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Review of the Fort St. James Forest District Archaeological Predictive Model 2009

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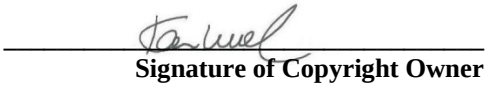

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MANAGEMENT SUMMARY

Ecofor Consulting Ltd. received Forest Investment Account (FIA) funding through Conifex to update and review the Fort St. James Forest District Archaeological Predictive Model, which includes input of field data collected in 2007-2008, and the results of feedback from users of the model. The data was used to evaluate the model in terms of effectiveness and efficiency, as well as to create suggestions for improvement.

Analysis of the Fort St James Forest District Archaeological Predictive Model indicates that it is effective at predicting archaeological site locations, but not effective at predicting culturally modified tree (CMT) locations. The model is not efficient in predicting locations of neither archaeological nor CMT sites. Both effectiveness and efficiency were measured using the guidelines put forth by the Archaeology Branch (Province of BC 2008).

A preliminary analysis of the variables used to create the model show a bias for high archaeological potential in the southern and western portions of the district. Significant watercourses and their associated landforms in the eastern portion around Nation and Omineca Rivers have been under-rated in this model. The weighting and ranking of the variables should be re-visited to rectify these deficiencies. Variables should also be scrutinized for their applicability in predicting archaeological sites within the district.

A preliminary analysis of the potential zones overall bring into the question the role of the moderate potential zone. Greater effectiveness, efficiency, and usability might be achieved by phasing the moderate potential zone out.

All information gathered for this study has been accrued through the necessity for archaeological survey by development proponents who have used the model to determine where AIAs should occur; therefore, the preponderance of survey has been in high and moderate potential zones. Low potential areas have not been sufficiently evaluated to determine if these areas have actual in-field potential or not. Objective field testing of the model would survey and assess areas through all potential zones, which would provide data to further analyze and refine the model.

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1.0 INTRODUCTION

Ecofor Consulting Ltd. received Forest Investment Account (FIA) funding through Conifex to update and review the Fort St. James Forest District Archaeological Predictive Model. This report documents the efforts of the update and analysis, which includes input of field data collected in 2007-2008, and the results of feedback from users of the model.

Since the GIS-based model was implemented in 2004, archaeological survey has been completed in moderate and high potential areas with very little work in low potential areas. Archaeological survey has been motivated by proposed developments within the district; therefore, it has not been the objective field examination required to test the model. Addition of the information gathered in the past two years to the model provides a larger data set to test the model's efficiency and effectiveness, but does not provide a scientific analysis of the model as a whole.

Users of the model can provide information on areas for improvement. Questionnaires were sent to First Nations and licensees within the District asking for comment on any areas of concern, short comings, or areas for improvement to the model.

This report consists of a description of the methodology used to update the database and to elicit information from users of the model. The results section (3.0) lists information gathered within the last two years, as well as the feedback gathered from users of the model. Section 4.0 discusses the efficiency of the model using the archaeological data inputted into the database, analyzes the variables used in creating the model and interprets comments from users. Finally, Section 5.0 outlines conclusions and recommendations for further testing and model refinement. References cited within this document complete the report.

1.1 Background

In 1998, Norcan Consulting created an archaeological predictive model for the Fort St. James Forest District (Canuel 1999). This model was deductive, applying weighted values to the following 10 variables: water; fish; cultural; aspect; natural disturbance; sediment; drainage; surface materials; surface expression; and slope. In order to use the model, users inputted information on the above variables for the area of interest into Microsoft Access. The program would then apply a number to the area which would correspond to a rating of low, moderate or high archaeological potential.

Between January 2003 and May 2004, Ecofor Consulting utilized FIA funding received through Canadian Forest Products (Canfor) to assess and upgrade the Norcan archaeological predictive model. A multi-phase project was proposed and executed that resulted in a more comprehensive and definitive GIS-based archaeological predictive model. Three phases of the project were completed at this time (Marshall and Bond 2004).

Phase I involved consultation with the various First Nations within the Fort St. James Forest District to generate interest and support for the project and collect necessary ethnographic and traditional data for the creation of the Cultural Heritage Resource Inventory Database (CHRID).

During Phase II, CHRID was created by inputting known archaeological sites into a Microsoft Access database, which enabled the user the storage, sorting, and retrieval of information. This data was gathered from all of the known archaeological assessments done in the district between 1951 and 2003. At this time, site location data also allowed for the statistical analysis of the Norcan model.

Phase III of the project proposed field-testing for the current model. However, due to time and budget constraints, field-testing did not occur. Thus, the project proceeded onto Phase IV.

Phase IV generally consisted of the development and assessment of the newly created GIS-based predictive model for the Fort St. James Forest District. Weighted variables used in the new model were pared down to seven, including: water resources; soil stability/surficial geology; proximity to wetlands; landforms; forest cover; aspect; and slope (Marshall and Bond 2004). This analysis included information on environmental, cultural, and archaeological aspects of the study area and how these were used to develop the model.

The new Fort St. James Archaeological Predictive Model utilized an inductive GIS-based approach to help minimise cultural bias. By focusing on the areas where previously recorded sites actually occur and how they pattern, modern perspectives of the land and its topography are overcome. It is meant to be used in a scientific way, i.e. through spatial GIS plotting of various environmental factors and previously recorded sites, as well as in an ethnographic or human way, i.e. to see if the variables are correlating in a way that makes sense to humans (Marshall and Bond 2004:13).

Subsequent to the creation of the predictive model in 2004, it was accepted by the Ministry of Forests for use by developers, archaeologists, and other persons in the Fort St. James Forest District in determining the necessity for specific types of cultural assessment.

In 2007, Ecofor received FIA funding through Pope and Talbot to update CHRID with data collected during the 2004, 2005 and 2006 field seasons. At that time, an initial model review found that archaeological sites were found in predicted areas of potential, but that field testing would be essential to a scientific and thorough analysis of the model.

This report is a secondary review of the model without the field-testing component. It has been generously funded through FIA from Conifex.

2.0 METHODOLOGY

2.1 Data Input

One of the primary objectives during this review was to update and refine CHRID, which provides preliminary background information prior to any archaeological overview or impact assessment. This database enables archaeologists to view and retrieve information on all previously recorded sites within range of a proposed development area. This knowledge assists in the determination of possible archaeological potential as it provides a pattern of site location.

All pre- and post-1846 heritage sites recorded in 2007 and 2008 were spatially plotted and entered into CHRID. Archaeological impact assessment (AIA) and preliminary field reconnaissance (PFR) reports for areas surveyed within the Fort St. James Forest District were reviewed. Assessments were completed by Archer CRM Partnership, Ecofor Consulting and Norcan Consulting during this time period, including the following heritage inspection permits:

- 2007-137, Ecofor Consulting (King 2008a)
- 2007-140, Archer CRM Partnership (report not available)
- 2007-098, Norcan Consulting (Canuel and Botting 2008)
- 2008-194, Norcan Consulting (Canuel *et. al.* 2009)
- 2008-237, Ecofor Consulting (Baillaut 2009)

The final report for Archer's 2007-2008 field season had not been completed at the time of writing this report; therefore summaries on site locations were obtained from the clients. Information for some data fields were unavailable at the time of writing this report and have been left blank.

Reports for preliminary field reconnaissance (PFR) that were reviewed include: King (2008b, 2008c), Mooney (2008) and Walton (2008).

Time was also allotted to visually and digitally rectify site locations and descriptions that may have been incorrectly entered during the initial construction of the database. Efforts were made to match as closely as possible the locations of pre-1846 and important post-1846 sites to the Remote Access to Archaeological Data (RAAD), which is maintained by the BC Archaeology Branch. This also served to better define cultural heritage trails within the district, as several segments have been located and GPS'ed in the past three years.

Analysis of the inputted data included a forward and reverse review. The forward review investigates the general work done and the reverse review compares sites to the area of potential in which they were located. The data was also used to analyse the effectiveness and efficiency of the model. Effectiveness is measured by the percentage of sites falling within high and moderate potential zones. Efficiency is measured using Kvamme's gain statistic.

Several proposed development areas were archaeologically assessed, but no sites were located. These locations were tabulated and cross-referenced for modeled and assessed potential. If field testing of a modeled high archaeological potential area returns no archaeological sites, it does not necessarily mean that area has low archaeological potential. The modeled archaeological potential must be compared with the assessed archaeological potential, which indicates whether the model is accurately predicting the potential to find archaeological sites.

2.2 User Feedback

Users of the model can provide information on areas for improvement. Questionnaires were sent to First Nations and licensees within the District asking for comment on any areas of concern, short comings, or areas for improvement to the model. A copy of the questionnaire is included in Appendix A. Follow up included phone calls and meetings to discuss the issues presented in the questionnaire.

First Nations were asked their opinions about including information on sensitive sites with matching recommendations. They were also asked about collecting information from recent Traditional Land Use Studies, trail databases, and other sources.

Both First Nations and licensees were asked for feedback regarding the usability of the model and areas for improvement.

3.0 RESULTS

3.1 Field Data Results

Assessments from 115 development areas were used to compile this data. Of these 115 development areas, 55 contained cultural heritage sites while 60 had no sites. The compilation of data from the past two years results in four sets of data: recorded archaeological (pre-1846) sites; recorded pre-1846 CMT sites; recorded post-1846 sites; and areas surveyed with no sites identified. These data sets are summarized in Tables 1 through 4 below. In all of the tables, the following abbreviations are used: H=High, M=Moderate, L=Low.

Table 1. Recorded Archaeological Sites and Modeled Potential

Borden Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
GbSc-8	Trail, CMT	2008-0237	093K.028/.029	402147	6018088	M
GcRx-6	Trail	2007-137	093J.041/.051	439260	6039484	M-H
GcSa-13	Cache Pit, CMT	2007-140		428309	6034942	H
GcSd-2	Cache Pit	2007-140		401838	6026083	M-H
GcSd-3	Lithic	2007-140		401354	6025227	M
GcSd-4	Cache Pit	2007-140		394782	6024178	H
GdSh-12	Cache Pit	2008 PFR	093K.054	350195	6051542	H
GdSh-13	Cache Pit	2008 PFR	093K.054	353863	6050777	H
GdSh-14	Cache Pit	2008 PFR	093K.054	354761	6049954	H
GdSh-15	Cache Pit	2008 PFR	093K.054	354951	6049833	H
GdSh-16	Cache Pit	2008 PFR	093K.054	355202	6050259	H
GdSh-17	Cache Pit	2008 PFR	093K.054	357500	6050644	H
GdSh-18	Cache Pit	2008 PFR	093K.054	357626	6050701	H
GdSh-19	Cache Pit	2008 PFR	093K.054	357601	6050542	H
GdSh-20	Cache Pit	2008 PFR	093K.055	358657	6050143	H
GdSi-10	Cache Pit	2008 PFR	093K.054	346569	6051728	H
GdSi-7	Cache Pit	2008 PFR	093K.063	340727	6054996	H
GdSi-8	Cache Pit	2008 PFR	093K.063	341506	6053159	H
GdSi-9	Cache Pit	2008 PFR	093K.054	346469	6051384	H
GeSa-9	Lithic	2007-140		434117	6068440	H
GeSf-2	Cache Pit	2007-137	093K.076	381021	6067080	H
GfSg-4	Cache Pit	2007-137	093K.095	363894	6090431	M-H
GgSb-2	Cache Pit	2007-137	093N.009	417605	6104837	M-H
GgSb-3	Lithic	2007-140		418900	6105269	M
GgSb-4	Lithic	2007-140		418840	6105259	M
GgSh-?	Lithic	2007-140				H
GgSh-7	Cache Pit	2007-140		353046	6115638	H
SAL 059-1 (No Borden #)	Cache Pit	2007-140				M

