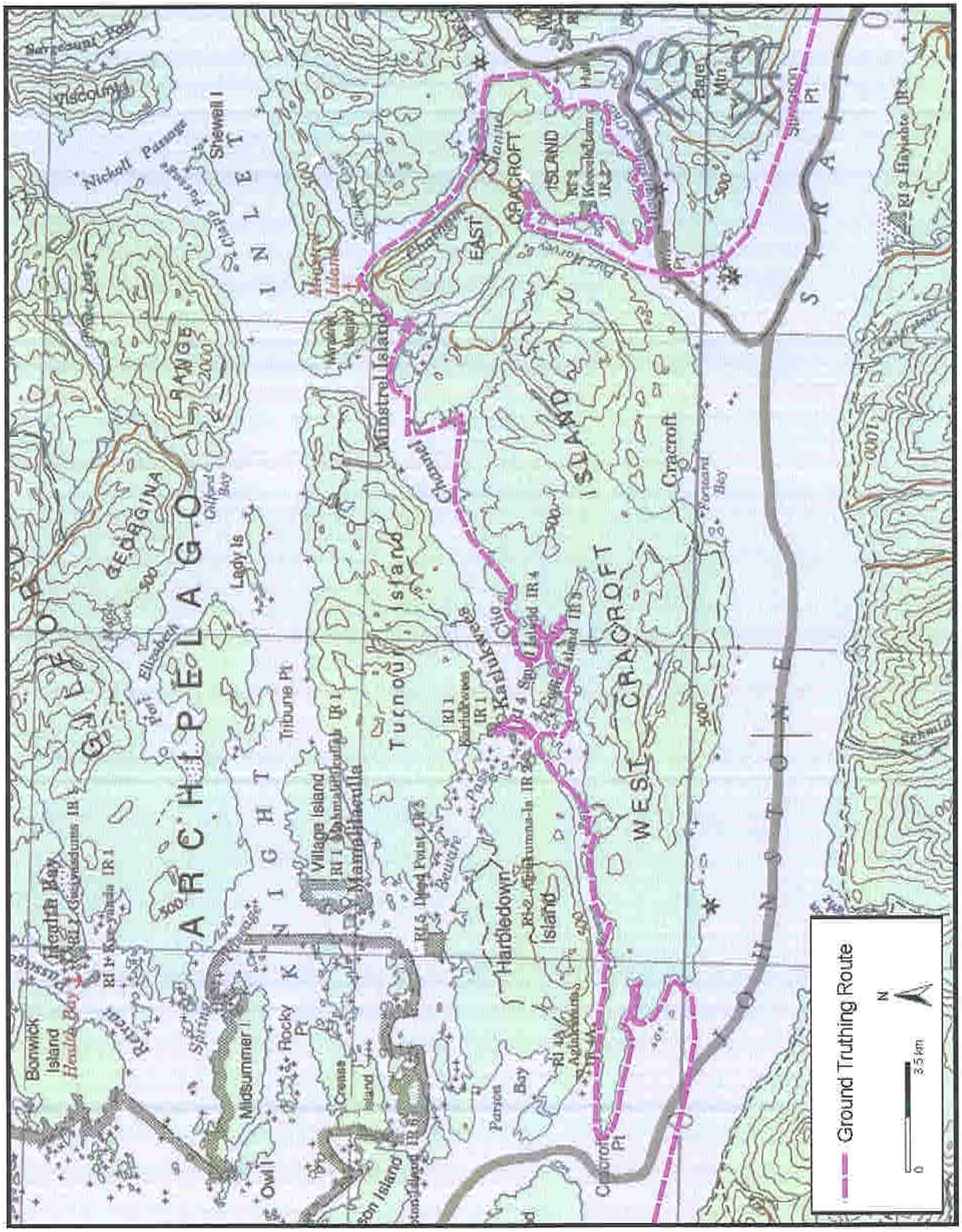

Figure 11. Ground truthing traverse West and East Cracroft Island (NTS 92/L; 1:175,000).

