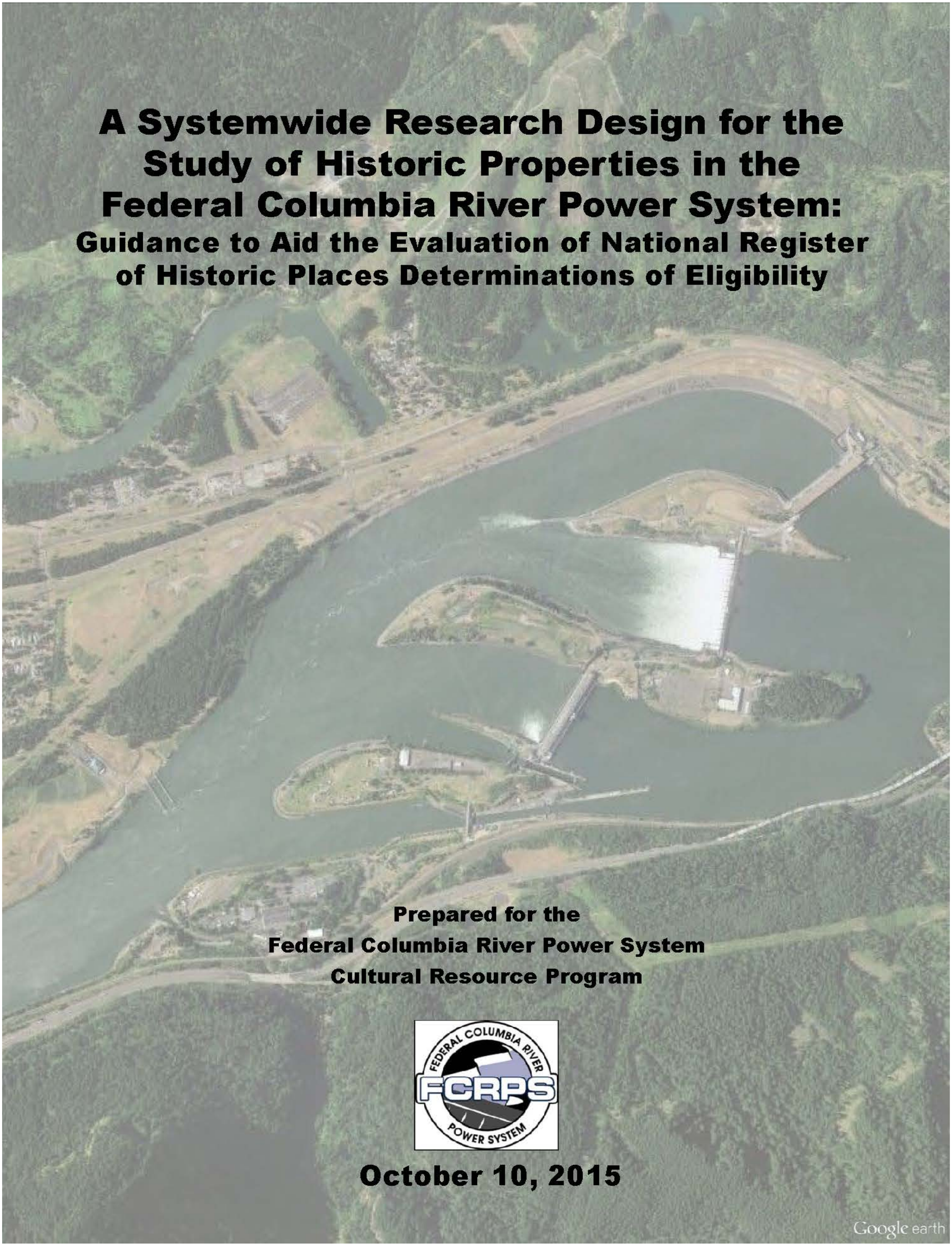

A Systemwide Research Design for the Study of Historic Properties in the Federal Columbia River Power System:

Guidance to Aid the Evaluation of National Register of Historic Places Determinations of Eligibility

Prepared for the
Federal Columbia River Power System
Cultural Resource Program

October 10, 2015

A Systemwide Research Design for the Study of Historic Properties in the Federal Columbia River Power System:

Guidance to Aid the Evaluation of National Register of Historic Places Determinations of Eligibility

Submitted to:

U.S. Army Corps of Engineers
Bureau of Reclamation
Bonneville Power Administration

Under BPA Contract Number 64599 for the jointly funded FCRPS Cultural Resource Program

Submitted by:

Historical Research Associates, Inc.

October 10, 2015

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ABSTRACT

This document has been prepared for the Federal Columbia River Power System (FCRPS) Cultural Resources Program (CRP) to address a requirement in the 2009 Systemwide Programmatic Agreement (SWPA) for preparation of a Systemwide Research Design (SWRD) to aid in evaluating cultural resources for their National Register of Historic Places (NRHP) eligibility under Section 106 of the National Historic Preservation Act (NHPA) at the 14 federally operated hydroelectric projects in the Columbia River Basin (CRB). Staff of the Bonneville Power Administration, Bureau of Reclamation, and U.S. Army Corps of Engineers ("Agencies") coordinated production of the SWPA with contractors, state historic preservation offices, tribes and other federal agencies throughout the Pacific Northwest.

The SWRD creates a context for interpreting the historical significance of cultural resources in the process of determining their NRHP eligibility. This document seeks to establish a foundation for the Agencies to evaluate resources under all NRHP criteria. The context for evaluation is organized through five research domains, most of which address the potential of FCRPS Project Area resources under Criterion D. However, Chapter 3 presents the Native Peoples domain, associated research themes, and research questions, which collectively offer the potential for evaluating archaeological and non-archaeological properties under all four of the NRHP criteria.

As many of the cultural groups that are considered in the SWRD organized their lives around the spatial and temporal distribution of natural resources, Chapter 4 presents the Environmental Variability domain independently of the other domains, the balance of which are presented in Chapter 5, together with the historical context of each. Regional cultural sequences generally trace a long-term change from relatively dispersed and mobile bands of hunter-gatherers to more sedentary hunter-gatherer groups who established villages, stored large amounts of fish and plant foods for consumption during the winter, and engaged in trade networks that stretched throughout the western United States. Some of the most dramatic cultural changes started in the late 1700s, when Euroamericans began to establish a cash-based economy that focused on exploiting natural resources as commodities. Chapter 6 includes research themes for each of the archaeologically focused domains and reviews the status of research conducted to date. Chapter 7 lays out FCRPS-specific research questions and the types of data that would be needed to address those research questions. References Cited follow and then a two appendices of Best Practices to be utilized by FCRPS-funded research.

With the SWRD in place, the FCRPS will have a coherent set of regionally tailored guidelines for evaluating whether or not properties should be included in the NRHP and, if so, how they should be managed.