Table 2. Recorded Pre-1846 CMT Sites and Modeled Potential

Borden Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
GbSc-6	CMT	2007-098	093K.069	405272	6020656	M-H
GdSb-5	CMT	2008-0237	093K.094	416339	6057273	M
GfSh-5	CMT	2007-137		355640	6092782	M
GgSh-8	CMT	2007-140		353345	6115742	M-H
GhSh-2	CMT	2007-140		359859	6116811	H
GgSi-7	CMT	2007-140	093K.038	341723	6101761	H

Table 3. Recorded Post-1846 Sites and Modeled Potential

Site Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
A64428-18-1	CMT	2007-137	093N.019	414794	6112083	M
A64428-21-1	CMT	2007-137	093N.019	415209	6112086	M
A64428-21-1	CMT	2007-140				M
A64428-21-10	CMT	2007-140				H
A64428-21-11	CMT	2007-140				H
A64428-21-12	Trail	2007-140				H
A64428-21-13	CMT	2007-140				H
A64428-21-14	CMT	2007-140				M
A64428-21-2	CMT	2007-140				M
A64428-21-3	CMT	2007-140				H
A64428-21-4	CMT	2007-140				M
A64428-21-5	CMT	2007-140				M
A64428-21-6	Trail	2007-140				H
A64428-21-7	CMT	2007-140				H
A64428-21-8	CMT	2007-140				H
A64428-21-9	CMT	2007-140				H
A64428-32-1	CMT/Trail	2007-137	093N.019	414320	6110933	H
A64428-32-2	CMT	2007-137	093N.019	413964	6110586	H
AIR 003-3	CMT	2007-140				H
AIR 006-1	CMT	2007-140				H
AIR 007-1	CMT	2007-140				L
AIR 008-1	CMT	2007-140				M
BAP 055-SK1	CMT	2007-137	093K.094	355110	6088584	H
CHU 025-1	CMT	2007-140				H
CHU 025-2	CMT	2007-140				H
CHU 025-3	CMT	2007-140				H
CHU 030 Access-1	CMT	2007-137	093N.019	417984	6107698	H
CHU 030 Access-2	CMT	2007-137	093N.019	418006	6107307	H
CHU 030 Access-3	CMT/Trail	2007-137	093N.009	417966	6106743	H

Table 3 continued

Site Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
CHU 030 Access-4	Trail	2007-137	093N.009	418234	6106491	H
CHU 030 Access-5	Trail	2007-137	093N.009	418140	6106601	H
CHU 030-1	CMT	2007-137	093N.009	418365	6106192	M-H
CHU 031-2	CMT	2007-137	093N.009	417829	6104645	H
CHU 032-J1	Campsite	2007-137	093N.009	421106	6101884	H
CHU 032-J2	CMT	2007-137	093N.009	421740	6102359	H
CHU 032-J4	Cultural Material	2007-137	093N.009	420255	6101428	H
CHU 032-SB1	CMT	2007-137	093N.009	420321	6103418	H
CHU 032-SB2	CMT/Trail	2007-137	093N.009	420466	6103695	H
CHU 032-SB3	CMT	2007-137	093N.009	420235	6101995	M
CHU 032-SB4	CMT	2007-137	093N.009	421286	6102313	H
CHU 032-SB5	CMT	2007-137	093N.009	421672	6102253	H
CHU 032-SB6	CMT	2007-137	093N.009	420772	6101732	H
CHU 032-SB7	CMT	2007-137	093N.009	420983	6101761	H
CHU 032-SK1	CMT	2007-137	093N.009	420186	6101800	H
CHU 032-SK2	CMT	2007-137	093N.009	420590	6101632	H
CHU 032-SK3	CMT	2007-137	093N.009	420175	6101461	H
CHU 032-SK4	CMT	2007-137	093N.009	421722	6102602	H
CHU 032-SK5	CMT	2007-137	093N.009	421330	6102848	H
CHU 040-1	CMT	2007-140				H
CHU 040-2	CMT	2007-140				M
CHU 040-3	Trail	2007-140				M-H
CP A Blk 5-1	CMT	2008 PFR	093K.059	416302	6044656	H
CP328-519-SK1	CMT	2007-137	093K.095	361161	6092556	H
CP328-519-SK2	CMT	2007-137	093K.095	361150	6093039	H
CP330-495-H1	CMT	2007-137	093K.094	359133	6095492	M
CP330-495-H2	CMT	2007-137	093K.094	358910	6095274	M
CP330-495-H3	CMT	2007-137	093K.094	359134	6095198	H
Cripple-1	CMT	2008-0237	093K.090	427244	6082301	H
HAT-J1	CMT	2008-0237	093K.079/.080	422676	6071380	H
HAT-J2	CMT	2008-0237	093K.079/.080	422669	6071575	H
HAT-R1	CMT	2008-0237	093K.079/.080	422832	6071076	H
HAT-R2	CMT	2008-0237	093K.079/.080	422773	6071601	H
JPRF Blk H-R1	CMT	2008-0237	093K.069	411679	6056527	H
JPRF Blk H-R2	CMT	2008-0237	093K.069	411697	6056652	H
JPRF Blk H-R3	CMT	2008-0237	093K.069	411636	6056935	H
JPRF Blk I-SB1	CMT	2008-0237	093K.069	412777	6055741	H
JPRF Block 56A-1	Trail	2007-137	093K.069	409875	6055219	M

Table 3 continued

Site Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
JPRF Block 56D Access-1	CMT	2007-137	093K.069	410500	6055235	M-H
JPRF Block 56G Access-J1	Historic Structure	2007-137	093K.069	410566	6053906	M
JPRF Block 56G Access-J2	Historic Structure	2007-137	093K.069	410776	6053877	M
JPRF Block A-R1	CMT	2008-0237	093K.069	417796	6056232	H
JPRF Block B-R1	CMT	2008-0237	093K.069	417129	6056613	H
K037-002-1	CMT	2007-140				M-H
K037-07-1	CMT	2007-140				H
K1D010-R1	CMT	2008-0237	093K.028/.038	402967	6019743	H
K1D010-R2	CMT	2008-0237	093K.028/.038	402500	6020110	M
K1D010-R3	CMT	2008-0237	093K.028/.038	402346	6020334	H
K1D010-R4	CMT	2008-0237	093K.028/.038	402078	6019849	M-H
K1D012-1	CMT	2008 PFR	093K.038	400150	6018398	M-L
K1D012-2	CMT	2008 PFR	093K.038	401350	6019575	M
KO37-002-2	CMT	2007-140				M-H
MOS 165-CMT 1	CMT	2007-098	093J.043	470134	6029672	M-H
MOS 165-CMT 2	CMT	2007-098	093J.043	470134	6029672	M-H
MOS 165- CMT 3	CMT	2007-098	093J.043	470134	6029672	M-H
MOS 165- CMT 4	CMT	2007-098	093J.043	470134	6029672	M-H
MUR 019-1	CMT	2007-140				H-M
NAH 008-2	CMT	2007-140				H
NAH 008-3	CMT	2007-140				H
NEC 054-1	CMT	2007-137	093J.021/.022	447295	6012192	H
NEC 054-10	CMT	2007-137	093J.021/.022	447571	6010851	H
NEC 054-2	CMT	2007-137	093J.021/.022	447244	6011949	M-H
NEC 054-3	CMT	2007-137	093J.021/.022	447656	6012054	H
NEC 054-4	CMT	2007-137	093J.021/.022	447970	6011744	H
NEC 054-5	CMT	2007-137	093J.021/.022	447840	6011596	H
NEC 054-6	CMT	2007-137	093J.021/.022	446227	6011279	M-H
NEC 054-7	CMT	2007-137	093J.021/.022	446818	6011042	H
NEC 054-8	CMT	2007-137	093J.021/.022	447096	6011116	H
NEC 054-9	CMT	2007-137	093J.021/.022	447186	6011400	M
NEC 055-1	CMT	2007-137	093J.021	446290	6011697	M
NEC 056-1	CMT	2007-137	093J.021	444652	6014659	H
NEC 056-2	CMT	2007-137	093J.021	444409	6014235	M
NEC 056-3	CMT	2007-137	093J.021	445113	6013700	M
NEC 056-4	CMT	2007-137	093J.021	445269	6013612	H
NEC 057-1	CMT	2007-137	093J.021	442878	6013756	M

Table 3 continued

Site Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
NEC 057-2	CMT	2007-137	093J.021	442709	6014025	M-H
NEC 057-3	CMT	2007-137	093J.021	443373	6014283	M
NEC 057-4	CMT	2007-137	093J.021	442656	6013966	H
NEC 057-5	CMT	2007-137	093J.021	443045	6014243	M
NEC 057-6	CMT	2007-137	093J.021	442927	6014198	M
NEC 058-1	Trail (Heritage)	2007-137	093J.021	438599	6014752	H
OKA 524-R1	CMT	2007-137	093K.095	363485	6092309	H
OKA 524-R2	CMT	2007-137	093K.095	364192	6091947	M
OKA 524-R3	CMT	2007-137	093K.095	364361	6092112	H
OKA 524-R4	CMT	2007-137	093K.095	364392	6092230	M-H
OKA 525-1	CMT	2007-137	093K.095	363499	6090527	H
OKA 525-2	CMT	2007-137	093K.095	363853	6090452	M
OKA 525-3	CMT	2007-137	093K.095	363185	6091061	H
OKA 525-4	CMT	2007-137	093K.095	364099	6090972	M
OKA 526-1	CMT	2007-137	093K.095	365732	6089593	M
OKA 526-1	CMT	2008-0237	093K.095	365732	6089593	M
OKA 526-2	CMT	2007-137	093K.095	366716	6089258	M
OKA 526-2	CMT	2008-0237	093K.095	366716	6089258	M
OKA 526-3	CMT	2007-137	093K.095	366875	6089747	M-H
OKA 538-1	CMT	2008-0237	093K.095	366994	6094491	H
OKA 538-2	CMT	2008-0237	093K.095	366535	6094767	H
OKA 538-3	CMT	2008-0237	093K.095	367094	6094413	H
RAIN 013-R1	CMT	2007-137	093K.099/.100	424810	6087399	H
RAIN 013-R2	CMT	2007-137	093K.099/.100	425001	6087405	H
RAIN 013-R3	CMT	2007-137	093K.099/.100	426798	6088070	M
RAIN 013-R4	CMT	2007-137	093K.099/.100	426384	6087659	H
RAIN 013-R5	CMT	2007-137	093K.099/.100	426258	6087511	M-H
RAIN 013-SB1	CMT	2007-137	093K.099/.100	424508	6088152	M-H
RAIN 013-SB2	CMT	2007-137	093K.099/.100	424522	6088410	H
RAIN 013-SK1	CMT	2007-137	093K.099/.100	424390	6088201	H
RAIN 021-BK1	CMT	2007-137	093J.091	444000	6091481	H
RAIN 021-SK1	CMT	2007-137	093J.091	444999	6091139	M
RAIN 021-SK2	CMT	2007-137	093J.091	445204	6091224	M
RAIN 021-SK3	CMT	2007-137	093J.091	444841	6091272	M
SAL 029-R1	CMT	2007-137	093J.072	449850	6071750	H
SAL 029-R2	CMT	2007-137	093J.072	450155	6071594	H
SAL 045-R1	CMT	2007-137	093K.080	434050	6069228	H
SAL 045-R2	CMT	2007-137	093K.080	433977	6068896	H

Table 3 continued

Site Number	Site Type	Permit	BCGS Map	Easting	Northing	Modeled Potential
SAL 045-R3	CMT	2007-137	093K.080	434166	6068683	H
SAL 045-SK1	CMT	2007-137	093K.080	434360	6068985	H
SAL 046-1	CMT/Trail (124th)	2007-137	093K.080/J.071	435586	6065867	M
SAL 046-2	CMT	2007-137	093K.080/J.071	434986	6064957	H
SAL 059-2	CMT	2007-140				M
SAL 059-3	CMT	2007-140				M-H
TAN 056-1	CMT	2007-137	093K.075	361941	6067880	H
TAN 057-B1	CMT	2007-137	093K.076	382325	6065609	H
TAN 057-B2	CMT	2007-137	093K.076	382579	6065921	H
TAN 057-B3	CMT	2007-137	093K.076	382200	6066356	H
TAN 057-S2	CMT	2007-137	093K.076	381012	6067075	H
TAN 057-S3	CMT	2007-137	093K.076	381197	6066967	H
TAN 057-S4	CMT	2007-137	093K.076	381015	6066906	H