The CMT potential of East and West Cracroft Islands was also discussed, and remnant patches of old growth western redcedar were observed along the shore. The CMT potential model developed for this project predicted that CMTs would be present on East and West Cracroft Islands. Though not confirmed by a pedestrian survey, this prediction appears to have been confirmed by observations of remnant old growth forest patches on these Islands, both at the shore and inland.

Rough weather in the afternoon of the second day did not allow the crew to complete its circumnavigation of West Cracroft Island, although the boat did make it beyond Cracroft Point. An intimate knowledge of local weather conditions was certainly appreciated during the fieldwork and long discussions on the boat covered topics like the skill of past aboriginal peoples' in canoeing amongst the islands as well as the importance of favourable foreshore characteristics for landing canoes near village sites.

The third and fourth days of the groundtruthing survey covered a larger portion of the study area, commencing in Loughborough Inlet and travelling as far north as Heydon Bay. Mary Point and Beaver Inlet were also briefly visited at this time. This portion of the field component lead to discussions about the importance of overland trails in certain locations such as from Loughborough Inlet to Heydon Lake, from Beaver Inlet to Forward Harbour, and from Topaze Harbour to Heydon Lake. The importance of the trail from Jackson Bay to Tom Browne Lake and the critical access route to the Knight Inlet eulachon fisheries was also noted. Overland trails were certainly present in the distant past, but their locations are rarely easy to verify , primarily due to their destruction by historic resource harvesting and land use. The lack of particular trail information was discussed and identified as an obvious data gap for this project. Highlights of the third day included an opportunity to visit portions of Forward Harbour and Topaze Harbour, as well as the circumnavigation of Hardwicke Island.

The fourth field day focused on Port Neville and surrounding lands. Port Neville has many recorded archaeological sites denoting a long history of human occupation. Nearby Blenkinsop Bay was an area of interest due to the discovery of a large fish trap in the sandy bay during the 2002 groundtruthing survey. Seasonal tide patterns did not permit a re-visit to the fish trap in Blenkinsop Bay but a cursory survey of this location did not reveal high potential for the presence of midden sites. Instead, it was suggested that the large, presumably communal fish trap in Blenkinsop Bay was probably controlled by families living either in nearby Port Neville or Jackson Bay, as both locations have significant village sites and are within an easy travelling distance to Blenkinsop Bay.

The revised CMT potential model was not based on TEM data and its improvement over the previous version was immediately apparent during the groundtruthing component. CMT potential was observed throughout Port Neville and vicinity, along with the Topaze Harbour and Loughborough Inlet localities, although the presence of steeply sloping terrain along some of the shoreline in Loughborough Inlet decreases the potential in those settings. Remnant patches of old growth forests were observed in the field, and most were highlighted on the maps output from the preliminary revised model. These findings are considered to represent a significant improvement on the abandoned CMT potential model developed by the 2002 overview.

