3.0 RESEARCH DESIGN AND METHODS

3.1 A Research Framework for Understanding the Little Beaver Watershed

The highest elevations of mountain cordillera seem to most observers an unlikely landscape to investigate the relationship of indigenous populations to their environment. Such areas offer, after all, a harsh and limiting environment for human use much of the time, and there is no general acknowledgment of the importance of such landscapes to pre-contact indigenous populations over much of North America. Nevertheless, evidence from mountain cordillera around the world reveals the important influences they exert on the human populations that reside in and near to them.

Perhaps there is no better place than right here in the Pacific Northwest to examine the reciprocal influences of human groups and montane ecosystems. After all, much of the land area is ruggedly mountainous, and the juxtapositions of oceans and sounds, cordillera, plateaus, and basins, result in an ecosystem diversity and richness that exerted profound influences on indigenous populations. The marine-influenced mountain ranges of the Pacific Northwest possess several ecological characteristics not found in the continentally-influenced ranges of western North America. Pacific Northwest mountains exhibit maturely-glaciated valleys, great elevational relief, and heavy snow accumulation resulting in numerous active alpine glaciers and permanent snow patches, and an elevationally broad and lush subalpine belt (Mierendorf 1999). By contrast, continentally-influenced ranges exhibit less mature glacial erosion, moderate relief, and lower annual snowfall resulting in few active glaciers and a narrow subalpine belt. Historically, continentally-influenced ranges, such as the Rocky Mountains, have a long tradition of archaeological research, whereas maritime-influenced ranges like the northern Cascades, do not. Archeological assemblage characteristics, chronology of use, the structure of subsistence resources, the effects of population aggradation, more intensive use of subsistence resources, and the effects of climate change are several of the important but poorly understood problems to be investigated in Pacific Northwest high country studies. Investigation of these issues promises to shed new light on the pre-contact history of Pacific Northwest indigenous groups.

Understanding of the Little Beaver watershed's archeology is achieved by considering four main factors, and their differing relationships at different temporal and spatial scales. The four variables considered necessary and sufficient for understanding (and ultimately, explaining) archeological assemblages are resource structure, climate, physiography, and demography (or socio-cultural factors) (Mierendorf 1999). However, the relationships between these variables is not constant, but varies according to scale. Thus for example, the annual distribution of subsistence foods in Little Beaver watershed over one year may have little to do with the distribution of these same resources across the entire Pacific Northwest over the last several thousand years.

Resource structure consists of the temporal and geographic availability of food and utilitarian resources. Those who study pre-contact history have known for a long time that the dispersion of subsistence resources over time and space results in very different human foraging strategies compared with landscapes having subsistence resources concentrated in time and space. Within the Little Beaver watershed, resources tend to be concentrated due to the steep gradients in slopes and climate variables, and due to strong seasonal differences in these variables. But at a regional scale, these same resources are dispersed across many such watersheds, and have been for millennia. As noted in section 2.2, climate variations occurring at millennial scales tends to drive regional vegetation changes while fire and other disturbances drive vegetation change at decadal to century time scales. The abundance and availability of indigenous animal and plant food resources are controlled largely by climate variables, but local climate effects more than just food. It may, for example, render certain mountain landforms unfavorable for habitation, due to pervasive cold air drainage or winds, as controlled by local physiography, the third variable necessary to consider. Local physiography may not be an important variable in many lowland landscapes, but in montane environments it assumes great importance at both local and regional scales. The last variable, demography (or socio-cultural phenomena), acknowledges the importance of cultural influences on how groups used montane landscapes like the project area. A remarkable quality of the Little Beaver watershed, in fact, derives from the interaction of physiography and demography, resulting in two very different demographic conditions when comparing the eastern and western extremities of the watershed. Not a great distance to the west and north of the western extremity lies the broad Fraser River valley, characterized by large, dense populations dwelling in large winter villages. The pithouse villages extending up the Chilliwack River valley, as far as Chilliwack Lake, are even closer to the project area. In contrast, the eastern extremity is distant from any such population centers or any permanent settlements. Here, only dispersed mobile groups, from widely separated and distant population centers, foraged seasonally across a vast expanse of the upper Skagit River valley and its tributaries. In this sense, the Little Beaver watershed serves as a demographic boundary, a characteristic that has been associated with high mountain massifs that form the headwaters of the largest regional watersheds, such as the Fraser and Skagit Rivers (Mierendorf 1999:17).

One goal of this project is to investigate archeological sites in an extreme environment, where the factors of physiography and climate are considerably more constraining to human activity than in the lowland terrestrial environments of the region. Partly this is because extreme (or "marginal") environments can be sensitive to certain kinds of cultural change, be they triggered by demographic or climatic influences. From this perspective, the Little Beaver project offers an optimum area for investigating pre-contact indigenous adaptations to montane environments.