Table 4. No Site Areas and Modeled Potential

Block	Permit	Easting	Northing	Archaeological Potential	
				Modeled	Assessed
A40178-1	2007-137	418124	6102463	M to L w/ small bit of H	L w/ small area of H
A53765-1	2007-140			M w/ some L & small bit of H	Unknown
A64428-232	2007-137	418583	6101109	M w/ some H	L
A64428-33/42	2007-137	415115	6110590	M w/ some H	L
A64428-85	2007-137	418526	6107398	M w/ some H	L w/ small area of M
A80727-1	2007-137	453002	6073662	M to L	L
AIR 001	2007-140			M-H w/ small bit of L	Unknown
BAP 056	2007-137	348997	6090747	M w/ some H	L w/ small area of M
BAP 126	2007-140			M w/ small bit of H	Unknown
BAP 127	2007-140			H	Unknown
BAP 128	2007-140			M-H	Unknown
BAP 129	2007-140			M-H	Unknown
CAR 468	2008-0194	473991	6028261	M w/ some H & L	L
CAR 482	2007-098	483351	6040710	M to H w/ some L	L
CAR 499	2007-098	481242	6040360	M to H w/ few areas of L	L w/ 4 areas of H
CAR 501	2008-0194	466281	6039962	High	L
CAR 507	2007-098	461741	6037689	M to L w/ some H	L
CAR 508	2007-098	460275	6038059	M to H	L
CAR 514	2008-0194	467000	6029350	M to H w/ some L	L w/ areas of H
CAR 542	2007-098	474103	6037118	M w/ some H & L	L
CHU 028	2007-137	414226	6106502	M to L w/ small bit of H	L
CHU 028/029 Access	2007-137	415370	6106397	M to L	L
CHU 029	2007-137	414306	6107479	M w/ some H & L	L
CHU 032/033 Access	2007-137	418068	6102472	M w/ some H & L	L
CP 450-1	2008-0194	414057	6104806	L to M	L
CP 450-2	2008-0194	417628	6108341	M w/ some H & L	L
CP 461-001	2008-0194	439181	6077652	M w/ some H	L
CP 902001	2007-137	362444	6070733	M to L w/ some H	L
CP A Blocks 1-4	2008-0237	425793	6072086	M to L w/ some H	L
CP E Blk 10	2007-137	380856	6098863	H to M	L
CUN 037/A52226-1	2007-137	385824	6038297	M w/ some H	L
JPRF Blks 22B & C	2007-137	401010	6057252	M to H	L
JPRF Blks 26D, 27C, 44B & D, 106D & E	2007-137	398750	6060300	M w/ some H	L

Table 4 continued

Block	Permit	Easting	Northing	Archaeological Potential	
				Modeled	Assessed
K037-03	2007-140			M-L w/ small area of H	Unknown
K038-01/02	2007-140			M w/ some H & L	Unknown
K1D006	2007-098	403736	6017257	M to L	L
K1D009	2008 PFR	402681	6017265	M to L w/ some H	L
KDL Blk 14	2007-098	360494	6090217	M to H	L
KDL Blks 1-4	2007-137	403500	6024900	M to H	L
KDL Teardrop	2008-0237	448789	6028363	M w/ some H	L
MAR001	2007-098	399760	6022655	High	L
MOS 106	2007-098	464511	6025825	H w/ some M	L
NEC 051	2007-137	445500	6008585	M w/ scattered H	L
NEC 052 & Access	2007-137	444980	6009334	M w/ some H	L
NEC 053	2007-137	445902	6009923	M to H	L w/ small area of H
OKA 523-1	2007-140	359345	6093743	H	L w/ small area of H
OKA 537	2007-137	365517	6091394	H to M	L
OKA 1033/1034	2007-140	355771	6090767	M-H w/ small bit of L	L w/ small area of H
OKA 1026/1032	2007-140	356292	6089526	M-H w/ small bit of L	L
RAIN 014 Access	2007-137	425660	6089940	M to L	L
RAIN 015 Access	2007-137	427285	6089500	High	L
SAL 031	2007-137	447170	6071514	M w/ some H & L	L
SAL 042	2007-137	437471	6074392	M to H	L w/ small area of H
SAL 047	2007-137	436356	6066885	M w/ some L	L
SAL 049	2007-137	427870	6069615	M w/ some H	L
SAL 050 1 & 2	2007-137	440488	6068439	M to L	L w/ small area of H
SAL 052 & Access	2007-137	426272	6069595	H to M	L
TAN 048	2007-137	365575	6062358	M w/ lg. areas of H	L w/ small area of M
TAN 050	2007-137	368237	6060872	M w/ some H	L w/ small area of M
TAN 051	2007-137	365749	6061159	M to L w/ some H	L

3.2 First Nation Consultation Results

Requests for feedback were sent to the following First Nations groups. Table 5 below presents the feedback received from these groups.

- Gitxsan Treaty Office
- Lake Babine Nation
- Lheidli T'enneh Band
- McLeod Lake Indian Band
- Nak'azdli Band
- Takla Lake First Nation
- Tl'azt'en Nation
- Yekooche First Nation

Table 5. First Nations Feedback

First Nation	Information Provided by	Information Solicited	Comments
Gitxsan Treaty Office	Bev Clifton-Percival & Elmer Derrick	Email Feb 19 & Mar 10; Letter Feb 18; Phone Feb 23	• No response
Lake Babine First Nation	Chief Betty Patrick, Doris Munger & Wilf Adam	Email Feb 19 & 20; Phone Feb 18; Meeting Feb 25	• Lake Babine staff was not familiar with model. • Gave them paper copies of 2004 Model Report and 2007 Model Review, which Wilf said he would review. Also emailed link to the model on the MoF FTP site.
Lheidli T'enneh Nation	Chief Dominic Frederick, Patricia Wight & Jackie Brown	Email Feb 20; Letter Feb 18; Phone Feb 20 & Mar 10	• Patricia has heard of the model but she is not sure who or if anyone is using it, perhaps the forestry coordinator (Jackie Brown) and/or the referral person (off on leave now). She will check with them. • She would like to learn more about it and learn how to use it. She did not know where to find it, but is interested in learning more about it and she would like to get together to see it used. • Committed to emailing her and Jackie a copy of the 2007 report and the location of the model on the MoF FTP site.
McLeod Lake Indian Band	Alec Chingee & Eran Spence	Email Feb 19; Letter Feb 18; Meeting Feb 26	• MLIB did not know there was a Fort St James FD Model and have never used it. • Sent a copy over so they can try it out and comment on how easy it is to use and understand.

Table 5 continued

First Nation	Information Provided by	Information Solicited	Comments
Nak'azdli Band	Clara Jack, Chief Fred Sam, Alec McKinnon & Andy Little	Email Feb 19; Letter Feb 18; Phone Feb 17; Meeting Mar 11	• Andy said he said that they don't use it as it goes through Apollo. • Set of six layers for high and six for moderate are large files. Laura is looking into making one large map layer for high. Also maybe make it open for smaller areas as well. • Clara said Alec McKinnon uses it the most but she would like to use it as well. • Clara suggested we get to know and use the CSTC's portal for referrals. It will hold the TLUS sites and sensitive site data which are visible to CSTC but not licensees, so a developer's information would go into the portal then CSTC would forward that to the related FNs and they would review and send back recommendations to developers. This portal is not up and running yet but maybe it might be up and running this summer.
Takla Lake First Nation	Terry Teegee & Chief Dolly Abraham	Email Feb 19; Letter Feb 18	• No response
Tl'azt'en Nation	Jim Webb, Elke Lepka & Chief Thomas Alexis	Email Feb 20 & 23, Mar 10; Letter Feb 18; Phone Feb 2; Meeting Mar 11	• Elke asked where we get the layers from. Laura described points used to identify zone 9 and 10 sites. • Site and heritage trail layer were looked at (first from Norm Canuel). On the FTP site the layers are divided into zones. • Elke asked if we used the TRIM II data. New vegetation model would be good to use.
Tsay Keh Dene	Chief Pierre & Karl Strumanis	Email Mar 3; Letter Feb 18	• No response
Yekooche First Nation	Rob Diaz & Chief Partner Schielke	Email Feb 19; Letter Feb 18; Phone Feb 17 & Mar 10	• No response

3.3 Forestry Licensee Consultation Results

Request for feedback were sent to the following forestry groups. Table 6 below presents the feedback received from these groups.

- Apollo Forest Products
- BC Timber Sales, Stuart-Nechako Branch
- Brave Holdings
- Canyon Tree Farms
- Chuzghun Resources
- Conifex
- KDL Group
- Ministry of Forests and Range, Fort St. James District
- Nak'al Koh Logging
- Tanizul Timber
- Woodlot managers through Steve Harrison at the Ministry of Forests and Range

Table 6. Forestry Licensees Feedback

Organization	Information Provided by	Information Solicited	Comments
Apollo Forest Products	Paul Koch & Shane Perry	Email Feb 20; Phone Mar 10; Meeting Mar 11	• They use the model on each block. The first thing they do is pull up the block and look at model. • They do not have a problem opening "all six" files. Suggest maybe a revision to only one layer of moderate. • They do not use the site layer with heritage trails and recorded sites. Shane asked if the site layer gets kicked back into model to help predict potential. Laura responded that we are updating the site info layer, and it will be reposted to MoF site. It will have updated site and trail info. • Shane said based on experience/knowledge of staff and cruisers, he does not always base the need for AIA only on presence of high, but he assesses it then passes it along for AIA if needed.
BC Timber Sales	Jeremy Greenfield	Email Feb 20; Phone Feb 17 & 19 & Mar 5	• The model works fairly well. • Their FSP states that when a proposed block includes any high rating (even a single pixel), the question of the necessity of an AIA is triggered. He then passes the block on to an archaeology consultant for review. In very few cases, a block with a single high pixel may be evaluated as not requiring field assessment. In most cases the block proceeds to AIA fieldwork. • The version of the model he was using had the single high potential layer, but multiple layers of moderate potential.
Brave Holdings	Bruce Harris (Forest Floor)	Email Feb 19; Phone Mar 5	• He uses the model for Brave Holdings from the MoF site. • Nathan their GIS guy uses it in ArcView. • In their FSP they tied management to the arch model, where any high is required to have AIA completed and other areas are not required. • The model overkills the high potential areas - in a perfect world this should not be and he knows it is impossible to predict but finds it is too conservative. Some areas read pink (high) but when you get to the area, there really seem to have no reason for high. • It is a good tool but after lots of other attempts he tied it to the model. In order to get the FSP approved he tied it to the model, but he wishes it could be more specific. They go into lots of smaller pine stands and it just doesn't always match and it creates a lot of work. Bruce is not unhappy with this but it does create added costs to the client. • He was frustrated with using the model as a guideline and being tied to it but they have agreed to look at every block with even one pixel, but they do not necessarily do AIA on all that have one pixel. For example if a block shows 7 or 8 pixels of high next to each other, then it would trigger an AIA. • He was not sure if they are using the site and trail layers. He would like an updated site and trail layer. • He does like the model and he likes that it gives them a threshold to pass.