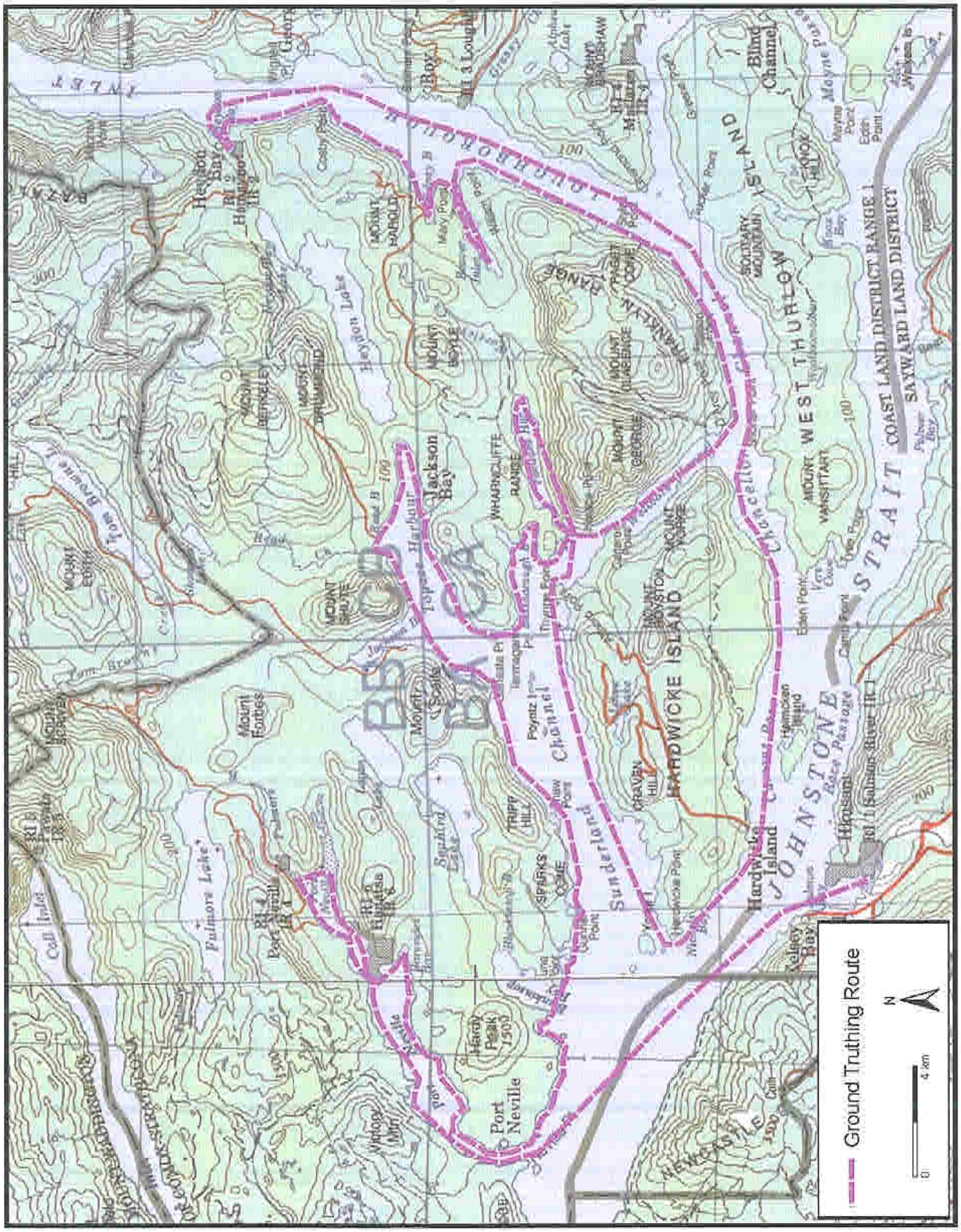

Figure 12. Ground truthing traverse Port Neville (NTS 92/K and 92/L; 1:200,000).

4.0 RESULTS OF ARCHAEOLOGICAL POTENTIAL MAPPING

4.1 Model Results

The GIS models adopted by the present overview classified the entire study area into three classes of non-CMT potential as was accomplished by the 2002 overview (see previous report): Class 1 (High potential, Low constraint); Class 2 (Moderate potential, Moderate constraint); and Class 3 (Low potential, High constraint). As well, two classes of CMT potential were used: Moderate-to-High, and Low. These classes are defined in the previous report. Overall for non-CMT archaeological resource potential, the revised GIS model has significantly increased the areas of land with Class 1 and Class 2 potential ratings, with 2.00% of the overview study area is modelled as having Class 1 potential (versus 0.95% with the previous model) and, 1.20% now modelled as having Class 2 potential (versus 0.50% by the original model). Approximately 6.0% of the overview study area is modelled as having CMT potential (versus 0.13% by the 2002 model) which represents a significant increase (Tables 4 and 5).