FOREWORD AND ACKNOWLEDGMENTS

This document is the work of many, over many years. The impetus for its creation came about during the long and arduous process of developing and negotiating the Systemwide Programmatic Agreement (SWPA). During that process, several sources, including Advisory Council on Historic Preservation staff (Alan Stanfill, notably) commented that the program did not have a guiding star to focus its efforts so as to provide the best possible legacy as the program's ultimate outcome. Eventually, a requirement for the Systemwide Research Design (SWRD) was added to the stipulations. Meanwhile, several of the program participants independently began discussing forms and directions that the SWRD might take. Dr. Pei-Lin Yu at the Bureau of Reclamation had recently completed a dissertation using Columbia River Basin and other Plateau data sources, and had compiled a list of data quality and publication issues that her use of the region's literature had unearthed. Messrs. Kevin Lyons of the Kalispel Tribe's Natural Resource Department and Lawr Salo of the Seattle District of the U.S. Army Corps of Engineers met Dr. Yu in 2007 to discuss their similar experiences with the issues, and the trio begin looking for ways to remedy some of the more vexing problems; an initial draft of a Best Practices Appendix was the immediate result of the "best practices" discussions.

The three agencies formally began work on the SWRD soon after the SWPA was ratified in October 2009. The effort proceeded haltingly at first, and eventually a design process was instituted in 2010. A subgroup met in Polson, Montana, in October 2010 in a breakout session during a biennial Federal Columbia River Power System (FCRPS) Systemwide Meeting to discuss the SWRD status and plan for completion, and shortly thereafter, a working committee began to hold monthly teleconferences. Mr. Salo was responsible for the conferences and was the *de facto* project manager for the SWRD, with the support of Mr. Eric Petersen of Bonneville Power Administration, and Ms. Gail Celmer of the Northwestern Division of the U.S. Army Corps of Engineers, Dr. Sean Hess, Bureau of Reclamation Pacific Northwest Region, and Mr. Lyons, each of whom contributed to the content.

The production crew would like to thank several individuals in the SWRD interest group for input at varying times during the process. Mr. Guy Moura of the Confederated Tribes of the Colville Reservation's History and Archaeology Department has shared several comments that have affected the directions taken, and Mr. Brent Martinez also has given much valuable and very insightful input. Ms. Catherine Dickson at the Confederated Tribes of the Umatilla Indian Reservation likewise has offered focal ideas and comments on several occasions. John Pouley and Dr. Dennis Griffin of the Oregon State Historic Preservation Office have generously taken the time to provide broad and detailed comment on the initial draft.

The Lead Agencies contracted with Historical Research Associates, Inc. (HRA), who worked with Lyons, Petersen, Hess, Celmer, Salo, and Kristen Martine of the Bonneville Power Administration in revising the Agencies' previous version and who directed the addition of new content. HRA's efforts involved Brent Hicks, Dr. Carol Schultze, Dr. Michele Punke, Alexander Stevenson, Dr. Kelly Derr, Gabriel Frazier, Dawn Vogel, Shannon Legler, and Dr. Heather Miller. The Lead Agencies and HRA met with the region's Tribes seeking input on the proposed content of the SWRD and, in particular, what became the Native Peoples domain. While a number of Tribes provided valuable input, both during development of HRA's initial draft and through written comments on that initial draft, the Tribes restricted virtually all of their self-produced and FCRPS reports from HRA's use. The content of the Native Peoples domain will be updated in the future when pertinent information is made available.

LIST OF ACRONYMS

ACHP	Advisory Council on Historic Preservation
aDNA	ancient DNA
AMS	Accelerator Mass Spectrometry
APE(s)	Area(s) of Potential Effects
ARPA	Archaeological Resources Protection Act
B.P.	years before present
BPA	Bonneville Power Administration
cal yr B.P.	calibrated years before present
CBP	Columbia Basin Project
CCC	Civilian Conservation Corps
CCS	cryptocrystalline silicate
CCT	Confederated Tribes of the Colville Reservation
CMTs	culturally modified trees
CRB	Columbia River Basin
CRM	cultural resource management
CRP	Cultural Resources Program
CRPP	Cultural Resources Protection Program
CSKT	Confederated Salish and Kootenai Tribes
CTUIR	Confederates Tribes of the Umatilla Indian Reservation
DAHP	Department of Archaeology and Historic Preservation
DOE	Determination of Eligibility
EOS	Exterior Occupation Surfaces
EPA	U.S. Environmental Protection Agency
FCRPS	Federal Columbia River Power System
FGV	fine-grained volcanics
FMR	fire-modified rock

GIS	Geographic Information Systems
GLO	General Land Office
GPS	Global Positioning System
HBC	Hudson's Bay Company
HBE	Human Behavioral Ecology
HPMP	Historic Properties Management Plan
HPRCSITs	Historic Properties of Religious and Cultural Significance to Indian Tribes
JDP	John Day Project
LIA	Little Ice Age
MCA	Medieval Climate Anomaly
MNI	Minimum Number of Individuals
MPD	multiple property determination
MS	magnetic susceptibility
mtDNA	mitochondrial DNA
Mya	million years ago
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NISP	Number of Identified Specimens
NPS	National Park Service
NRHP	National Register of Historic Places
NWC	Northwest Company
OFT	Optimal Foraging Theory
OSL	Optically Stimulated Luminescence
OSN	Oregon Steam Navigation Company
PA	Programmatic Agreement
PFC	Pacific Fur Company
RBS	River Basin Survey
rcbp	radiocarbon years before present

RD	Research Design
Reclamation	Bureau of Reclamation
SCS	soil control sample
SHA	Society for Historical Archaeology
SHPO	State Historic Preservation Officer
SOR	System Operation Review
Sr/Ca	Strontium/Calcium
SWPA	Systemwide Programmatic Agreement
SWRD	Systemwide Research Design
TCPs	Traditional Cultural Properties
TEK	Traditional Ecological Knowledge
THPO	Tribal Historic Preservation Officer
TL	Thermoluminescence
TP	test probe
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
Warm Springs	Confederated Tribes of the Warm Springs Reservation of Oregon
WVSP	Winter Village Settlement Pattern

CHAPTER 1—INTRODUCTION

This Systemwide Research Design (SWRD) addresses a requirement in the 2009 Systemwide Programmatic Agreement (SWPA) regarding the adverse effects of the Federal Columbia River Power System's (FCRPS) operation of 14 multipurpose projects in the Columbia River Basin (CRB). The Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers (USACE) operate the 14 projects, whose power the Bonneville Power Administration (BPA) markets; these three agencies, referred to throughout this document as "Agencies" or "Lead Agencies," have prepared this research design (RD) and are responsible for implementing it in fulfillment of the SWPA and the requirements of Section 106 of the National Historic Preservation Act (NHPA).

1.1 Purpose, Background, and Scope

1.1.1 Purpose

A research design provides direction to researchers on a particular topic or problem. In this case, SWPA provision VII describes the need and presents the scope of the problem to be addressed.