3.2 Survey and Inventory Methodology

Archeological survey refers to the set of techniques used to discover, describe, and inventory previously undetected archeological resources. The primary survey technique employed in the project area requires walking a series of transects in order to visually detect archeological sites. Ideally, transects are spaced close together, with each crew member walking approximately parallel transects. While following each transect, crew members walk a more or less sinuous route in order to see more of the ground along the transect. Due to the constraints imposed by demanding field conditions, however, transects are rarely parallel;

rather, their course is most often determined by the need to avoid steep slopes and cliffs and other obstructions. The extreme relief that characterizes the Little Beaver project area overrides other factors, frequently requiring crew members to judgmentally select only safe routes.

Surveyors are trained to detect a range of cultural resource types, including stone tools and the debris produced during tool manufacture and maintenance; on-the-ground features such as pits and trenches, and stacked rock features such as walls and cairns; charcoal concentrations, especially in association with fire-modified rocks or other artifact types; culturally-modified trees; rock art; structures such as cabins; and historic artifact concentrations and debris scatters.

Cultural resource data are recorded on-site on site inventory forms. In most cases, site locations were recorded with a hand-held GPS (Global Positioning System) unit; in other cases, site locations were determined with the aid of an altimeter and 1:24,000 scale U.S. Geological Survey topographic map. Sites are assigned a field number at the time of discovery and all subsequent field notes and records are referenced to this number. Later, in the laboratory, another site form is prepared and sent to the state Office of Archeology and Historic Preservation in Olympia, where each site is assigned a Smithsonian trinomial number.

Removal and collection of artifacts from sites is limited to formed tools, culturally and temporally diagnostic artifacts, small samples of flaking debris (≤5 items) and representative samples of natural rock or mineral specimens, as dictated by analytic tests, such as X-Ray Fluorescence analyses (see section 3.3 below).

3.3 Special Analyses: X-Ray Fluorescence Analysis of Vitrophyre, Electron Microprobe Analysis of Tephra, Radiocarbon Dating of Charcoal

The analysis of archeological remains in the study area utilizes several laboratory techniques requiring specialized scientific equipment. The results of these analyses provide the data necessary to identify tool stone sources and volcanic ashes, and to date organic remains. Below, each technique is briefly described, accompanied by the name of the laboratory and references to more technical information about these analyses.

X-Ray Fluorescence analysis (XRF) of obsidian provides a way to obtain the chemical "signature" of known obsidian sources. Archeologists have successfully used such signatures to follow the indigenous routes of obsidian movement in Northwest Coast (Carlson 1994). Because the test is non-destructive and requires no chemical pretreatment, all samples, including artifacts, are unaltered by the analysis. A Spectrace 5000 energy dispersive X-ray fluorescence spectrometer measures peak signals corresponding to the quantity of individual trace elements in each sample. These signals are then converted to trace element quantities in parts per million (ppm) (for detailed information about the analysis of North Cascades samples, see Skinner 1999a and 1999b). The trace element composition in ppm for the suite of measured elements makes up the chemical signature of the sample.

A total of four artifacts from the project area was analyzed using XRF in order to determine if any could be correlated with known, chemically-characterized obsidian sources. Three of the samples are from 45WH631 and one sample is from 45WH515. All samples were collected from the site surfaces by NPS archeologists as part of site documentation. In later sections of this report, the results of these analyses are compared with the chemical signatures of vitrophyre (obsidian) sources and artifacts from several other sites in the northern Cascades (see Appendix A-2 for trace element data). This comparison is made possible by the use of XRF data obtained on a large sample of vitrophyre specimens removed from source outcrops from the adjacent Chilliwack watershed. These data, previously unpublished, are derived from a long-term research effort by the author to identify, verify, and chemically characterize glassy tool stone types found in the park's volcanic terrain. All XRF analyses used in this study were conducted at the Northwest Research Obsidian Studies Laboratory, a commercial laboratory operated by Craig Skinner in Corvallis, Oregon. Results of the analysis are described in section 4.6.

Layers of volcanic ash are common in Northwest archeological sites. Electron microprobe analysis has been used successfully to identify the source volcano and ages of volcanic ash (tephra) layers. Similar to XRF, the technique provides a measure of the major element composition of glass shards within an ash sample in order to develop a chemical "signature" of the ash. Prior to analysis, each ash sample is cleaned by chemical pretreatment, permanently mounted on a slide, and then analyzed on the Cameca electron microprobe at the Geo-Analytical Laboratory located in the Department of Geology, Washington State University (see Foit et al. [1993] for a more detailed description of the technique). The chemistry of the sample is then compared to a database of tephra signatures of dated eruptive events. Results of the analysis are described in section 4.5.

One sample from a primary tephra layer was collected from 45WH631 and analyzed in order to identify its source. The chemical composition of the sample is matched to a known tephra from a dated eruptive event. The age of the event is then used to estimate the age of artifacts observed in association with the tephra layer. This tephra sample is also compared with several chemically similar tephra identified from other nearby localities outside of the project area (see Appendix A-3 for tephra sample chemistry data).