Lands with high archaeological potential exhibit the largest number of attributes/variables/characters that favourably influenced the distribution of archaeological sites. However, as previously discussed, though the highest overall density and frequency of archaeological sites should be found in Class 1 lands, sites may not be present at all points within these settings. Conversely, Class 3 lands exhibit the fewest attributes that would have influenced site distribution, and the lowest overall site density and frequency are expected in such locations. However, it is important to keep in mind that low-potential lands do not have 'nil potential', and archaeological sites of some kinds are probably present within Class 3 lands. The presence of significant archaeological data gaps, including information about the absolute distribution of documented archaeological sites, means that these results should not be considered as representative of the study area as a whole.

Table 4. Study Area Breakdown by Non-CMT Potential Class.

Potential Class (Non-CMT)	Area (in hectares)	Percent of Total Area
1 (High)	1828	2.00%
2 (Moderate)	1,148	1.2%
3 (Low)	90,824	96.8%
Total	93,800	100%

Table 5. Study Area Breakdown by CMT Potential Class.

Potential Class (CMT)	Area (in hectares)	Percent of Total Area
Moderate-to-High	6046	6.4%
Low	87,754	93.6%
Total	93, 800.0	100%

4.2 Overall Modelling Limitations

The following limits to the revised GIS models have been observed:

- Modelling with TEM data was attempted for a second time and again met with limited success. Don Davis postulated that using TEM data could help ascertain where in the landscape western redcedar may have been present in the past, and by extension, that knowledge could be used for the CMT model using both TEM and traditional Forest Cover data. The preliminary results of the TEM model indicated that a considerable fraction of the study area had the potential for the presence of western redcedar in the past, and that the criteria being used to model for CMTs were too generalized to justify a more comprehensive study of past CMT potential in second growth settings. The TEM-based approach to the CMT model was reluctantly abandoned, but its potential utility for the next generation of GIS potential models must be acknowledged;

- The groundtruthing surveys revealed a poor understanding about the specific location of inland trails in the landscape, and yet the importance of such trails (be it of secondary importance to navigable marine routes) for potential modelling is apparent;

- Some landscape features which are suspected to affect archaeological potential could not be used, due to a lack of data or GIS limitations. For example, the inability to differentiate between the different beach or shoreline types precluded the ability to model for clam gardens;

- Insufficient understanding of paleoshoreline data that could be used to predict the location of early habitation sites;

- Insufficient distribution data (for both archaeological and traditional use sites) is available to confidently determine the appropriate width of feature buffers; and

- Even with the important addition of digitized TUS data, accurate or limited ethnographic sources for modelling traditional land use do not accurately reflect all pre-Contact land use activities that could have resulted in the formation of archaeological sites; this cannot be over-emphasized, as it has significant consequences for the reliability of any GIS model that may be developed.

4.3 Data Gaps

This study could not have taken place without the extensive research and work done for the original 2002 AOA project conducted for TFL by Arcas. Since that time, there has been an improvement in the reliability of the TEM data along with a better understanding of the non-TEM data as provided by TFL. However some data gaps continue to exist and are discussed below.

4.3.1 Archaeological Inventory

The development of a reliable archaeological potential GIS model is partially dependent on the quality of data concerning the distribution of archaeological sites within the study area. As originally stated in the 2002 overview report, information used to build the model should come from all parts of the study area and should represent all environmental settings present. The current database is biased towards sites in shoreline settings and there is a distinct imbalance in the area of surveyed inland settings. Furthermore, a systematic site inventory for the entire study area has not been conducted, and should be considered as an important step in the ongoing process of understanding the distribution of archaeological resources. Although there is a significant interest in the location of CMT sites and the potential for CMTs in the landscape, the absence of inland survey representation in the context of the overall archaeological site inventory should be considered when developing terms of reference for any site inventory research in the study area.