> "VII. SYSTEMWIDE RESEARCH DESIGN
>
> A. To date, the Lead Federal Agencies have largely focused Section 106 compliance efforts at the Project level, particularly on localized measures to address adverse effects to historic properties. While this focus remains a priority, the Lead Federal Agencies also agree that, given the geographic scope of the undertaking, it is important to facilitate an understanding of the history and culture of the Columbia Basin and its peoples on a broader scale than at the Project level. In order to facilitate a broader view as this Systemwide [Programmatic Agreement] PA is implemented, the Lead Federal Agencies shall prepare a Systemwide Research Design.
>
> B. The Systemwide Research Design will encourage consideration at the Project level of research, cultural, and educational objectives that have application on a broader, potentially regional level. The Systemwide Research Design could be used, for example, in updating Project [Historic Properties Management Plans] HPMPs and research designs. It could also aid in defining priorities at a Project, preparing historic contexts for evaluating sites for the National Register [of Historic Places (NRHP)], designing site treatment plans or evaluating contract proposals. The Systemwide Research Design will not replace Project-specific research designs, but it could:
>
> 1. Define broad ranging themes, study domains, and context statements that span the region and pose associated research questions that would

contribute to understanding those themes and domains. They would encompass a full array of potential property types, including but not limited to precontact and historic period archeological properties and [Traditional Cultural Properties] TCPs.

2. Identify types of materials or data that are important to analyze and collect to address research questions.
3. Define methods to enable data synthesis and comparison between properties and across geographic areas.
4. Identify potential audiences for the information, and means to make the information accessible and meaningful.

C. The Systemwide Research Design shall be prepared by the Lead Federal Agencies with input and assistance from the Cooperating Groups and consulting parties. Opportunity for input and assistance during preparation shall also be afforded to interested members of the public. The Lead Federal Agencies shall review and revise the Systemwide Research Design as needed. Any substantive revisions will be prepared with the same opportunities for input and assistance as for the initial design."

In sum, the SWRD will assist researchers in assessing cultural resources for their National Register of Historic Places (NRHP) eligibility. NHPA seeks to foster a sense of orientation for present and future generations of Americans by preserving the historical and cultural foundations of the nation as a living part of community life and development. A key step in the preservation process is determining the eligibility of properties for the NRHP under Criteria A, B, C, and D. This document seeks to establish a foundation for the Agencies to evaluate resources under all NRHP criteria. The increased emphasis on assessing all sites for Criteria A, B, and C is expected to involve an increased level of tribal participation to assure that determinations are accurate and otherwise valid.

There has been no agreement within the FCRPS Cultural Resources Program (CRP) and stakeholders on how to evaluage archaeological sites, Traditional Cultural Properties (TCPs), or Historic Properties of Religious or Cultural Significance to Indian Tribes (HPRCSITs) for eligibility under Criteria A, B, or C. For Criterion D, this has traditionally been done through archaeological research. Many resources, including archaeological properties, may be significant for multiple reasons and, therefore, may be NRHP eligible under multiple criteria. If a property provides information that contributes to the research questions in this RD, it should be considered NRHP eligible.

Regardless of the method by which a resource is found to be NRHP eligible, the FCRPS CRP strongly favors preservation in place for all historic properties, with the hope that they might remain for future generations. The SWRD will help expedite NRHP-eligibility determinations so that if mitigation or treatment of adverse effects is necessary, it can occur as quickly as is feasible.

The SWRD may be used as a substantial part of the methodology from which the Agencies and their contractors will work when assessing resources' NRHP eligibility; however, it should be viewed as a starting point from which researchers may identify other research topics, issues, and questions to pursue, but in a manner consistent with the methodology of the SWRD. The types of analyses pursued for cultural studies should reflect the scale of the study area and the research questions asked. Despite its emphasis on archaeological themes, the aim of this RD is not to encourage large-scale archaeological data recovery excavations. Data recovery will be practiced only when it is the best treatment for the site and within the prerogative of the affected tribes in that particular area. Some tribal participants in the FCRPS Program area prefer that archaeological deposits be disturbed only as minimally as needed to accomplish the Agencies' regulatory compliance. This is likely since most additions to archaeological knowledge within the FCRPS Program area will largely derive from small-scale testing projects related to the process of obtaining determinations of NRHP eligibility. For that reason, the Determination of Eligibility (DOE) process must obtain the most and best quality knowledge for its associated effects. This SWRD also does not present burial-related research questions, as any recovery of human remains in the FCRPS Project Areas is expected to occur as a result of an inadvertent discovery with the aim of reburial, and any examinations will be determined through consultation between involved agencies and Tribes.

In general terms, this RD addresses whether something is "important" and worth preserving through the lens of research themes' contexts. The RD assists in implementing investigations specific to the kind of property being examined and by using appropriate techniques of the discipline to contribute to the contexts within which the property might have "importance." The techniques applied also verify the "integrity" of the property; in the case of archaeological properties, integrity is typically a test of intactness or an assessment of disturbances. As noted in Provision VII, Subsection C, the SWRD will require ongoing review and revision to, in part, reflect the acquisition of new knowledge and new understandings about the nature of the resources and the Program's effect(s) on them. In particular, the region's Tribes have particular expertise to bring to evaluating resources, especially under Criteria A, B, and C. The Tribes chose to limit their contributions to this version of the SWRD, which has limited inclusion of that expertise, but the next version of this document is expected to include greater Tribal input.

Resolution of Adverse Effects is another part of the Section 106 compliance process in which an effective RD plays a role. If a candidate property meets NRHP criteria, and if it is affected by a federal project or program in a way that degrades how it represents its eligibility (i.e., its eligibility is adversely affected), then the responsible agency is to consider ways to treat that adverse effect. The RD can aid selection of the most appropriate context(s) and techniques for treating an adverse effect.

1.1.2 Background

The FCRPS comprises 14 multipurpose projects within the CRB, on the Columbia River and the tributary Clearwater, Flathead, Kootenai, Pend Oreille, and Snake Rivers (Figure 1-1). Constructed between 1933 and 1975, five are storage projects that collect spring runoff and pass the water downstream on a gradual basis (Grand Coulee, Hungry Horse, Albeni Falls, Dworshak, and Libby) and nine are run-of-river projects with little or no storage capacity (Chief Joseph, Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville). In the 1970s and 1980s, several of the reservoir pools were raised or the power plants expanded to increase power generation capacity. The three Federal Agencies that operate the FCRPS—the USACE, Reclamation, and BPA—are responsible for ensuring compliance with the requirements of Section 106 of NHPA and, since the 1990s, have worked together to meet those requirements for the dams and reservoirs.

In 1995, the Agencies completed a comprehensive technical and environmental impact analysis of the FCRPS commonly called the System Operation Review (SOR). The purpose of this study was to develop and implement a coordinated system operating strategy for managing the multiple uses of the Columbia River system into the twenty-first century. The SOR concluded that historic properties were being affected by system operations but that the scope of effect could not be accurately assessed. The Agencies participating in the FCRPS CRP committed to address the effects of multipurpose operations on historic properties at the FCRPS reservoirs. From 1995 through 2009, the Agencies developed a SWPA for the management of historic properties affected by the multipurpose operations of the FCRPS projects. The 2009 SWPA reinforced much of the program as it had developed since 1997.