Table 6 continued

Organization	Information Provided by	Information Solicited	Comments
Canyon Tree Farms	Harry Hooke	Email Feb 20; Phone Mar 5	• Harry does not use the model himself. He said it seems a bit redundant - lots of high, with so much consultation on the blocks already he does not think we need to add more.
Chuzghun Resources	Dexter Hodder	Email Feb 20; Phone Mar 5 & 9	• He has used it a lesser amount than others like Sue (out until April 2009). Dexter really only uses it through Ecofor and does not use it himself. • Resolution - he had a few issues with areas where a few pixels were assessed as high and they did not seem to be high.
Conifex	Tanya Krusselbrink & Shaun Hales	Email Feb 20; Phone Mar 5	• Shaun said they use it digitally because the paper was so huge. They pull up shape file in genus and toggle that layer. • When turning on high and moderate layers there is some confusion as to overlap or projection overlays. They sometimes could not tell if high and moderate were overlapped. • Under their plans, so much moderate would trigger an AOA and so much high would trigger an AIA. • Genus is underlain by Arch so it is reading shape files and making maps with Genus but it is based on ArchMap. The moderate could have been a problem when high and moderate were on at same time. • As a planner he sees a lot of high, but as a planning tool they use it a lot. It's an upfront planning tool of increased alertness of staff in the field. • In report from 2004 - the guideline created in the model - they still use the guidance table as per when to do what type of assessment work. That gets passed along to the folks in the field as per the table. • Model is approved by the District so our due diligence is tied to the model. Improvements really have to be in the data layers that make up the model. • Visually the model works well. • The end goal would be to have a live model so results are linked automatically to the model. • It is not "prediction tool it is a potential tool". • We have a very small sample size but compared to the size of the District it is too low. We need to field test the model. Maybe go by pdf by mapsheet or another more logical scale for use. Break it down by smaller scale.
KDL	Ross Hamilton	Email Feb 20	• I find the model a valuable tool, working with Ecofor has been a pleasure. • The one comment is related to this scenario: The model predicts "high" (most of us have commitments around high areas and AIAs in our FSPs) and we then spend the time and money to have an AIA, field crew assess the site, often on tight timelines and budgets. More often than half the time, we end up with nothing or occasional post-1846 CMTs. Is there a way we could refine the sensitivity of the 'high' outcome of the model?

Table 6 continued

Organization	Information Provided by	Information Solicited	Comments
MoFR	Neal Gooding, Carmen Minor & Carmen Wheatley	Email Feb 20; Phone Mar 5; Meeting Mar 9	• Suggested adding site identifying numbers for the site table to be able to easily reference sites. • They use the model for the FN consultations and also for small scale salvage to help them assess the area of interest. • They asked "Is it possible to look at model in separate areas?" To do separate areas would require separate models. • The trail layers are very important to them. • Overall they like using the model. • They also asked if we had received any TLUS information. FNs were asked if they would like to include (but protect TLUS information) but FNs declined and we have not been given any other TLUS information.
Nak'al Koh Logging	Alex Pierre	Phone Mar 10	• This is under the Nak'azdli umbrella - best to speak with Shane Perry at Apollo as they manage their wood
Tanizul Timber	Don Marchal, Alex Pierre (now with Conifex)	Phone Mar 3 & 10	• Don said they did not use model much at all and said to ask Alex Pierre at Conifex. • Alex uses it - he thinks they have their own spatial data. • They still use the Norcan model and the 2004 FSJ Model with high, moderate and low. • They use the guidelines as listed in 2004 and they talk to the band. Sometimes they talk to the band and then go straight to get an AIA done. • Alex did not have any other comments or suggestions about improvements to the model.

4.0 EVALUATION AND DISCUSSION

4.1 Forward and Reverse Review

By a forward review of the model, the vast majority of the work conducted was completed in moderate and high potential areas, while very little work was conducted in the low potential areas. In summary, areas of low potential were usually surveyed by field crews only indirectly, on their way to or from areas of moderate or high potential. Sites recorded in low potential areas were generally trails that passed through the low area, or sites that were identified in moderate and high potential areas and then delineated to include small parts of low potential areas.

For a reverse review of the model, a total of 189 sites identified in 2007-2008 were located within the model parameters. Table 7 below breaks down the sites by frequency and site category. Where a site straddled more than one potential zone, the highest potential represented was used in this table.

Table 7. 2007-2008 Reverse Review

	High #	High %	Moderate #	Moderate %	Low #	Low %	Total
Archaeological Sites	23	82%	5	18%	0	0%	28
Pre-1846 CMT	4	67%	2	33%	0	0%	6
Post-1846 Sites	115	74%	39	25%	1	1%	155
Total	142	75%	46	24%	1	<1%	189

4.2 Modeled Versus Assessed Potential

The assessment of blocks where no sites were found is useful in evaluating the model. Although there are no sites found, it does not mean that the area does not hold potential. There may be features within the block that indicated potential for archaeological resources, yet shovel testing produced negative results. Analysis of this data will indicate if archaeological potential exists but no sites are found or if no archaeological potential exists at all.

There were 115 development areas slated for archaeological survey because they contained some portion of archaeological modeled potential. Of those, 55 (or 48%) contained cultural heritage sites (pre- and/or post-1846). There were 60 development areas where no sites were identified. Of these 60 areas, only 11 (or 18%) were determined to have some archaeological potential that required shovel testing. The vast majority (41 blocks, or 68%) contained low archaeological potential, mostly because of low-lying, poorly-drained, and/or sloping ground or a lack of significant landforms. Within this data set, there were eight (8) blocks where the information on assessed potential was not available at the time of writing this report.

This information may indicate that there is too much modeled high in the district, which is likely a product of some variable having too much or too little weight. Field testing and an in-depth analysis of the variables used to predict archaeological site location would refine the model and hopefully place these assessed low potential blocks into low potential in the model. This would cut back on the number of AIAs required by licensees and thus, lower their costs.

4.3 Model Effectiveness

The Archaeology Branch accepts models that capture at least 70% of known archaeological site locations (Province of BC 2008). The following table displays the number and percentage of sites captured by each potential zone, which is a measure of its effectiveness.

Table 8. Model Effectiveness

		High #	High %	Moderate #	Moderate %	Low #	Low %	Total
1951-2003	Archaeological Sites	135	75%	44	25%	0	0%	179
	Pre-1846 CMT	50	57%	34	37%	4	5%	88
	Arch + Pre-1846 CMT	185	69%	78	29%	4	2%	267
2004-2006	Archaeological Sites	18	72%	7	28%	0	0%	25
	Pre-1846 CMT	6	46%	7	54%	0	0%	13
	Arch + Pre-1846 CMT	24	63%	14	37%	0	0%	38
2007-2008	Archaeological Sites	23	82%	5	18%	0	0%	28
	Pre-1846 CMT	4	67%	2	33%	0	0%	6
	Arch + Pre-1846 CMT	27	79%	7	21%	0	0%	34
1951-2008	Archaeological Sites	176	76%	56	24%	0	0%	232
	Pre-1846 CMT	60	56%	43	40%	4	4%	107
	Arch + Pre-1846 CMT	236	70%	99	29%	4	1%	339

These numbers indicate that the model is effective at predicting archaeological sites, but not at predicting CMT sites. It would be beneficial to predict the locations of archaeological sites separately from CMT sites, as the new guidelines suggest (Province of BC 2008).

4.4 Model Efficiency

The Archaeology Branch recommends that model efficiency should be calculated using Kvamme's gain statistic (Province of BC 2008):

$$1 - (\%area / \%sites)$$

%area = percentage of the study area with archaeological potential

%sites = percentage of known sites of the type modelled actually found in the same area

High efficiency models have a Kvamme's gain statistic of 0.90 or greater, while moderately efficient models have a statistic between 0.80 to 0.90.

Table 9 (below) outlines the Kvamme's gain statistic for the existing model using the data inputted in 2004 and compares that to data collected after the model had been implemented. The current model predicts that 37% of the entire forest district is covered by low archaeological potential, 37% by moderate, and 26% by high potential (Marshall and Bond 2004). The potential values do not exclude areas such as lakes or wetlands, of which several fall within high potential range; therefore, if water sources were excluded from potential analysis, the amount of high archaeological potential would be even less (Marshall and Bond 2004:93).

Table 9. Model Efficiency Using Kvamme's Gain Statistic

Data Set	Potential Area	# of Sites	% Sites	% Area	Kvamme's Stat
1951-2003 Arch	High	135	75%	26%	0.65
1951-2003 Arch	High & Moderate	179	100%	63%	0.37
1951-2003 Arch + CMT	High	185	69%	26%	0.62
1951-2003 Arch + CMT	High & Moderate	263	98%	63%	0.36
2004-2006 Arch	High	18	72%	26%	0.64
2004-2006 Arch	High & Moderate	25	100%	63%	0.37
2004-2006 Arch + CMT	High	24	63%	26%	0.59
2004-2006 Arch + CMT	High & Moderate	38	100%	63%	0.37
2007-2008 Arch	High	23	82%	26%	0.68
2007-2008 Arch	High & Moderate	28	100%	63%	0.37
2007-2008 Arch + CMT	High	27	79%	26%	0.67
2007-2008 Arch + CMT	High & Moderate	34	100%	63%	0.37
1951-2008 Arch	High	176	70%	26%	0.63
1951-2008 Arch	High & Moderate	232	100%	63%	0.37
1951-2008 Arch + CMT	High	236	70%	26%	0.63
1951-2008 Arch + CMT	High & Moderate	335	99%	63%	0.36

These numbers indicate that the model is neither highly nor moderately efficient. If the high potential zone and archaeological sites (exclusive of CMTs) are used in the calculation of the statistic, then the model is almost moderately efficient. These numbers indicate that further testing and recalculation of the variables is required to make the model more efficient.

4.5 Model Variables

The archaeological predictive model assigns high, moderate or low archaeological potential using the following variables: water resources; soil stability/surficial geology; proximity to wetlands; landforms; forest cover; aspect; and slope. Visual analysis of the archaeological potential maps created by the model has displayed some discrepancies that may be related to these variables. It has been noted that the southern portion of the district appears to have more modeled high potential than the northern portion. This is troubling if the model is under-assigning high archaeological potential in the northern portions of the district.

For example, mapsheet 093K.060 has approximately 50% high potential in a wide buffer around Ocock River, Hyman Creek and their associated wetlands. It seems there is too much modelled potential in this mapsheet. By contrast, mapsheet 093N.015 contains a major lake (Tchentlo Lake) and three other lakes (Takatoot, Tlutsacho and Airline), all of which are modelled to have mostly moderate potential; however, the numerous wetlands on the mapsheet are modelled to have high archaeological potential. The wetlands on mapsheet 093N.015 are given higher archaeological potential than the lakes, which does not make sense given our assumptions of human movements and habitation. It would seem more likely that Tchentlo Lake would have the highest archaeological potential on this mapsheet and the wetlands more moderate potential. Maps of these two areas are included in Appendix C for visual comparison.

In this situation, there appears to be problems regarding the variables controlling landforms, proximity to wetlands and water resources. The landform variable only defines areas by contours, where the highest

potential is assigned to areas that are below 830 m asl. This does not actually look at landforms so much as elevation; therefore the southern portion of the district that is at lower elevations receives more potential than the north. In the situation described above, mapsheet 093K.060 is mostly below 900 m asl; where none of mapsheet 093N.015 is below 850 m asl.

These anomalies prompted a review and discussion of the use and justification for each of the seven variables that create the potential zones within the model.

1. Water Resources

   This variable takes into account present locations of lakes, rivers and streams and classifies them according to size, discharge and presence of fish. It is based on three assumptions:
   - Fish were a critical food source and had ceremonial importance
   - First Nations lived in close proximity to lakes and streams
   - Waterways were used as travel corridors and navigational aids

   Critique of this variable includes:
   a) Fish were only a critical food source for the Carrier and Gitsxan peoples who had reliable salmon runs within their territories. The Sekani largely did not have salmon within their territory and thus were more dependent on large game. Jenness noted that the Sekani held "the scorn of true hunters for fishermen" (1932:379, quoted in Denniston 1981:436). Theoretically, lakes, rivers and streams in the Upper Omineca River and Nation River watersheds (eastern edge of the district), which drain into the Peace and have no salmon runs might be modeled to have lower archaeological potential, when in fact they have comparable potential to salmon bearing lakes, rivers and streams.
   b) The variable accounts for present sizes, discharges and presence of fish within waterbodies. It is highly unlikely that these factors have remained steady over the past 10,000 years. Present characteristics likely account for the past 2000-4000 years, but the environment before then was likely very different from today. It is likely that a reliable salmon run was not in place until 3000-4000 years ago, when there appears to be a shift from nomadic to a semi-sedentary lifestyle (Carlson 1996).
   c) Locations of waterfalls and rapids were identified within this variable, but no mention is made of springs (hot, warm or otherwise), that likely had some significance to First Nations.