As emphasized in the 2002 report, it is important that an archaeological site inventory be conducted, and that it be complete, accurate, and current. The results from the present project can be considered to represent an improvement over the original 2002 AOA, but, this research is merely a starting point for understanding patterns of archaeological potential in the region.

4.3.2 Digital Mapping Information

This project included a second attempt at modelling for CMT potential on the landscape using TEM data. As with the attempt in 2002, the results of this approach were not successful. In this case, the results were overly generous in that the TEM data modelled large portions of the study area with CMT potential.

The inability to differentiate between different classes of beaches within the study area was unfortunate, in that while there was discussion during the groundtruthing survey about the presence of clam gardens and the importance of sandy beaches versus rocky beaches. Beach type characteristics could not be elicited from the data-sets, although perhaps this information could be obtained at a later date.

Lastly, the absence of digital information for trails or possible trails in the study area was observed as a data gap during the groundtruthing component of the study, and certainly represents a data gap that should be addressed for the next round of study.

4.3.3 Data Gap Recommendations

The following specific recommendations are made in order to address data gaps identified during the present study. More general recommendation on how to deal with data gaps by future projects is provided in Section 5 of this report.

Archaeological Inventory

- To address deficiencies regarding archaeological inventory data, we recommend that TFL in cooperation with the HTS initiate an application for a systematic archaeological inventory of the revised overview area, particularly focusing on inland settings with or without CMT potential.

Digital Mapping Information

- The issue of CMT modelling using TEM data should be addressed as TEM holds great promise, but it appears that further research is required to finesse the data.

- Missing trail data is a cross-over issue from the 2002 overview. Some funds should be allocated by TFL to enable the HTS to conduct an accurate trail mapping project in study area, with the results shared between TFL and the HTS.

5.0 RESOURCE MANAGEMENT AND RECOMMENDATIONS

5.1 Archaeological Resource Management Recommendations

Section 5 of the 2002 overview report includes an introduction to archaeological resource management and how an overview fits into the overall process as defined by the Archaeology and Registry Services Branch (Ministry of Sustainable Resource Management).

The results of the present overview study are presented in the same configuration as the 2002 overview report. There are three classes of archaeological resource potential for non-CMT resources: Class 3 (Low potential), Class 2 (Moderate potential), and Class 1 (High potential). The archaeological potential for CMT potential is expressed as either Low or Moderate-to-High potential. On paper maps, the non-CMT potential classes are coloured red for high and yellow for moderate potential; CMT potential is indicated by green hatched lines which overly the coloured non-CMT potential model.

As recommended in the 2002 report, all proposed TFL developments in the present study area should be reviewed to determine whether archaeological studies are required in the context of the Archaeological Impact Assessment and Review Process discussed in Section 5.3 of the 2002 overview report. The original list of management actions in response to a proposed development within the study area are repeated here as they are important and bear repeating.

Furthermore, TFL is responsible for consultation with all First Nations' communities with identified interests in the study area, and while specific management recommendations concerning First Nations' consultation are not provided in the following management recommendations, TFL is once again reminded of its responsibility for such consultation and for ensuring that consultation occurs in a manner acceptable to all parties.

Non-CMT Resource Potential:

- If a proposed development is planned in an area with **Class 3 Potential (low)**, and no conflicts or concerns are demonstrated, it is recommended that no further archaeological studies take place. If possible conflicts or concerns are demonstrated, it is recommended that TFL consider the need for an in office review, PFR, or AIA in consultation with the First Nations, MoF, and an archaeologist.

- If a proposed development is planned in an area with **Class 2 Potential (moderate)**, the appropriate level of effort is an in office review or a PFR of the development area to identify micro-topographic features and assess their effect on the archaeological potential rating assigned to the location by the overview. If such landscape features can be identified on airphotos or maps, then an in-office review is recommended. If such features are not visible on airphotos or maps, then a PFR is recommended. It is also recommended that the PFR be conducted under a heritage inspection permit.