1.1.3 Scope

As stated in the first sentence of the SWPA's provision calling for creation of this SWRD, Section 106 compliance, particularly the need to develop measures to address adverse effects to historic properties, remains a priority for applying the SWRD. The Agencies need to establish the NRHP eligibility of cultural resources in order to proceed to resolving adverse effects. The limits of the Project-specific Areas of Potential Effects (APEs) influence the contents of this RD. APEs are roughly defined as the 14 dams and associated facilities, their reservoirs, and federally managed lands, as well as surrounding areas when those specific area or sites are affected by the FCRPS undertaking. The 14 APEs are referred to throughout this document as the Project Area(s).

However, scoping the study of cultural resources in the Project Areas cannot occur in a vacuum, and understanding the resources within the bounds of those Project Areas requires acknowledging that they represent only a part of the people's lifeways that created those resources. All 14 Projects occur within large river valleys, but their occupants also used vast areas outside of the present day Project Areas. Stated simply, large river valleys do not represent the entirety of peoples' lifeways. This RD seeks to provide contexts for those lifeways as a bridge to Section 106 compliance-focused research within the Project Areas.

To create that bridge, the geographic scope of this document has two scales. At the *broadest* scale, for the purpose of understanding the archaeological and cultural-historical context of the 14 FCRPS projects, it includes the entire CRB, including contiguous surrounding areas (Figure 1-1). This expansive scale is described through the use of broad research domains and equally broad research themes. At the *narrowest* scale, for the purpose of influencing the specific activities that the FCRPS Agencies undertake to understand and preserve cultural heritage at the component 14 multipurpose projects, it adheres to the Project Areas the SWPA addresses.[1] As such, the research questions recommended for conducting future research narrow from the broader context of the FCRPS Program area to the 14 Project Areas. Further, while the CRB extends north into Canada to include the drainage area of the Columbia River north of the border, that area is de-emphasized in this RD, since there are no FCRPS Projects in Canada and no Agency responsibility or authority outside of the United States. Similarly, the Snake River Plain area in Idaho is deemphasized because there are no FCRPS Projects there either. These two subregions of the CRB are acknowledged as having cultural influence in adjacent Project Areas: the Grand Coulee Dam Project and the upper Columbia River projects are near the United States–Canada border, and the geographic position of the Snake River Plain at the northern end of the Great Basin opens the CRB to various influences from the Great Basin.

As is readily evident, the 14 member Projects' combined area (about 900 square miles, including water surfaces) is but a small percentage of the entire CRB's 258,000 square miles. Thus, although the aggregate FCRPS entity may seem to encompass a large area, it is actually quite spatially constrained.

[1] The APE for each project is or will be documented in Project-specific Programmatic Agreements and/or Historic Properties Management Plans (HPMPs).

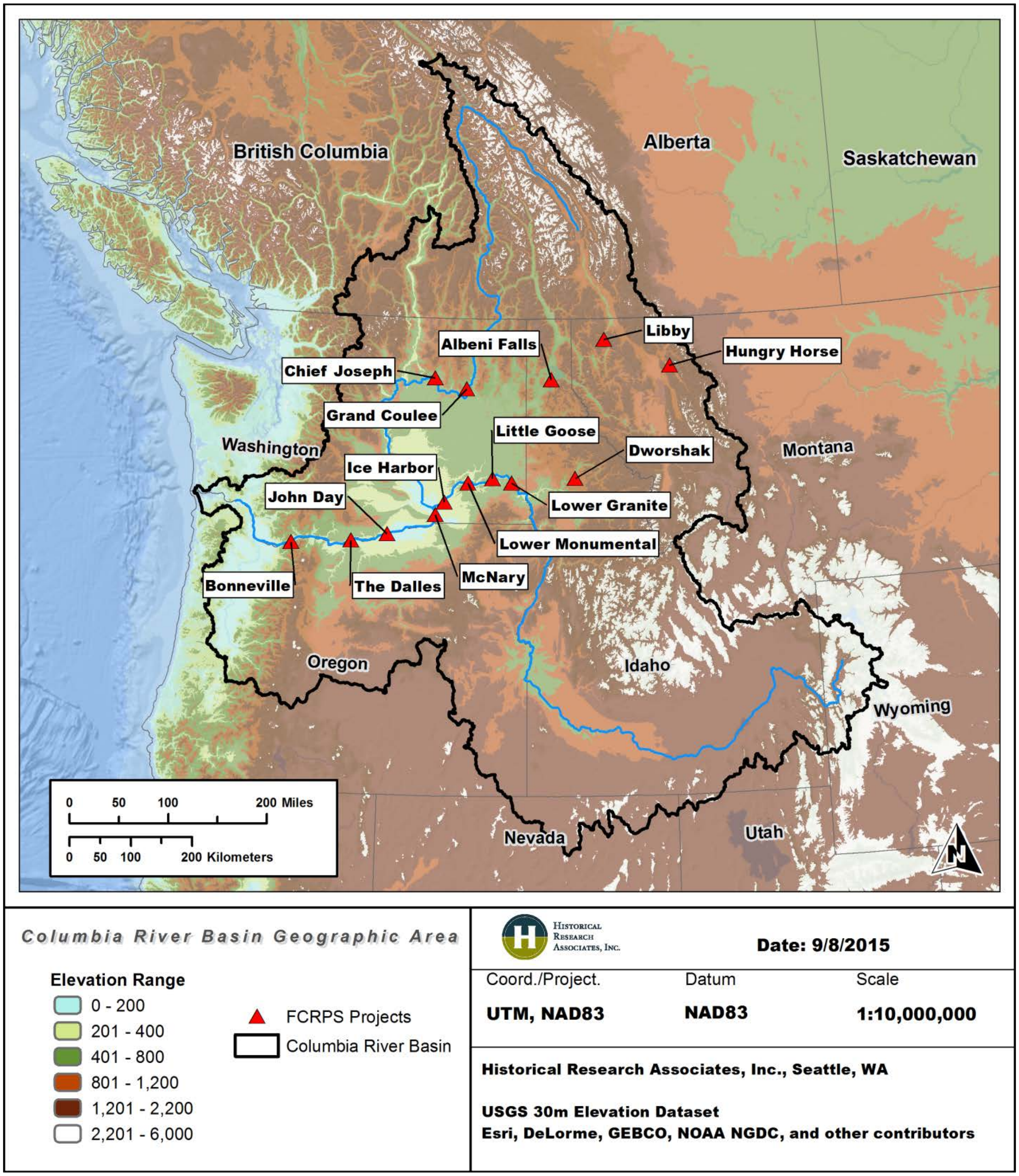


Figure 1-1. FCRPS Project locations within the Columbia River Basin geographic area, with topographic relief background.

Certain environmental elements also restrict the scope. For example, animal and plant resources within the Project Areas are restricted to those commonly found in river valley ecozones and do not include all plants and animals used by the people that also made use of the lands. Furthermore, the Projects occur in only 5 of the 14 Level 3 Ecoregions within the U.S. portion of the CRB. The types of water bodies at the Projects are also limited. Although many *natural lakes* are in the CRB, only one of the Projects includes a large permanent lake as part of its power pool (Pend Oreille Lake at Albeni Falls Dam). The scale of the rivers on which the projects are located varies as well: six of the Projects are on the main stem of the Columbia River, four are on the main stem of the Snake River, and four are on smaller tributaries.