   Despite this critique, the proximity to waterbodies has traditionally been the most important variable in predicting archaeological potential and the resulting discovery of archaeological sites in association with waterbodies seems to support this assumption. The aim of critique is to make the variable more effective and efficient in predicting potential, and perhaps in identifying areas that would otherwise be overlooked.

2. Soil Stability/Surficial Geology

   This variable is based upon surficial geology information in the southern portion of the district (NTS mapsheets 93K and 93N) and upon terrain stability information in the northern portion (Takla and Sustut regions). The variable is based on the assumption that people prefer certain stable landforms to conduct their activities and that these landforms are dependent on the underlying geology.

   Critique of this variable includes:
   a) Marshall and Bond (2004) note that the majority of archaeological sites (66%) occur on glacial till deposits, which caused them to postulate that this type of sediment must have been

favoured, especially for storage of goods (cache pits). It should be noted that the majority of the district is covered in glacial till deposits, so it is just as likely that the majority of sites occur on this sediment type because it is, in many areas, the only choice.

b) Marshall and Bond (2004) note that the highest site density occurred on modern alluvial sediments, which are those created by river or stream deposition. These modern sediments occur next to rivers, so this may be more of an indication that people are picking spots next to rivers not necessarily because of the underlying sediment.

c) The southern portion of the district was assigned six different weightings based on the different underlying geological classes, whereas the northern portion was assigned only three weightings, based on stable, potentially unstable or unstable. A footnote (Marshall and Bond 2004:41) notes that surficial geology for the entire district should be available in 2005 and that the model should be updated accordingly. If this information is still unavailable, the surficial geology data in the southern portion might be categorized into the stable, potentially stable and unstable classes to create a continuous ranking across the district.

The question about this variable is whether it is a proxy to determine landform characteristics, such as a well drained spot or a level plain next to a river, or whether it represents characteristics that past people chose preferentially. Essentially, did a person recognize that this was a good spot because it had sandy sediments, as opposed to an area nearby that had glacial till? The other question is, does it matter whether these factors were chosen consciously or indirectly?

3. Proximity to Wetlands

This variable is based on the assumption that wetlands contain resources that First Nations would have exploited. The variable classifies wetlands according to size and association with streams.

Critique of this variable includes:

a) Perhaps this variable should be incorporated with the water resources variable? The way it is now, streams may have potential assigned under this variable, as well as the water resources variable, which may give it a higher potential than reasonable. In the situation where a small lake is surrounded by a wetland, its potential may be exacerbated by being counted twice as well.

b) While it is not argued that wetlands were utilized by First Nations, what is the probability of finding residue of that use? Budhwa *et. al.* (2007) argues that wetlands offer areas of traditional use, but do not often produce archaeological sites. Statistical analysis should offer some data on the correlation between site location and wetlands.

c) Wetlands may have once been lakes or streams that no longer have water flow or water storage. As such, these types of wetlands may have higher potential as paleofeatures when compared to smaller wetlands. Whether these types of wetlands can be picked out from the rest is unknown.

4. Landforms

This variable is based on the assumption that landforms influence landscape use patterns, with the example given that a flat river terrace is a more preferable area for travel and habitation than an elevated mountainside. The landform variable is determined by elevation, where all land below 830 m asl is given the highest weighting, land at 831-1300 m is given a moderate weighting and everything above 1301 m asl is given the lowest weighting.

Critique:

a) Elevation does not delineate landform, instead it is an arbitrary measurement of height above sea level. Marshall and Bond (2004) argue that the terraces surrounding the prominent water bodies of Stuart Lake, Takla Lake and Sustut River largely fall below 830 m asl, thus all major landforms should be captured within the highest potential rating. It also means that all landforms within this elevation range are given a high potential rating, from the rolling terrain in the Carrier Operating Area to the steep slopes around Trembleur Lake.
b) This variable assumes that lower elevations were more intensively used, giving higher potential to the southern portion of the district, which is generally more flat to rolling, than the northern portion, which is more mountainous. Jenness (quoted in Denniston 1981:436) describes the Sekani as living in the plateau and mountain slopes in the winter where they could hunt caribou and moose, indicating that the mountainous terrain was no less used than the rolling terrain.
c) This variable misses some of the major landforms that it intends to capture. For example, the landforms that surround Tsayta, Indata, Tchentlo and Chuchi Lakes, as well as Nation and Omineca Rivers, are modelled in the middle category (801-1300 m asl). Marshall and Bond (2004:47) consider this middle elevation range to have "less than ideal" archaeological conditions, which seems doubtful for these large and significant waterbodies.

5. Forest Cover

This variable assumes that preference was given to lodgepole pine stands, especially for cambium collection. Forest cover maps are used to identify species leading areas. Statistical analysis showed that archaeological sites (non-inclusive of CMT sites) have occurred with the highest frequency in pine leading, aspen leading and Douglas fir leading stands. The same analysis showed that very few of the archaeological sites identified occurred in spruce, birch or cottonwood stands.

Critique:

a) Forests change over time, especially in the fire-driven ecosystem within the district. The current tree stands have been there since the last natural disturbance, which likely only represent that past 200-300 years. Stands that are pine-leading today may indicate a drier, well-drained soil, but may also indicate an area that burnt particularly hot, which encouraged the growth of pine.
b) If the forest cover variable was mostly meant to predict the occurrence of CMTs, it is a good indicator, but should be separate from the prediction of archaeological sites.
c) Statistical analysis was based on comparing site present to site absent data within each forest cover type. This base data is skewed in that the majority of assessments have been completed for forestry developments, most of which have been conducted in pine leading areas. No site absent data is located within the cottonwood, birch and Douglas fir groups, which indicates that very few studies have been conducted in these types, not that there isn't potential for sites to occur within these types.
d) If forest cover is used as a proxy to describe environment, ie, that pine grow on well-drained areas while balsam grow on poorly-drained areas, then ecotyping would likely be a better indicator. The biogeoclimatic system classifies all of BC using a number of factors, which includes forest cover, soils, climate, etc. While this system is also reflective of a current condition, the multi-faceted approach takes factors into account that are representative of more than the past 200-300 years.

6. Aspect

   This variable is based on the assumption that landforms with a south-facing aspect were preferentially chosen by First Nations. Statistical analysis found that the highest frequency of sites is located on east- or west-facing aspects with a high frequency also occurring on south-facing aspects. Very few sites to date have been located on landforms with north-facing aspects.

   Critique:
   a) The statistics seems to imply that east- and/or west-facing slopes have just as high, if not higher, a frequency of site presence, but it is difficult to analyze since they were grouped together. The information seems to indicate that site occur more often on landforms that face from 80 to 280 degrees, so where is the justification to rank south facing higher than east or west facing?

   Despite this, the variable seems to be a good indicator of archaeological potential. Some adjustments in weighting and ranking may be necessary.

7. Slope

   This variable is based on the assumption that people preferentially chose areas that were flat over those that were sloping. The weighting and ranking of this variable appears reasonable.

Overall, it seems that the variables are biased towards a lifestyle where salmon runs were the dependable food source. A lifestyle which was based on a more varied food base and a wider use of the landbase is not represented, and as such, the eastern portion of the district where there is no salmon has been modelled to have lower potential. It could be postulated that the prediction site types prior to the establishment of the salmon runs (likely before 4000 years BP) seems lacking.

Patterns were established from the existing archaeological site database, which has very few entries compared to the size of the district. The majority of the sites recorded at the time of the development of the model were located in the southern part of the district, which is located on the interior plateau, displaying mostly rolling to gently undulating terrain. The northern part of the district is within the Skeena and Omineca Mountains. Thus, the patterns for site distribution found within the southern part of the district may have been applied to the northern part when the patterns of land use may vary between the two. A comparison and analysis between larger landform use may be warranted.

The variables have also been used to predict CMTs, which should be predicted separately from archaeological sites according to the new guidelines (Province of BC 2008)

4.6 Model Usability

Feedback from forestry professionals who use the model indicates the following points:

1. The moderate potential files are spread across six separate files, all of which need to be opened to look at moderate potential within the district. Some users find this confusing and/or cumbersome.
2. There is too much high predicted that does not seem to correlate with any distinctive feature in the field. The costs of field inspecting areas which are modeled “high” but assessed as “low” is substantive. Refinement of the “high” potential zone would be beneficial.
3. Every licensee has a different method for interpreting when an AIA should be triggered while using the model. Not all licensees used the “action matrix” described in the 2004 model

document (Marshall and Bond 2004: 98). Some licensees refer any blocks with any amount of "high" to an archaeological professional, while others use their professional judgement.

4. The importance of an updated site and trail layer was expressed, though not all licensees use this layer. There is confusion as to whether this layer is used in predicting archaeological resource potential. For clarification, this layer is not currently used to predict potential; it is included as a planning tool for users of the model. Suggestions to make the site and trail layer more usable included assigning numbers to sites, including TLUS information and making it a "live" layer that is updated automatically as new archaeological information is gathered.
5. Several licensees expressed support for field testing to refine the model, especially if it makes the high potential zone more accurate, which would reduce their costs.

Feedback from First Nations includes the following points:

1. Several First Nations were not familiar with the model. Several First Nations representatives were involved with the initial creation of the model in 2003-2004. It is postulated that the current lack of use may be related to changing staff over the past years.
2. It was suggested that there might be more up-to-date mapping layers for the variables that could be incorporated into the model.
3. It was suggested that licensees could also use the Carrier Sekani Tribal Council (CTSC) referral system that should be up and running in the next year.

To address these points the following discussion suggests areas for improvement.

The new AOA Guidelines issued by the Archaeology Branch in May 2008 (Province of BC 2008) indicates that models should produce a map layer that has no gradation in potential or relative ranking. As such, the current predictive model should be revised to have only low and high archaeological potential, where the moderate zone is phased out. Under this system, high archaeological potential zones would require further professional expertise while low archaeological potential zones would require no further work. This would eliminate the confusing action matrix developed for the current model (Marshall and Bond 2004: 98) as well as confusion regarding overlapping high and moderate zones.

The current model states the following:

> When the development area contains no areas of high potential and it is classified as moderate, moderate/low or low, then there is no cultural heritage concern and the licensee is clear to proceed with the development without an AOA or AIA (Marshall and Bond 2004:100).

This statement essentially says that there is no difference between moderate and low potential zones; therefore, a phasing out of the moderate zone should have no impact on the usability from the licensee's perspective. Phasing out of the moderate potential zone may also fix the problem of having six files for the moderate zone.

The new AOA guidelines (Province of BC 2008) also indicate that CMTs should be modeled separately from archaeological sites. The data presented in Table 8 above indicates that the current model is capturing 56% of pre-1846 CMTs within high potential zones and 40% in moderate potential zones. This indicates that the current model is not particularly effective in predicting the locations of CMT sites, likely because CMT sites are largely dependent on tree types while archaeological sites are more dependent on a variety of other variables. Modeling CMTs separately from archaeological sites would create more detail in recommended action to the licensee, ie, that the development area is high for CMTs but low for archaeological sites, so budget for a CMT survey instead of an AIA with shovel testing.

Analysis of the variables and feedback from the licensees indicate that there is too much modeled high potential in some areas. Field testing and subsequent refinement of the variables would help to isolate areas of high potential to more specific site locations. Finding newer or alternate data sources, such as updated surficial geology or forest cover data, might help to refine the variables as well.