- If a proposed development is planned in an area with only **Class 1 Potential (high)** present, the recommended action is: an AIA of the development area under a heritage inspection permit.

- If a proposed development is planned in an area with a combination of **Class 3 and 2 Potential, or Class 2 and 3 Potential**, the recommended action is that the highest potential rating present should be applied over the entire proposed development area, with the expectation of adjustments to the work required based on a field inspection.

CMT Resource Potential

- If a proposed development is planned in an area with **Low CMT Potential** and no conflicts or concerns are demonstrated, the recommended action is that no further archaeological studies take place. If possible conflicts or concerns are demonstrated, then the proponent should decide the need for an in-office review, PFR, or AIA in consultation with the First Nations, MoF, and an archaeologist.

- If a proposed development is planned in an area with **Moderate-to-High CMT Potential**, the recommended action is: a PFR to identify the presence or absence of CMTs. Where the PFR identifies CMTs, a follow-up AIA may be required. The need for an AIA should be determined in consultation with the MoF and an archaeologist.

- If a proposed development area has potential for both CMT and non-CMT resources, the recommended action is for a PFR or AIA to be conducted under a heritage inspection permit, depending on the level of non-CMT potential.

In accordance with Heritage Inspection Permit conditions, the results of an AIA must be reported to the Archaeology and Registry Services Branch, who will review the assessment and forward recommendations for the management of possible archaeological impacts to TFL. It is possible that some impacts will be so severe that a development cannot proceed, but more frequently the development can proceed if design or development plans are modified to avoid or reduce adverse impacts.

As discussed in the above recommendations, a reconnaissance assessment can consist of a variety of activities. The main purpose of the reconnaissance is to "fine tune" the archaeological potential rating for the development area, using detailed information that was not practical or available for use in the overview model development. Such information could include: airphotos, topographic and biophysical mapping at scales larger than 1:20,000, revised or more detailed forest stand data, and information about traditional use sites provided by First Nations' communities. A reconnaissance assessment might include the previously discussed PFR as defined in the *British Columbia Archaeological Impact Assessment Guidelines*. A PFR could consist of a simple overflight or windshield survey of the development area, or pedestrian "ground-truthing" to accurately assess its archaeological resource potential. Shovel testing is sometimes needed to confirm non-CMT site potential. If so, such a PFR must be conducted in accordance with a Heritage Inspection Permit issued by the Ministry of Sustainable Resource Management, pursuant to section 14 of the *Heritage Conservation Act.*

The reconnaissance assessment will result in recommendations either to conduct an AIA or to carry out no further archaeological studies for a particular development area. If no AIA is recommended, the reconnaissance assessment usually completes the archaeological work required for that development. The results of the reconnaissance assessment should be reported (see below).

5.2 Application of Overview Results

This overview study, as was the case with the 2002 overview, was initiated and designed specifically for forestry planning. However, the results are also applicable to management planning for all kinds of land-altering developments in the study area, as well as to archaeological research and traditional use studies generally. It is recommended that the revised GIS models results be used during development planning by all regulatory authorities, and industries responsible for overseeing or initiating land-altering activities, including the Ministry of Forests, Ministry of Transportation, Lands and Waters BC, BC Parks, forestry licensees, mining companies, real-estate developers and tourism operators.

All proposed land-altering developments should be reviewed to determine if (and what kind of) archaeological studies are required. The CMT and non-CMT site potential coverages are mapped digitally across the entire study area, and are available in the form of digital files or paper maps from the TFL Johnstone Strait Operation office.

For the application of the overview results in forestry planning, it is recommended that the steps identified in Table 6 be followed (per Table 11 in the 2002 overview report). TFL is primarily responsible for overseeing the application of the overview in forestry planning.