The FCRPS CRP has been developing Historic Properties Management Plans (HPMPs) for each of the Projects. The individual HPMPs will use the research themes and questions presented in this SWRD as guidance in deriving their own specific Project-based questions. Those themes and questions will be included as part of the Project HPMPs as they are updated.

1.2 Organization of the Research Design

Following introductions to the purpose and regulatory basis of this research design in Chapters 1 and 2, the document presents the five research domains that provide structure to the presentation on the status of archaeological/culture historical knowledge and the focus of future research. A Native Peoples domain is presented in Chapter 3. The FCRPS Projects' current and paleo-environmental settings are presented in Chapter 4 as the first domain, together with the status of existing knowledge on Plateau ecology, since an understanding of this information contributes to each of the other five research domains. The three remaining research domains are defined in Chapter 5. In general, a "domain" is a sphere of knowledge within which theories can be defined and tested. For the purposes of this SWRD, and as commonly applied in cultural resource management (CRM) applications of archaeology, overlap between domains is acceptable as long as the definitions of terminology and data types and their use are specified.

Chapter 6 presents research themes that break down the non-ecology research domains into manageable units for discussion and for the presentation of the status of existing research. While these discussions address the status of research across the entirety of the FCRPS Program area and acknowledge undeniable interrelationships among resources both within and beyond the Project Areas, the RD avoids focusing future research beyond the Project Areas or on the kinds of research that do not contribute directly to regulatory compliance (see discussion in Section 1.1.3).

Following the research themes defined in Chapter 6, Chapter 7 presents research questions and the data types needed to address them that seek to extend current understandings through future research, which is expected largely to be accomplished through studies triggered by regulatory compliance. References Cited follow Chapter 7, and then two best practices appendices.

As noted in Section 1.1.3, the Agencies' responsibility for Section 106 compliance, particularly the need to determine the NRHP eligibility of resources in the FCRPS Project Areas, is a priority for this RD. Efforts have been made to include broader application of Criteria A through C to all resources, in addition to Criterion D that is commonly applied to evaluation of archaeological sites.

Another factor that influences the structure and content of the SWRD is how it addresses the CRB at two scales: broadly, for introduction of general research domains and themes, and then more narrowly, for presentation of research questions (and the associated data needed to address those questions) within each of the 14 Project Areas. The broad scale acknowledges that the lifeways of the occupants of the Project Areas extended beyond the Project Area boundaries, and research questions focused on the evidence of activities that occurred within the Project Areas must acknowledge the influence of activities that occurred outside of the Project Areas. The adjustment in scale from broad (the CRB) to narrower (the Project Areas) for archaeological domains occurs between Chapters 6 and 7. It is expected that the broad research questions developed for the SWRD will be tailored for eligibility determinations at the individual reservoir projects through Project-specific HPMPs. It is also within the HPMPs that the resulting focused research questions and historic contexts are developed for use as the basis for mitigation.

Another influence is the presumption that an RD with such broad ambitions as the SWRD does not need to, and should not, be simply an expanded version of a site- or district-specific RD. In particular, a more narrowly focused RD must include context statements to inform the reader's understanding of why certain research questions have been identified as important. Such context statements usually appear as overviews, and a CRB-wide overview is already available in the form of the 1998 Smithsonian *Handbook of North American Indians* for the Plateau (Walker 1998b), which provides a thorough context and summary of the status of existing research through about the mid-1990s. The SWRD does not need to duplicate the content of that volume. Instead, this SWRD presents context statements focused on the research themes that are most likely to apply to Section 106 compliance-based research that can properly be done within the Project Areas. The context discussions here focus more on research published after about 1995, although they reference older material as necessary to establish the chronological assimilation of findings over time.

Finally, to be effective, this document must reach a wide audience within administrative and stakeholder circles, as well as among government agencies, Tribes, and other researchers. It generally must be made available to, and comprehensible by, both lay and professional readers.

While some highly technical material is presented, the main text body summarizes such material and refers the reader to original reports and articles for details.

1.3 Perspectives on Cultural Resources and Their Management

Studying how the main communities of interest view cultural resources and their management sheds light on resource evaluation methods, which is the focus of the SWRD.

A fundamental premise of NRHP evaluation is that eligible resources are to represent a significant part of history, engineering, culture, art, architecture, or archaeology. However, since the passage of NHPA, tribal people, agency representatives, and archaeologists and historic preservationists alike have come to realize that the current evaluation criteria often fall short when trying to understand or assess the range of values and meanings traditional people ascribe to resources that are less grand or obviously significant than Celilo Falls, for example. Furthermore, the NRHP criteria for evaluating significance are strongly biased toward recognizing and evaluating historic structures and districts, rather than the earthen traces, rock alignments, or artifacts that typically represent the remains of tribal ancestral sites, much less the living knowledge about how those places figured, or continue to play on, in the lives of the communities.

1.3.1 Regulations and Policies

Agency perspectives are defined by laws and regulations, and the policies established for implementing them. In part, this stems from the fundamental constraint that the federal government only has authority to act in accordance with Congressional approval, and agencies' powers are inherently limited. The regulatory responsibility to manage the remnants of past history also leads agencies to seek precision in the definition and description of what they are responsible for managing.

The Agencies' traditional approach to historic preservation (at least since 1974) has been active, in accordance with the roles assigned to them by historic preservation laws, regulations, and executive orders. During the era of FCRPS Project capital construction, begun in the 1930s and largely completed in the 1980s, archaeological data recovery was a commonly used measure to mitigate adverse effects of the projects. Since the end of the construction era, the majority of the federal response with respect to archaeological sites at operating Projects has been to complete Project inventories, evaluate properties for NRHP eligibility, develop plans to manage the properties, foster proper curation and use of collections gathered during both the construction and operations eras, and complete technical reports of archaeological salvage projects from the earlier eras. Since the end of the construction era, the Agencies increasingly have supported efforts by the region's Indian tribes to identify and secure for their future generations the traditional knowledge of Project Areas. The Agencies also have contracted with Tribes to lead archaeological efforts at the Projects and to carry out priority work, especially on Indian lands at the Projects. The Agencies recognize that the Tribes have unique knowledge regarding cultural significance of places and resources within the FCRPS Project Areas, and that this knowledge is vital to understanding and documenting and evaluating historic properties (including TCPs and HPRCSITs).

1.3.2 Native Peoples' Cultural Knowledge and Traditional Practices

The Tribes in the FCRPS CRP have a unique understanding about the past, their relationships with the Columbia River, and the physical entities called "cultural resources." Despite the fact that tribes' perspectives may diverge from Euroamerican views, there is no such thing as a single, unified perspective shared by all the Tribes. In addition, non-tribal people cannot fully understand or characterize the importance of cultural resources to a specific tribe because they are not members of that community. Some tribal members, especially traditional cultural authorities, often have highly developed skills in accurately conveying the meaning and significance of places valued by Tribes. As this document evolves, we hope that input from tribal programs will replace our provisional statements, which are in part based on information from members of tribal cultural resource programs and, in some cases, that tribal elders shared with the preparers.