Yearly updates of the site and trails layer is beneficial as a planning tool. It is not incorporated into the model because the data was used to apply weighting to the variables, thus it would bias the data. Research into the creation of a "living" layer could be completed to look at the feasibility and cost of linking information collected during the field season directly into a database. Incorporation of sensitive First Nations data has been requested, but has not been approved as yet. Utilization of the CTSC's referral process may be a viable alternative.

5.0 CONCLUSIONS AND RECOMMENDATIONS

After five years of application, it would appear that the Fort St James Forest District Archaeological Predictive Model is effective at predicting archaeological site locations, but not effective at predicting CMT locations. The model is not efficient in predicting locations of neither archaeological nor CMT sites. Both effectiveness and efficiency were measured using the guidelines put forth by the Archaeology Branch (Province of BC 2008). Despite this, the model has been useful to licensees to indicate where AIAs should occur.

A preliminary analysis of the variables used to create the model show a bias for high archaeological potential in the southern and western portions of the district. Significant watercourses and their associated landforms in the eastern portion around Nation and Omineca Rivers have been under-rated in this model. The weighting and ranking of the variables should be re-visited to rectify these deficiencies. Variables should also be scrutinized for their applicability in predicting archaeological sites within the district.

A preliminary analysis of the potential zones overall bring into the question the role of the moderate potential zone. Greater effectiveness, efficiency, and usability might be achieved by phasing the moderate potential zone out.

All information gathered for this study has been accrued through the necessity for archaeological survey by development proponents. Areas selected for survey have been determined through use of the model; therefore, the preponderance of survey has been in high and moderate potential zones. Low potential areas have not been sufficiently evaluated to determine if these areas have actual in-field potential or not. Objective field testing of the model would survey and assess areas through all potential zones, which would provide data to further analyze and refine the model.

The following field testing program is recommended to analyze the ability of the model to predict the occurrence of cultural resources. Subsurface shovel testing should be part of the field testing, which would require a Section 14 permit from the Archaeology Branch. Field testing should occur under frost free conditions in the spring or summer utilizing a three-person crew of one supervisor, one technician, and one First Nations participant. Proposed field testing methods are briefly described below. In-depth descriptions can be provided for funding applications.

Random but Biased Selection of Test Areas

The initial step would involve the selection of five, relatively small (50 ha) test areas in each of the low, moderate and high potential zones. In this way, approximately 250 ha within each predictive level would be tested, 750 ha total.

It is proposed that an intentional test of the model would be conducted within Supply Block C, which encompasses the southern portion of the forest district. The reasoning for this would be to keep the test areas relatively close to the Fort St James office, which would cut down on travel and accommodation costs, as well as to test an area that is currently the most heavily logged within the district and thus the area most prone to archaeological disturbance. It is suggested that four areas each of modeled high, moderate and low potential (12 areas total be located within Supply Block C).

In order to distribute the test areas across the Forestry Licensees currently working within Supply Block C, representative lists will be collected containing each company's proposed developments within Supply Block C. Each entry within that company's list will be given a sequential or representative number. Random number generation will be used to select a series of possible test areas. The goal would be to select two or three entries from each company's list that would each completely enclose a 50 ha test area

of low, moderate, or high potential. Test units that do not possess a single continuous area of one probability level will be rejected and the next randomly generated test area will be selected and reviewed. Approximately 550 raster cells will be located within a 50 ha test unit, which may cause problems in finding a 50 ha area containing entirely one level of probability; therefore selection methodology may have to be revised.

It is proposed that the remaining three test areas (one each in low, moderate and high potential) be placed in the Nation Lakes area to address the discrepancy of modeled potential noted in Section 4.2.

Field Testing Methods

The objectives of the field test would be three-fold:

1. To assess the modeled potential versus the actual potential, in the professional opinion of the crew supervisor.
2. To assess the accuracy of the data that the variables are based on, ie, if the model says that the area is in a pine forest on alluvial deposits, is that correct.
3. To record any cultural heritage features within each test unit, including CMTs, trails, cultural depressions, lithics and cairns.

These objectives would be met through reconnaissance survey of each test unit as well as 50 subsurface shovel tests to be placed at the discretion of the supervisor. Reconnaissance survey will be based on systematic transects conducted at approximately 10–20 m intervals to provide complete coverage of the test unit. Survey will include:

1. Assessment of landforms for archaeological potential.
2. Assessment of the accuracy of the seven variables used in the prediction of the archaeological potential: proximity to water, surficial geology, proximity to wetlands, forest cover, landforms, aspect and slope.
3. Ground surface inspection, scrutiny of exposed soils and 50 subsurface shovel tests to determine the presence of archaeological sites.

A Heritage Inspection Permit under Section 14 of the Heritage Conservation Act will be required to perform the subsurface shovel testing. All cultural heritage resources identified will be recorded according to the methodology under the permit.

Final Model Review and Report Production

Following the completion of the field testing program, the results of the testing will be evaluated in conjunction with a review of data. Any new cultural resources identified will be included in CHRID. If the results suggest that the prediction of the occurrence of cultural resources is significantly lacking or could be greatly improved, these recommendations will be presented and methods will be developed to update the model. If the predictive mapping is updated, then electronic copies of the mapping will be distributed to those companies working within the District as appropriate under the direction of the Ministry of Forests.

Field Testing Logistics and Schedule

If funding for field testing is secured, the program could be completed in the 2009 field season. Random generation of the fifteen test areas and preparation work for the fieldwork would occur in the spring or early summer with field work occurring through the summer or fall. It is anticipated that access to each of the test areas, survey and recording both negative and positive information of each test area will take approximately 1.5 crew days per test area, for a total of approximately 25 crew days. The results of the field testing, related site recording, and final review of the model is anticipated to be completed in late 2009 and the final report would be submitted prior to March 1, 2010. An approximate cost estimate is presented below for the field testing and final review and recommendations for the model.

Table 10. Field Testing Cost Estimate

Field Testing Tasks	Estimated Person Days	Total Burdened Costs
Sample Block Selection and Prep Work	5	$3,150
Intensive Field Testing & Site Recording (750 ha)	75	$40,000
Data Recording and Model Review	12	$7,500
Preparation of Model Review Report	6	$3,750
Total	**98**	**$54,400**

The importance of the field-testing component cannot be overemphasized. This would allow for the objective analysis of all modelled potential areas and completion of the Phase III section that was initially proposed in the 2004 report. Furthermore, as modeled low archaeological potential areas have not been properly evaluated, this investigation would allow for the adjustment of areas that may have initially been rated too low or too high. In so doing, the Fort St James Forest District Archaeological Predictive Model would be sufficiently analyzed to better predict the likelihood of archaeological sites, which would have an increased benefit for developers in their pre-planning assessments.

Avenues for additional funding have been suggested through the Forest Investment Account and Forests For Tomorrow. Apollo Forest Products, BC Timber Sales, the Ministry of Forests and Range, Tl'azt'en Nation and Nak'azdli Band have suggested contacts for additional funding and/or have offered their support in securing funding.

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Review of the Fort St. James Forest District Archaeological Predictive Model 2009

APPENDIX A

Letters
Sent to First Nations and Licensees

First Nation Letter Template

Dear,

I am writing to inform you that Ecofor Consulting Ltd. is in the process of reviewing the Fort St James Archaeological Predictive Model on behalf of Conifex and the Forest Investment Account. The original large scale model revision was completed in 2004. As part of the current review, we would like to invite you to please consider sharing with us comments, concerns, issues, recommendations or additional cultural resource data that you may have concerning the Fort St James Model.

As part of the data collection and updating (this February and March), we will include known site data collected through BC Government permitted Archaeological Impact Assessments (AIAs). However, other known site data may be available from non-permitted work. Of course, First Nations may also have additional data in regards to trails, CMT sites and other cultural resources, which are not part of the model database.

If you had any non-AIA recovered site or resource data that you would like to add to the model database, we would be happy to include that data as per your recommendations for use of the information.

We would also like to solicit comments, concerns or suggestions dealing with recommendations for the management of cultural resources within the Forest District.

If you would like to schedule a visit to discuss the model review in person, please contact me at james@ecofor.ca or (250) 996-2151 Ext 26. I will be pleased to arrange a meeting to discuss the model.

Thank you for your consideration and I look forward to hearing your perspectives on the review of predictive model.

James Mooney, RPA
Ecofor Consulting Ltd.,
Cultural Resources Specialist

Licensee Letter Template

Dear ,

I am writing to inform you that Ecofor Consulting Ltd. is in the process of reviewing the Fort St James Archaeological Predictive Model on behalf of Conifex and the Forest Investment Account. The original large scale model revision was completed in 2004. As part of the current review, we would like to invite you to please consider sharing with us comments, concerns, issues, or recommendations or additional cultural resource data that you may have concerning the Fort St James Model.

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James Mooney, RPA
Ecofor Consulting Ltd.,
Cultural Resources Specialist

Review of the Fort St. James Forest District Archaeological Predictive Model 2009

APPENDIX B

Data Sets Used for Model Effectiveness and Efficiency Tabulations

Archaeological Sites

Note: Where modeled potential for a site straddled several zones, the highest zone within the site boundaries was used; therefore, portions of some sites, especially trails, will be located within the low potential zone.

Site Category Abbreviations: FS: fishing site; HR: human remains; PHS: permanent habitation site; RAS: rock art site; T: trail: THSS: temporary habitation/subsistence site.

Borden Number	Permit	Site Type	Site Category	Age	Modeled Potential
GbRw-1		Cultural Material	THSS	Pre-1846	High
GbRx-1	1995-139	Cache Pit, Lithic Scatter	THSS	Pre 1846	High
GbRx-3	1995-139	Isolated Lithic	THSS	Pre 1846	High
GbRx-4	1995-139	Cache Pit, Isolated Lithic, Trail	T, THSS	Pre 1846	High
GbRx-5	1995-139	Cache Pit	THSS	Pre 1846	High
GbRx-6	1995-139	Cache Pit	THSS	Pre 1846	High
GbRx-7	1995-139	Cache Pit	THSS	Pre 1846	High
GbRx-8	1995-139	Cache Pit	THSS	Pre 1846	High
GbSb-1		Cache Pit	THSS	Pre 1846	High
GcRu-1		Lithic Scatter	THSS	Pre 1846	High
GcRu-2	2006-173	Lithic	THSS	Pre-1846	High
GcRu-3	2006-173	Lithic	THSS	Pre-1846	High
GcRv-1	1999-292	Fish Weir, Lithic Scatter	FS	Pre 1846	High
GcRv-2	1999-292	Lithic Scatter	THSS	Pre 1846	High
GcRv-3	1999-292	Cache Pit	THSS	Pre 1846	High
GcRv-4	2005	Cultural Depression	THSS	Pre-1846	Moderate
GcRx-1	2000-120	Trail	T	Pre 1846	High
GcRx-7	2005-105	Isolated Lithic	THSS	Pre-1846	High
GcSb-1	1951	Fish Weir	FS	Unknown	High
GcSb-10		Cache Pit, Lithic Scatter	THSS	Pre 1846	High
GcSb-14		Lithic	THSS	Pre-1846	High
GcSb-2	1951	Cultural Materials (Pre)	THSS	Pre 1846	High
GcSb-3	1951	Cache Pit	THSS	Pre 1846	High
GcSb-4	1951	Cultural Materials (Pre)	THSS	Pre 1846	High
GcSb-5	1973-028	Burial Site, Lithic Scatter	HR, THSS	Pre 1846	High
GcSb-6	1977-017	Isolated Lithic	THSS	Pre 1846	High
GcSb-7	1978-009	Cultural Depression, Faunal Material, Lithic Scatter	THSS	Pre 1846	High
GcSb-8		Rock Art	RAS	Pre 1846	High
GcSc-1	1951	Fishing Station	FS	Unknown	High
GcSc-10		Rock Art	RAS	Pre 1846	Moderate
GcSc-11		Rock Art	RAS	Pre 1846	Moderate
GcSc-12		Rock Art	RAS	Pre 1846	Moderate
GcSc-13		Rock Art	RAS	Pre 1846	Moderate