Radiocarbon dating of organic matter is one of the most accurate techniques for dating sites. The technique employs an extremely sensitive counter to measure the radioactivity of stable and unstable isotopes of the element carbon, which is found in all living things. The derived radiocarbon age of a sample is actually the estimated time that has transpired since the parent organism ceased incorporating atmospheric carbon into its body, in other words, since it has died. Artifacts and other archeological site components are dated directly if they are made of organic materials, or indirectly if they are themselves undatable, but are physically associated with dated organic matter. Radiocarbon samples are subjected to strong chemical pretreatment and are destroyed in the subsequent analysis.

Three charcoal samples from 45WH220 provide the most accurate estimate currently available of the duration of indigenous use of the Little Beaver Creek watershed. All three samples consisted of charred woody tissue recovered from *in situ* in excavation levels 3 and 4 of Test Unit 2 (hereafter, TU2). All samples were analyzed by Beta Analytic, Inc., a commercial radiocarbon-dating laboratory located in Florida. Results of the analysis are described in section 4.4.5.

3.4 Tool Stone Confidence Classes

The accurate identification of tool stone types in archeological assemblages is a critical step in investigating questions about pre-contact indigenous subsistence, settlement, and group movements. One of the main techniques used for such investigations requires the identification of the provenance of geologic sources of the stone materials used by indigenous people to manufacture tools. However, given the great variety of tool stone types found in northern Cascades archeological assemblages, the abundance of geologic source areas, and the overall scarcity of archeological studies, it is understandable why there is little comparative information to draw on. As a result, the provenance and descriptive data currently available for tool stone sources is uneven, and ranges in accuracy from extremely poor to good. It follows, then, that any inferences based on imprecise data will have a low confidence level.

As a means of addressing this problem, I have developed a method to rank the confidence level of tool stone identifications and geologic provenance data for the project area and the adjacent upper Skagit River valley. The method uses four criteria for ranking confidence (see section 4.2 for a detailed discussion of how this is done). Of seven distinctive lithic types described in the project area, only two ranked "high" in confidence level. Comparison of assemblages and inferences regarding subsistence, settlement, and mobility in the project area are based on these two tool stone types (Hozomeen chert and Hannegan vitrophyre).

3.5 Test Excavations

Included in this report are the results of a text excavation conducted in July, 1996, at site 45WH220, which is located on a rocky, glacially-scoured bedrock bench several hundred meters upstream of the junction of Little Beaver Creek with the Skagit River. The site is located above the point where the creek exits the Little Beaver valley and has built its alluvial fan on the Skagit River flood plain. The purpose of the test excavation was to assess the effects to the archeological site of stabilizing the ground surface inside a historic shelter. This shelter is a rectangular, three-sided log structure, 3 m by 3.9 m, built to accommodate the needs of recreational visitors. The exact date of construction of the shelter is unknown, although it predates NPS administration of the park.

In order to prevent erosion of the shelter floor, NPS staff proposed to harden the ground by placement of a layer of crushed rock. Prior to any such action, two 1 m square test units were excavated into the shelter floor in order to determine if archeological remains would be effected by this undertaking. This constitutes the only excavation done at this site to date. Following the excavation, the ground was hardened in a manner that helps to protect the important archeological remains.

Excavation was conducted in conformance with standard procedures used in the park and elsewhere. All soils and sediments were excavated with a trowel and were sieved through a 6.3 mm (1/4 in) mesh screen; excavation proceeded by successive 10 cm thick levels; however, several levels deviated ± several cm from this thickness in order to avoid mixing together natural stratigraphic layers. All artifacts, regardless of time period, were collected in labeled level bags. Excavation data is recorded in excavation level forms, plan view maps, stratigraphy diagrams, a bag catalog list, crew field notes, photographs, and photograph roll logs.

The test excavation at 45WH220 was directed by the author; the field work was performed by two NPS staff archeologists, eight Student Conservation Association (SCA) volunteers, and their two SCA leaders. SCA volunteer groups annually work in the park to assist in the construction and maintenance of recreational facilities. The "international" SCA group consists of high school students from British Columbia and the U.S.A. Given that one of their tasks involved the rehabilitation of the shelter, the SCA volunteers first spent one week excavating the two test units under the direction of the NPS archeologists.

The test excavations conducted at 45WH220 were initiated by the park in compliance with the need for cultural review of recreation facility improvements. This compliance is unrelated to the on-going archeological investigations in Ross Lake that have been mandated by the City of Seattle's settlement agreement on historic resources, a condition of its license of the Skagit Hydroelectric Project (FERC No. 553), granted by the Federal Energy Regulatory Commission. The activity of the 1996 international SCA group was funded by SEEC.

3.6 Curation of Project Collections

All collections from this project are accessioned, cataloged, and permanently preserved at the park's curation facility located at the NPS Skagit District Ranger Station, Marblemount, Washington. The collections consist of artifacts and geologic specimens, and archival records of project notes, site maps, photographs, and related documentation. The curation facility meets federal standards developed for collection repositories.