Descendants of the indigenous peoples of the Columbia Plateau do not always partition the world in the same way as people of other cultural ancestry. Where "cultural resources" generally were viewed as "archaeological sites" and definable component classes to archaeologists of the 1970s, to indigenous peoples of the CRB, the term usually invokes a vision of *all* of the things a people need for survival and to function within their cultural grouping, which can include such things as language, fish, game, plants, sacred places, elders, and so on. As expressed in Indian leaders' statements at the Walla Walla Treaty Council in 1855, Indians have "a singular relationship with the prairies, mountains, valleys, rivers, lakes, trees, roots, berries, fish, and animals. The relationship had emerged at the beginning of creation, before mankind, when the plants, animals, and places made ready for the arrival of human beings. The Creator and all the creative powers had prepared the earth and its bounty so that humans could exist" (Karson 2006:77). In return, the "people" had a responsibility to the plants and animals, a general sense of interconnectedness with the world around them that the contemporary emphasis on "managing historic properties" fails to adequately convey. In fact, the term *property* indicates the extent to which American culture views all of these resources as ownable economic items rather than spiritual values (Karson 2006:78–79). These traditional values are discussed further in Chapter 3.

Tribal approaches to managing "cultural resources" vary considerably from group to group and cannot be generally characterized. With regard to archaeological sites, tribal management and the

Agencies share a general preference to leave sites alone, but especially so for those with ancestral remains. Many, but not all, tribal preservation programs support active preservation measures such as erosion control and Archaeological Resources Protection Act (ARPA) surveillance but do not believe that sites need to be disturbed (e.g., probed or otherwise tested) to determine if they are “important” before applying preservation measures. Many tribes have recognized the value of careful and culturally sensitive preservation of archaeological materials that have been removed from sites over the years by both professionals and amateurs and sponsor professional curation programs in which the Agencies take part. Most of the Tribes have taken active roles in preserving cultural knowledge in their elder communities and have succeeded in securing Agency funding for part of the effort. Tribal cultural preservation programs also are increasingly active in finding ways to help elder communities pass on key traditional cultural knowledge to new generations.

1.3.3 Confidentiality of Cultural Resource Data

In order to comply with the requirements of Section 106 of NHPA of 1966 (as amended), the Agencies of the FCRPS CRP contract with Indian tribes and private firms throughout the 14 Project Areas. Some of the results of these contracting efforts are of a sensitive and confidential nature, and their distribution and availability shall be limited. These limits can be applied within the requirements and responsibilities of the federal and state agencies related to cultural resource contract deliverable products. Such products could include archaeological site forms, photographs, maps, sketches, Global Positioning System (GPS) files, Geographic Information System (GIS) files, site databases, monitoring information, damage assessment reports, isolated find forms, annual reports, and TCP information.

Realizing the sensitive nature of the cultural resource data generated from compliance activities, the Agencies will ensure that access and the sharing of confidential data is restricted or will follow specific agreed upon provisions necessary to ensure confidentiality.

CHAPTER 2—THE NATIONAL REGISTER EVALUATION PROCESS

As noted above, this RD seeks to lay the foundation for evaluating the eligibility of archaeological sites and TCPs for the NRHP under Criteria A, B, and/or C, in addition to Criterion D. NHPA only concerns potentially eligible or listed NRHP properties. Generally, properties that are at least 50 years old may be eligible for listing if they are significant and have integrity. Under 36 CFR Part 60, "the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and that:

> (**a**) are associated with events that have made a significant contribution to the broad patters of our history; or
>
> (**b**) are associated with the lives of persons significant in our past; or
>
> (**c**) embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (**d**) that have yielded, or may be likely to yield, information important in history or prehistory."

The evaluation process that Section 106 outlines is intended to be flexible and allows for the federal agency and State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Officer (THPO) to define the type and format of information needed to determine eligibility (King 1993:60). These same entities can also decide which types of properties or groups of properties may be considered eligible or not eligible for the NRHP. This process is usually referred to as a consensus DOE, the difference being that the DOEs are not forwarded to the Keeper of the National Register for addition to the NRHP, but the resources are still considered and treated as Register-eligible. If the federal agency and SHPO or THPO disagree on eligibility, the agency is required to seek a formal DOE from the Keeper of the National Register. Due to limited agency resources and confidentiality concerns, formal DOEs and listings are rarely pursued, and consensus DOEs are preferred in the FCRPS Program. Currently, each of the four SHPOs in the FCRPS Program Area (Washington, Oregon, Idaho, and Montana) has state-specific documentation requirements for DOEs.

How the eligibility of a property is determined depends on the kind of property in question and its context. This is one of the contributions of this SWRD for resources in the FCRPS Project Areas. For a site, district, or object to be considered significant, it must not only meet one of the four eligibility criteria but also retain integrity of location, design, setting, materials, workmanship, association, and/or feeling. National Register Bulletin 15 (Andrus et al. 2000) clarifies that although integrity is important in determining eligibility, a property does not have to retain all elements of integrity to qualify for the NRHP; furthermore, the importance of integrity elements varies according to which significance criteria are applied.

Both the original wording of NHPA and the vocabulary of the original implementing regulations are strongly oriented toward the preservation of historic-period structures. This bias is apparent in the eligibility criteria, as well as in Bulletin 15 guidance for evaluating the integrity of historic properties (Andrus et al. 2000). Guidance was subsequently published in Bulletin 36 on how to apply significance criteria and integrity definitions to archaeological properties (Little et al. 2000).

In the case of archaeological properties being evaluated primarily for their research potential, historic contexts provide associations or connections to the extant archaeological record to which the site is likely to contribute important information. From a tribal perspective, it is not usually the information potential that makes precontact sites significant; rather, it is their association with past events, traditional teachings, or historical or legendary beings that makes these places important and worthy of protection (Anyon et al. 1997; Ferguson et al. 1993). In such cases, tribes are viewing the archaeological site as a TCP or HPRCSIT. Moreover, archaeological sites are only one of several kinds of TCPs within the Project Areas that the Tribes consider significant. Rock outcrops, mineral sources, trails, springs, and other landforms all hold varying degrees of cultural importance to different tribes. These and other landscape features that may not qualify for listing in the NRHP in and of themselves (i.e., as “properties”) hold cultural importance to the Tribes. These include the many native plants and animals living within the river corridor that were (and sometimes still are) used traditionally by Native American inhabitants of the region.

2.1 Property Categories

The following definitions for categories of historic properties are largely taken from National Register Bulletins “How to Apply the National Register Criteria for Evaluation” (Andrus et al. 2002) and “Guidelines for Evaluating and Documenting Traditional Cultural Properties” (Parker and King 1998) as well as National Park Service Preservation Brief 36, “Protecting Cultural Landscapes” (Birnbaum 1994). Each of the categories of properties below is currently represented in the system or is likely to be recorded in this geographic area.