Borden Number	Permit	Site Type	Site Category	Age	Modeled Potential
GcSc-14	1999-292	Lithic Scatter	THSS	Pre 1846	High
GcSc-15	1999-292	Lithic Scatter, Trail	T, THSS	Pre 1846	Moderate
GcSc-16	1999-292	Cache Pit	THSS	Pre 1846	Moderate
GcSc-17	2000-120	Trail	T	Pre 1846	High
GcSc-18	2000-120	Trail	T	Pre 1846	Moderate
GcSc-2		Rock Art	RAS	Pre 1846	Moderate
GcSc-20	2003-094	Isolated Lithic	THSS	Pre 1846	Moderate
GcSc-23	2003-094	Isolated Lithic	THSS	Pre 1846	High
GcSc-24	2003-094	Isolated Lithic	THSS	Pre 1846	High
GcSc-29	2003-094	Trail	T	Pre 1846	High
GcSc-3	1979	Cache Pit, Isolated Lithic	THSS	Pre 1846	High
GcSc-4		Rock Art	RAS	Pre 1846	Moderate
GcSc-5		Rock Art	RAS	Pre 1846	Moderate
GcSc-6		Rock Art	RAS	Pre 1846	Moderate
GcSc-7		Rock Art	RAS	Pre 1846	Moderate
GcSc-8		Rock Art	RAS	Pre 1846	Moderate
GcSc-9		Rock Art	RAS	Pre 1846	Moderate
GcSd-1	1999-292	Cache Pit	THSS	Pre 1846	High
GcSe-1	2006-125	Trail	T	Pre-1846	Moderate
GdRt-5	2004-051	Cultural Depression	THSS	Pre-1846	High
GdRw-12	2000-120	Trail	T	Pre 1846	High
GdRw-15	2000-223	Cultural Depression	THSS	Pre 1846	High
GdRw-16	2005-105	Isolated Lithic	THSS	Pre-1846	High
GdRw-9	2000-120	Lithic Scatter	THSS	Pre 1846	High
GdRx-4	2000-123	Trail	T	Pre 1846	High
GdRx-5	2000-123	Cultural Depression	THSS	Pre 1846	High
GdSb-2	2002-288	Trail	T	Pre 1846	High
GdSb-3	2003-094	Cultural Depression	THSS	Pre 1846	Moderate
GdSb-4		Lithic	THSS	Pre-1846	High
GdSc-1		Rock Art	RAS	Pre 1846	High
GdSc-10		Rock Art	RAS	Pre 1846	Moderate
GdSc-11		Rock Art	RAS	Pre 1846	Moderate
GdSc-12		Rock Art	RAS	Pre 1846	High
GdSc-13		Rock Art	RAS	Pre 1846	Moderate
GdSc-14		Rock Art	RAS	Pre 1846	High
GdSc-15		Rock Art	RAS	Pre 1846	High
GdSc-16		Rock Art	RAS	Pre 1846	High
GdSc-17		Rock Art	RAS	Pre 1846	Moderate
GdSc-18		Rock Art	RAS	Pre 1846	Moderate
GdSc-19		Rock Art	RAS	Pre 1846	Moderate

Borden Number	Permit	Site Type	Site Category	Age	Modeled Potential
GdSc-20		Rock Art	RAS	Pre 1846	Moderate
GdSc-21		Rock Art	RAS	Pre 1846	High
GdSc-22	2000-223	Cultural Depression	THSS	Pre 1846	High
GdSc-5		Rock Art	RAS	Pre 1846	Moderate
GdSc-6		Rock Art	RAS	Pre 1846	Moderate
GdSc-7		Rock Art	RAS	Pre 1846	High
GdSc-8		Rock Art	RAS	Pre 1846	High
GdSc-9		Rock Art	RAS	Pre 1846	High
GdSe-1	1999-292	Isolated Lithic	THSS	Pre 1846	High
GdSg-10	2000-122	Rock Art	RAS	Pre 1846	High
GdSg-11	2001-194	Isolated Lithic	THSS	Pre 1846	Moderate
GdSg-6	2000-120	Trail	T	Pre 1846	High
GdSh-7	2000-120	Trail	T	Pre 1846	High
GdSh-8	2000-120	Village/Multi Use Site	PHS	Post 1846	High
GdSh-9	2001-087	Cultural Depression	THSS	Pre 1846	High
GdSi-4	2000-122	Isolated Lithic	THSS	Pre 1846	High
GdSi-5	2000-122	Cultural Depression	THSS	Pre 1846	High
GdSi-6	2000-122	Cultural Depression	THSS	Pre 1846	High
GeRx-1	2004-051	Isolated Lithic	THSS	Pre-1846	Moderate
GeRx-2	2004-051	Isolated Lithic	THSS	Pre-1846	Moderate
GeRx-3	2005-105	Cultural Depression	THSS	Pre-1846	High
GeRx-4	2005-105	Cultural Depression	THSS	Pre-1846	High
GeSa-4	2005-105	Isolated Lithic	THSS	Pre-1846	High
GeSa-5	2005-105	Cultural Depression	THSS	Pre-1846	High
GeSa-6	2006-125	Cultural Depression	THSS	Pre-1846	Moderate
GeSa-7	2006-125	Cultural Depression	THSS	Pre-1846	Moderate
GeSa-8	2006-125	Trail	T	Pre-1846	High
GeSb-1	1999-292	Isolated Lithic	THSS	Pre 1846	High
GeSb-2	2000-120	Trail	T	Unknown	High
GeSc-5		Lithic Scatter	THSS	Pre 1846	High
GeSd-1		Isolated Lithic	THSS	Pre 1846	High
GeSe-1	1995-051	Cultural Depression, Lithic Scatter, Cultural Materials (Pre)	THSS	Pre 1846	High
GeSe-10	1999-292	Cache Pit	THSS	Pre 1846	High
GeSe-11	1999-292	Fish Weir	FS	Pre 1846	High
GeSe-13	2003-085	Trail	T	Pre 1846	High
GeSe-14	2005-105	Cultural Depression	THSS	Pre-1846	High
GeSe-15	2005-105	Cultural Depression	THSS	Pre-1846	High
GeSe-16	2005-105	Cultural Depression	THSS	Pre-1846	High

Borden Number	Permit	Site Type	Site Category	Age	Modeled Potential
GeSe-2	1999-292	Cache Pit, Lithic Scatter, Faunal Material	THSS	Pre 1846	High
GeSe-3	1999-292	Lithic Scatter, Faunal Material	THSS	Pre 1846	High
GeSe-4	1999-292	Cache Pit, House Pit, Faunal Material	PHS	Pre 1846	High
GeSe-5	1999-292	Fish Weir	FS	Pre 1846	High
GeSe-6	1999-292	Lithic Scatter	THSS	Pre 1846	High
GeSe-7	1999-292	Cache Pit	THSS	Pre 1846	High
GeSe-8	1999-292	Cache Pit	THSS	Pre 1846	Moderate
GeSe-9	1999-292	Cache Pit	THSS	Pre 1846	High
GeSf-1	2001-087	Cultural Depression	THSS	Pre 1846	High
GeSh-1		Rock Art	RAS	Pre 1846	High
GeSh-2		Rock Art	RAS	Pre 1846	High
GeSh-3	1999-292	Cache Pit	THSS	Pre 1846	High
GeSi-1	1999-292	Cache Pit	THSS	Pre 1846	High
GeSi-2	1999-292	Cache Pit	THSS	Pre 1846	High
GfRx-6	2004-051	Trail	T	Pre-1846	Moderate
GfSb-2	1998-057	Trail	T	Unknown	High
GfSb-3	2006-125	Trail	T	Unknown	High
GfSg-2	2006-125	Trail	T	Pre-1846	High
GfSg-3	2006-125	Cultural Depression	THSS	Pre-1846	High
GfSh-2	2001-087	Cultural Depression, Isolated Lithic	THSS	Pre 1846	High
GfSh-3	2003-094	Cache Pit	THSS	Pre 1846	High
GgSb-1	1971-037	Cultural Depression	THSS	Pre-1846	High
GgSg-8	2004-051	Trail	T	Pre-1846	High
GgSh-6	2002-214	Cache Pit, Isolated Lithic	THSS	Pre 1846	Moderate
GgSi-1	2000-120	Cultural Depression, Trail	T, THSS	Pre 1846	High
GgSj-4	1999-248	Cache Pit	THSS	Pre 1846	High
GgSk-1	1996-066	Isolated Lithic	THSS	Pre 1846	High
GhSc-2	1999-292	Lithic Scatter, Faunal Material	THSS	Pre 1846	High
GhSf-1	1971-037	Cache Pit	THSS	Pre 1846	Moderate
GhSk-1	1971-023	Rock Art	RAS	Pre 1846	High
GhSk-2	1971-023	Rock Art	RAS	Pre 1846	High
GiSk-1	1971-023	Rock Art	RAS	Pre 1846	Moderate
GiSl-1	1971-023	Rock Art	RAS	Pre 1846	Moderate
GiSl-2	1971-023	Rock Art	RAS	Pre 1846	Moderate
GiSl-3	1971-023	Rock Art	RAS	Pre 1846	High
GiSl-4	1971-023	Rock Art	RAS	Pre 1846	High
GjSm-1	1971-023	Cultural Depression, Hearth	THSS	Pre 1846	Moderate
GjSm-2		Lithic Scatter	THSS	Pre 1846	High
GjSm-6	2001-195	Cache Pit	THSS	Pre 1846	High

Borden Number	Permit	Site Type	Site Category	Age	Modeled Potential
GkSk-1	2000-120	Trail	T	Pre 1846	High
GkSm-1	2005-105	Trail	T	Pre-1846	High
GkSn-1	1971-023	Burial Site, House Pit, Cultural Depression, Hearth, Isolated Lithic	PHS	Post 1846	High
GlSl-2	2002-242	Trail	T	Pre 1846	Moderate
GlSo-1	2000-120	Isolated Lithic	THSS	Pre 1846	High
GlSp-3	2000-120	Dugout Canoe	THSS	Post 1846	High
GlSp-6	2000-120	Lithic Scatter	THSS	Pre 1846	High
GlSr-3	2002-242	Trail	T	Pre 1846	High
HaSs-1	2000-123	Lithic Scatter	THSS	Pre 1846	Moderate
HaSs-2	2000-123	Isolated Lithic	THSS	Pre 1846	High
HbSr-1	1974-001	Lithic Scatter	THSS	Pre 1846	High
HbSr-10	1974-001	Village/Multi Use Site	PHS	Unknown	Moderate
HbSr-11	1997-167	Cultural Depression	THSS	Pre 1846	High
HbSr-12	1997-167	Cultural Depression	THSS	Pre 1846	High
HbSr-13	1997-167	Cultural Depression	THSS	Pre 1846	High
HbSr-14	1997-167	Cache Pit	THSS	Pre 1846	High
HbSr-15	1997-167	Cache Pit	THSS	Pre 1846	High
HbSr-2	1974-001	Isolated Lithic	THSS	Pre 1846	High
HbSr-23	2003-102	Trail	T	Pre 1846	High
HbSr-24	1999-292	Cache Pit, Lithic Scatter, Faunal Material	THSS	Pre 1846	High
HbSr-25	2000-123	Cultural Depression	THSS	Pre 1846	High
HbSr-26	2000-123	Cultural Depression	THSS	Pre 1846	High
HbSr-27	2002-242	Isolated Lithic	THSS	Pre 1846	High
HbSr-28	2003-102	Cache Pit	THSS	Pre 1846	Moderate
HbSr-29	2003-102	Cache Pit	THSS	Pre 1846	High
HbSr-3	1974-001	Cache Pit, House Pit, Isolated Lithic	PHS	Pre 1846	High
HbSr-30	2003-102	Isolated Lithic	THSS	Pre 1846	High
HbSr-31	2003-102	Isolated Lithic	THSS	Pre 1846	High
HbSr-5	1974-001	Hearth	THSS	Unknown	High
HbSr-8	1996-139	Bridge, Trail	T	Post 1846	High
HbSr-9	1997-167	Cache Pit	THSS	Pre 1846	High
HbSs-1	1997-167	Cultural Depression	THSS	Pre 1846	Moderate
HbSs-10	2002-105	Isolated Lithic	THSS	Pre 1846	Moderate
HbSs-2	1997-167	Ceremonial/Sacred Site, Cultural Depression, Faunal Material	PHS	Unknown	High
HbSs-4	2002-242	Isolated Lithic, Trail	T, THSS	Pre 1846	High
HbSs-5	1999-292	Burial Site, Cache Pit, Isolated Lithic	HR, THSS	Pre 1846	Moderate