Table 6. Recommended Steps for Application of Overview Results in Forestry Planning.

Step	Required Action
1	Identify the mapsheets for areas where proposed forestry developments are located.
2	Obtain the appropriate digital files and/or paper archaeological potential maps.
3	Using the digital or paper archaeological potential maps as an overlay on the development plan, determine the archaeological potential of the area affected by the proposed developments.
4	Determine the appropriate archaeological management action(s) for each development area or portion thereof (see Archaeological Management Recommendations).
5	Obtain additional information necessary for determining the appropriate archaeological work in consultation with the MoF and relevant First Nations.
6	Where required, engage an archaeologist to conduct a field assessment or further research.

Step	Required Action
7	Document results of all archaeological fieldwork or research so that future revisions to the model can be made.
8	Determine the appropriate management actions for identified archaeological resources in consultation with the MoF, the appropriate First Nations, and an archaeologist.

5.3 Model Revisions and Recommendations

The revised TFL AOA represents a third attempt to develop a GIS-based archaeological potential model for TFL 47 in the Johnstone Strait Operation Area. The revised overview results are partially limited by the digital information available for developing the potential model. Data gaps, with recommendations for addressing those gaps, are presented in Section 4.3. As new information becomes available through future archaeological studies, digitization of new datasets, and from First Nations' communities, it is important that the model be revised, and that the revised model be applied to the overview as was done for revisions of the GIS model during the present study. With this in mind, it is recommended that (as per the 2002 overview):

- TFL commits to a yearly review in order to assess the model's success. The review should be conducted by a committee comprised of representatives from the First Nation communities, MoF, and a qualified archaeologist. The model should be revised when, in the opinion of the review committee, there is sufficient new information to require revision. This review and revision process would be subject to the availability of funding.

- The Archaeology and Registry Services Branch and MoF support initiatives and studies required to address the data gaps identified in this overview; and

- Any revisions to the model be done under the direction or in consultation with the proposed review committee.

AIA and PFR studies for proposed forestry developments are probably the most critical sources of information required to revise the model used in this overview. However, certain kinds of information about a development area need to be documented during an AIA if this information is to be of value for revising the model. In order to evaluate the model, each development area should be assessed in the field in terms of the criteria used by the model to determine potential. It will then be possible to compare archaeological potential as predicted by the model with archaeological potential as assessed in the field. Investigators also can use other criteria to assess potential, and these additional criteria could be included in future versions of the model. To ensure that the correct information is collected, it is recommended that:

- TFL require archaeologists undertaking PFR or AIA studies for proposed forestry developments within TFL 47 of the Johnstone Strait Operation Area to complete, as part of the assessments, a form evaluating archaeological potential of the development area, in terms of the criteria used in the model plus any other relevant criteria. The form could be designed by a qualified archaeologist, be made available to TFL, and be attached to reports submitted to the Archaeology and Registry Services Branch.

In the past, reconnaissance assessments of proposed development areas, particularly timber harvesting blocks, were reported orally, or reported briefly in writing to the proponent, often in the form of a memorandum. These reports are seldom forwarded to the Archaeology and Registry Services Branch or, in the case of forestry developments, to the MoF. As a result, few archaeologists are aware of these reconnaissance assessments. Further complicating the matter are CMT inventory projects, along with questions about who is responsible for compiling and reviewing the information gathered from future CMT inventories of this nature. To ensure that reconnaissance and inventory data are available to assist in the development of archaeological potential models, it is recommended that:

- The Archaeology and Registry Services Branch (and MoF, with respect to provincial forest lands) require that the results of all PFR and CMT inventory assessments be reported in writing and submitted to the Archaeology and Registry Services Branch.

- The Campbell River Forest District should compile and maintain a list of all AIA, PFR, and CMT inventory studies conducted in the district. All reports should be kept on file at the district office.