Site – A site is the location of a significant event, a precontact or historic occupation or activity, or a building or structure (whether standing, ruined, or vanished) where the location itself possesses historic, cultural, or archaeological value regardless of the value of any existing structure.

District – A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects untied historically or aesthetically by plan or physical development.

Building – A building is a structure created principally, in the historic period, to shelter human activity.

Structure – A structure is created principally for purposes other than human shelter in the historic period, or to shelter human activity in the precontact period.

Object – An object is primarily artistic in nature or relatively small in scale and simply constructed. Although it may be movable by nature or design, an object is associated with a specific setting or environment.

Cultural Landscape –A cultural landscape is a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or exhibiting other cultural or aesthetic values. The four general types of cultural landscapes are not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.

Traditional Cultural Property – A TCP may include any combination of sites, districts, buildings, structures, objects, or cultural landscapes and may be eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history and (b) are important in maintaining the continuing cultural identity of the community.

Historic Properties of Religious and Cultural Significance to Indian Tribes – An HPRCSIT is a type of TCP to which an Indian tribe attaches spiritual or cultural value. Unlike TCPs, HPRCSITs only apply to resources significant to American Indians. This type of property, unlike the others listed above, is specifically called out in the text of NHPA.

Given the broad potential application for both TCPs and HPRCSITs as defined above, it is often difficult to assign boundaries to them, and such boundaries rarely enable realistic management of the resources. In addition, different CRB tribes use different terms and descriptions for property types. For example, the Confederated Salish and Kootenai Tribes (CSKT) state that "HPRCSIT are one kind of traditional cultural property," noting that while TCPs can apply to any ethnic group, HPRCSITs are limited to properties significant to Indians (CSKT 2014:1). The Confederated Tribes of the Warm Springs Reservation (Warm Springs) do not generally do TCP studies, preferring to utilize the term HPRCSIT found in NHPA. In contrast, the Confederated

Tribes of the Umatilla Indian Reservation (CTUIR) is willing to use the terms TCPs, HPRCSITs, and Cultural Landscapes with little differentiation. The CTUIR prefers to use HPRCSIT since it is the term used in NHPA. For the purposes of this RD, *traditional cultural property* and *historic property of religious and cultural significance to Indian tribes* are often used interchangeably where a distinction has not been made.

2.2 Historic Contexts and Integrity

The significance of a historic property can be judged and explained only when it is evaluated within its historic context. Historic contexts are historical patterns that can be identified through consideration of the history of a resource and its surrounding area. The resource being evaluated must also have characteristics (often referred to as character-defining features) that make it a good representative of properties associated with that aspect of the past. Historic contexts are those patterns or trends in history by which a specific occurrence, resource, or site is understood and its meaning (and ultimately its significance) within history or prehistory is made clear. Their core premise is that resources or happenings in history are not isolated but rather are part of larger trends or patterns.

Assessing and reaching consensus on the integrity of a resource can be challenging, especially when different criteria apply to a single resource and the integrity requirements are significantly different for each criterion. This situation is encountered with increasing frequency in the CRB, as traditional knowledge of places that are archaeological sites is considered. Probably the most common examples of this are deflated archaeological sites in the draw-down zone of a reservoir that lack stratigraphic integrity and where artifact collection over time has undermined the representativeness of the remaining assembly of objects, yet a local Indian group asserts that even though erosion and ill-treatment have affected its significance for the region's archaeological (scientific) record, the site is still significant for its testimony to the tribe's historical legacy and tenure in the area. For general guidance on assessing integrity, see Bulletin 15 "How to Apply the National Register Criteria for Evaluation" (Andrus et al. 2002).

CHAPTER 3—NATIVE PEOPLES DOMAIN

> *Author's note: This chapter is based on information in publications and discussions with some of the tribes that participate in the FCRPS Cultural Resource Program. Content may be updated if new information becomes available in the future.*

This research domain acknowledges the culture of the aboriginal people of the FCRPS Program area as unique to this RD since they have been present from precontact times to today. While this domain includes information commonly found in ethnography and ethnohistorical context statements, it seeks to bridge that information with the research interests of the living cultures of today. Tribal interests do not always follow with the Agencies' need to evaluate cultural resources and the predominantly archaeological focus of this RD. Tribes prefer a greater focus on nonarchaeological resources as well as in evaluating archaeological resources under NRHP criteria other than Criterion D. This chapter presents alternative methods of evaluating historic properties that are more closely identifiable with living Native American culture.

3.1 Native Peoples of the Columbia River Basin[2]

Ethnohistorical information has been produced in the CRB since early in the nineteenth century with the observations by the earliest explorations and missionaries and has continued through the work of professional ethnographers to today. The late nineteenth and early twentieth centuries saw somewhat systematic attempts to record important information describing the CRB's peoples' cultures mostly under the auspices of the Bureau of American Ethnology. The studies attempted to preserve as much information as possible about the lifeways of peoples undergoing massive and rapid change and were specifically aimed at preserving information about how those lifeways operated before Euroamerican influences arrived. The material in this section summarizes ethnohistorical information as only a *beginning* place for studies that seek a deeper understanding of how cultures work.

Early twentieth-century ethnographers documented the traditional lifeways and practices of the Northern and Southern Columbia Plateau indigenous populations that lived in or near the FCRPS Program area. These ethnographies (Chalfant 1974; Elmendorf 1935–1936; Jacobs 1934, 1937a, 1937b; Ray 1933, 1936; Smith 1936–1938; Spier 1938; Spier and Sapir 1930; Spinden 1908; Teit 1898, 1906, 1909; Turney-High 1941) can be said to be in alignment with the Boasian or Chicago School of American Anthropology (1900–1940, [cf. Stocking 1992:92–177]). Despite their often rich descriptions, they suffer from a number of limitations, which bear explanation.

[2] This summary of ethnographic information relies heavily on research and writing by Kevin Lyons for a 2013 draft of the SWRD.

- Ethnography reflects an incomplete glimpse of one point in a historical trajectory. No matter how well gathered, ethnography does not capture the full range of contingent and/or variations of behaviors a society may have employed. Moreover, ethnography does not capture antecedent behavioral data and is often limited to a very narrow place in time and thus may not capture “normal” cultural behaviors. One aspect of this narrowness is that all early ethnographers in the CRB were men whose sources were also men, which resulted in little input about women’s roles in Native society. In addition, anthropologists arrived in the CRB after the reservation era began and collected observations of Native culture that had already changed to reflect that narrowed geography.
- Care should be used in ascribing ethnohistorical analogs to the archaeological record as the introduction of horse culture and early development of the fur trade dramatically added subsistence capacities for those communities that were early adopters and dramatically affected the orientation and transmission of behaviors in interethnic relationships within the region.
- All of the observed Native societies were affected by the devastating declines in their populations resulting from recurrent epidemics prior to ethnographers’ fieldwork; the ethnographers were not observing “pristine” Native American culture. Early anthropologists often characterized their sources as the last cultural practitioners. While devastating declines in Native populations resulting from epidemics undoubtedly affected the observed culture, the repetitive effects of such epidemics tended to prey on both the elderly and young, which would have undoubtedly influenced the degree of knowledge of traditional lifeways that could have been passed down to surviving populations, and then shared with ethnographers to the degree the surviving practitioners felt such data should be shared. Such population reductions also led, in some areas, to displacement and/or replacement of tribal peoples with subsequent interviews with people who may not have been as familiar with a particular area for an extended period of time.
- All of the tribes’ subsistence economies were dramatically altered through the industrial extraction of forest products, alteration of fire return intervals, fish harvesting methods, and reduction in the quantities and distribution of terrestrial fauna resulting from open-range grazing of domesticated species that outcompeted native species for forage and brought in new disease and parasite vectors. In addition, agroeconomic development of the floodplains resulted in (a) flood prevention that fragmented many economically important native plant communities and (b) Euroamerican settlers to displace and/or bar Native populations from continuing their historical subsistence patterns.
- Ethnography is limited by researchers’ understanding of the languages of the people they studied. An ethnographer’s retelling in English of what they were told, however accurate