Borden Number	Permit	Site Type	Site Category	Age	Modeled Potential
HbSs-6	1999-292	Cache Pit	THSS	Pre 1846	High
HbSs-8	2000-120	Trail	T	Pre 1846	High
HbSs-9	2001-195	Cache Pit	THSS	Pre 1846	Moderate
HbSt-3	1999-292	Cultural Depression	THSS	Pre 1846	High
HbSu-1	2000-123	Village/Multi Use Site	PHS	Unknown	High
HcSs-2	2000-123	Trail	T	Pre 1846	High
HcSs-4	2002-242	House Pit	PHS	Pre 1846	Moderate
HcSt-1	2001-195	Lithic Scatter	THSS	Pre 1846	High
HcSt-6	2001-195	Trail	T	Pre 1846	High
HcSx-1	2000-123	Trail	T	Pre 1846	High
HcSx-2	2000-123	Faunal Material, Lithic Scatter	THSS	Pre 1846	High
HcSx-3	2000-123	Burial Site	HR	Unknown	High
HdSo-1	2000-123	Lithic Scatter	THSS	Pre 1846	Moderate
HdSs-1	2000-123	Rock Cairn	T	Pre 1846	Moderate
NBN1	1974-001	Cache Pit	THSS	Pre 1846	High
NBN2	1974-001	Cache Pit	THSS	Pre 1846	High
NBN3	1974-001	Lithic Scatter	THSS	Pre 1846	High
NBN4	1974-001	Cache Pit	THSS	Pre 1846	High

Pre-1846 CMT Sites

Note: Where modeled potential for a site straddled several zones, the highest zone within the site boundaries was used; therefore, portions of some sites may be located within the low potential zone.

Site	Permit	Age	Modeled Potential
GcRv-3	1999-292	Unknown	High
GcSa-10	2002-214	Pre 1846	Moderate
GcSa-11	2002-214	Pre 1846	High
GcSa-12	2002-214	Pre 1846	High
GcSa-3	2002-214	Pre 1846	Low
GcSa-4	2002-214	Pre 1846	High
GcSa-5	2002-214	Pre 1846	High
GcSa-6	2002-214	Pre 1846	Moderate
GcSa-7	2002-214	Pre 1846	Moderate
GcSa-8	2002-214	Pre 1846	High
GcSa-9	2002-214	Pre 1846	High
GcSc-21	2003-094	Pre 1846	High
GcSc-22	2003-094	Pre 1846	Moderate
GcSc-25	2003-094	Pre 1846	High
GcSc-26	2003-094	Pre 1846	High
GcSc-27	2003-094	Pre 1846	Moderate
GcSc-28	2003-094	Pre 1846	Moderate
GcSe-2	2006-125	Pre-1846	Moderate
GdRx-1	2000-120	Pre 1846	High
GdRx-6	2001-194	Pre 1846	Moderate
GdRx-7	2001-194	Pre 1846	Moderate
GdRx-8	2004-051	Pre-1846	Moderate
GdRx-9	2004-051	Pre-1846	Moderate
GdSb-1	2000-223	Pre 1846	Moderate
GdSc-23	2000-223	Pre 1846	High
GdSd-1	2003-285	Pre 1846	High
GdSd-2	2002-288	Pre 1846	High
GdSd-3	2002-288	Pre 1846	High
GdSg-12	2001-194	Pre 1846	Moderate
GdSg-13	2001-194	Pre 1846	Moderate
GdSg-14	2001-194	Pre 1846	High
GdSg-15	2001-194	Pre 1846	High
GdSg-16	2001-194	Pre 1846	Moderate
GdSg-17	2001-194	Pre 1846	High
GdSg-18	2001-194	Pre 1846	High
GdSg-19	2001-194	Pre 1846	High

Site	Permit	Age	Modeled Potential
GdSh-10	2001-087	Pre 1846	High
GdSh-11	2001-087	Pre 1846	Moderate
GeSb-5	2006-125	Pre-1846	High
GeSc-2	1998-057	Unknown	High
GeSe-12	2003-094	Pre 1846	High
GeSi-2	1999-292	Unknown	High
GfRw-1	2006-125	Pre-1846	Moderate
GfRx-1	2004-051	Pre-1846	Moderate
GfRx-2	2004-051	Pre-1846	Moderate
GfRx-3	2004-051	Pre-1846	High
GfRx-4	2004-051	Pre-1846	High
GfRx-5	2004-051	Pre-1846	Moderate
GfRx-7	2004-051	Pre-1846	High
GfSf-1	2001-170	Pre 1846	High
GfSf-2	2001-170	Pre 1846	Moderate
GfSf-3	2001-170	Pre 1846	High
GfSf-4	2001-170	Pre 1846	High
GfSh-2	2001-087	Pre 1846	High
GfSh-4	2005-105	Pre-1846	High
GgSg-2	2001-194	Pre 1846	Moderate
GgSg-3	2001-194	Pre 1846	Low
GgSg-4	2001-194	Pre 1846	Moderate
GgSg-5	2001-194	Pre 1846	Moderate
GgSg-6	2001-194	Pre 1846	Moderate
GgSg-7	2001-194	Pre 1846	Moderate
GgSh-1	2000-120	Pre 1846	High
GgSh-2	2000-120	Pre 1846	High
GgSh-3	2000-120	Pre 1846	High
GgSi-1	2000-120	Pre 1846	High
GgSi-2	2001-297	Pre 1846	Moderate
GgSi-3	2001-297	Pre 1846	Low
GgSi-4	2001-297	Pre 1846	Low
GgSi-5	2001-297	Pre 1846	Moderate
GgSi-6	2001-297	Pre 1846	Moderate
GgSk-10	2001-194	Pre 1846	High
GgSk-11	2001-194	Pre 1846	High
GgSk-2	2001-194	Pre 1846	High
GgSk-3	2001-194	Pre 1846	High
GgSk-4	2001-194	Pre 1846	High

Site	Permit	Age	Modeled Potential
GgSk-5	2001-194	Pre 1846	Moderate
GgSk-6	2001-194	Pre 1846	Moderate
GgSk-7	2001-194	Pre 1846	Moderate
GgSk-8	2001-194	Pre 1846	High
GgSk-9	2001-194	Pre 1846	High
GjSm-3	1999-078	Pre 1846	High
GjSm-5	2001-195	Pre 1846	Moderate
GlSl-1	2002-242	Pre 1846	Moderate
GlSr-1	2002-242	Pre 1846	High
GlSr-2	2002-242	Pre 1846	High
HbSr-10	1997-167	Pre 1846	Moderate
HbSr-19	1999-078	Unknown	Moderate
HbSs-4	2002-242	Pre 1846	High
HbSs-5	1999-292	Pre 1846	Moderate
HbSt-4	2004-132	Pre-1846	High
HcSs-1	1998-057	Pre 1846	Moderate
HcSs-3	2000-123	Unknown	Moderate
HcSt-10	2001-195	Pre 1846	Moderate
HcSt-11	2001-195	Pre 1846	High
HcSt-2	2001-195	Pre 1846	High
HcSt-3	2001-195	Pre 1846	Moderate
HcSt-4	2001-195	Pre 1846	High
HcSt-5	2001-195	Pre 1846	High
HcSt-7	2001-195	Pre 1846	Moderate
HcSt-8	2001-195	Pre 1846	High
HcSt-9	2001-195	Pre 1846	High

Review of the Fort St. James Forest District Archaeological Predictive Model 2009

APPENDIX C

Mapsheets 093K.060 and 093N.015
Archaeological Potential Comparison

CONIFEX AOA : BCGS MAPSHEET 093K.060 ARCHAEOLOGICAL POTENTIAL MAP

Projection: NAD 83, UTM Zone 10
Date: February 10, 2009

200 0 200 400 600 800
Meters
Scale: 1:20,000

LEGEND

TRIM II INFORMATION

Waterbody
- Lake/River
- Swamp/Marsh

Stream
- Definite
- Indefinite

Contour
- 20m Interval
- 100m Interval

Transportation
- Road
- Railway

Other
- IR Boundary
- Private Land

Wetland

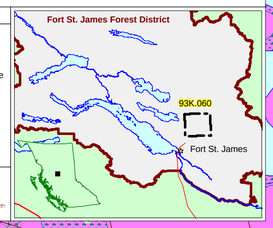
ARCHAEOLOGICAL INFORMATION
- Heritage Trail (GPS'd)
- Heritage Trail (Estimated)
- Arch RAAD Site
- FIA Database Site

ARCHAEOLOGICAL POTENTIAL
- High
- Moderate
- Low

Produced For: CONIFEX

Produced By: ECOFOR natural and cultural resource consultants

EPN: 2009-1019-001 (BM)



Woodlot 1892 Sch. A
Woodlot 648 Sch. A
Woodlot 295 Sch. A
Woodlot 666 Sch. A, Blk. B
Woodlot 666 Sch. A, Blk A
Woodlot 219 Sch. A, Blk 1
Woodlot 219 Sch. A, Blk A
Woodlot 219 Sch. A, Blk C
Woodlot 648 Sch. A

STUDY AREA 1
STUDY AREA 2
STUDY AREA 3
STUDY AREA 4

093K.060

MURRAY RIDGE

Ocock River Trail (68)
Ocock to 124 Meridian Trail (27A)
124 Meridian Trail (42A)

CMT
Trail

CONIFEX AOA : BCGS MAPSHEET 093N.015 ARCHAEOLOGICAL POTENTIAL MAP

Projection: NAD 83, UTM Zone 10
Date: February 10, 2009

N
W E
S

200 0 200 400 600 800
Meters
Scale: 1:20,000

LEGEND

TRIM II INFORMATION

Waterbody
- Lake/River

Wetland
- Swamp/Marsh

Stream
- Definite
- Indefinite

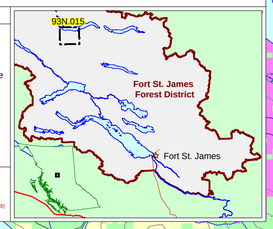
Contour
- 20m Interval
- 100m Interval

Transportation
- Road
- Railway

Other
- IR Boundary
- Private Land

ARCHAEOLOGICAL INFORMATION
- Heritage Trail (GPS'd)
- Heritage Trail (Estimated)
- Arch RAAD Site
- FIA Database Site

ARCHAEOLOGICAL POTENTIAL
- High
- Moderate
- Low



Produced For: CONIFEX

Produced By: ECOFOR natural and cultural resource consultants

EPN: 2008-1019-002 (BM)

Tchentlo Lake

Nation Lakes Park

GhSh-2

STUDY AREA 1

STUDY AREA 2

093N.015

Tlutsacho Lake

GgSg-1

STUDY AREA 4

STUDY AREA 3

Takatoot Lake

Airline Lake

GgSg-2
CMT
CMT
GgSg-3
GgSg-7
CMT
CMT
GgSg-5
CMT
GgSg-4
GgSg-6
CMT
CMT
CMT