to their first hearing, is still subject to the weaknesses that translations have. In addition, anthropology teaches that all people are products of the culture(s) in which they were raised. Even the most broad-minded and well-trained ethnographers brought (and always will bring) the biases of their upbringing to their observations of Native Americans. These biases affected how they translated their observations and descriptions of the people they studied, and variation in the extent of these effects between contributors' accounts must be expected. Even when an ethnographer "gets it right," their descriptions only describe parts of the lifeway (see #1 above). Pat Baird (Nez Perce) summed up these various translation effects as "Some ethnographers are reliable but not perfect" (personal communication, February 25, 2015).

Ethnohistorical information is useful for research as long as the caveats noted above are taken into consideration. Most precontact lifeway patterns continued into more recent times, albeit with accommodations. For example, although Native population declines may have led to greater emphasis of certain resources over others, the associated technologies and scheduling of labor related to gathering behaviors are likely representative of antecedent patterns. For example, the introduction of horses and rifles expanded the terrestrial range of the preexisting annual round and altered the prey spectrum as well.

The CRB is a subset of the broader Plateau Culture Area (as defined in Walker 1998b), which includes transmontane parts of the Fraser River Basin to the north and the Klamath/Modoc River Basins to the south. However, the CRB also contains samples of other Culture Areas. The CRB's southern extent includes areas occupied by Numic peoples of the Great Basin Culture Area, the westernmost extent intrudes into the Northwest Coast Culture Area, and the easternmost extent occurs at the edge of the Northern Plains Culture Area. Within the FCRPS Project Areas, the Great Basin and its peoples are not represented.

At the time of physical contact with Euroamericans about 220 years ago, the CRB was home to at least 60 ethnically distinct peoples. Home territories of 25 of these groups are included within the FCRPS Project Areas. Peoples of these groups are now represented by 10 federally recognized tribes:

- Coeur d'Alene Tribe;
- Confederated Tribes of the Colville Reservation;
- The Confederated Salish and Kootenai Tribes of the Flathead Reservation;
- The Confederated Tribes of the Umatilla Indian Reservation;
- Confederated Tribes of the Warm Springs Reservation of Oregon;
- The Confederated Tribes and Bands of the Yakama Nation;

- The Kalispel Tribe of Indians;
- The Kootenai Tribe of Idaho;
- The Nez Perce Tribe; and
- The Spokane Tribe of Indians.

There are at least six language family groups/phyla within the CRB as a whole (Penutian, Salishan, Kutenaian, Kalapuyan, Na-Dené, and Uto-Aztecan); the Na-Dené and Uto-Aztecan are not represented within the FCRPS Project Areas.

A very generalized summary of tribal lifeways in the FCRPS Program area at the time of contact follows. Details available in ethnography and archaeological data about protohistory and Native American ethnohistory after contact with Euroamericans continue below.

Tribes each occupied a territory that included their living sites and places or areas used for fishing and gathering as well as hunting for foods, technological items, and medicines. Throughout the Northwest, tribes' territories generally consisted of watersheds or portions of them, depending on local geography. Watersheds include water bodies and uplands with a variety of specific habitats, such as freshwater streams and lakes, various types of wetlands, prairies, shrub steppe, woodlands, and alpine areas, that host the variety of resources needed for each group's subsistence, which could consist of some combination of fish, shellfish, plant products, birds, and large and small game. Geography and environmental variety, as well as their particular social history, means that each tribe's territory could be widely different in size and probably overlapped with their neighbors for certain uses through time. Although anthropologists have disagreed about tribes' concepts of territorial ownership, the recognition of tribal territories is important because they are the areas to which tribes adapted through their knowledge and use of local resources. As anthropologist Eugene Hunn (1991:170) wrote, "Native American peoples survived for millennia in the Pacific Northwest not solely because of their ingenious fishing and food processing technology, but by virtue of their detailed knowledge of the land and its resources."

People moved around their territory to make the best use of seasonally abundant resources in a pattern often referred to as a seasonal round. During the winter season, people lived in aggregations (villages) of substantial structures that housed one to several extended families. Winter villages were often located at productive fishing locations. Together, they hunted and gathered some fresh foods available in winter, depending on resource availability and weather conditions. This time of year was also a time of community social and ceremonial gatherings, storytelling, and intergenerational transmission of knowledge, as well as for making and repairing the many personal and technological items used throughout the year. From spring through fall, smaller family groups traveled away from the winter village to camp in temporary structures where plentiful plant, fish, and game resources occurred. They also gathered materials for the construction of technological items (e.g., stone, wood) and traded for others during these seasonal travels. All Plateau tribes sent task groups back to the large rivers to fish for anadromous fish like salmon and steelhead as they swam upstream to spawn throughout the spring, summer, and fall. Similarly, large efforts were made to gather root plants at various times during the spring to fall period and to prepare them as overwintering stores.

3.1.1 Settlement

For hunting and gathering societies, settlement and subsistence are tightly interwoven. The pattern of ethnohistoric residency for the communities of the Columbia Plateau broadly comports with that described by Ray (1933) in his description of the Sanpoil-Nespelem's winter village settlement pattern (WVSP), which is a specific case of logistical arrangement of labor and resource extraction (cf. Binford 1980, 2001). That pattern is seasonally differentiated with kin-based resident groups aggregating in the winter months along rivers or lakes in close proximity to prolific resource patches (e.g., a fishery or deer yard). Winter residency occurred in villages of multiple contemporaneously occupied households or single communal lodges. At winter's end, household (often extended families) task groups moved up from the shorelines to gather early roots and other plants at gradually higher elevations as resource patches became productive and additional resources became available through the spring. Many family groups would return to the large rivers in the region in June to harvest anadromous or resident fisheries for immediate consumption and to prepare as stores for the next winter. This pattern results in spatially and seasonally differentiated site types and material assemblages where the periodic abundance of a resource patch is processed away from the winter village but then transported there for delayed consumption.

3.1.2 Subsistence

Subsistence choices are tightly joined with residency. The emphasis of this section is the regional disparities that exist in the accessible biomass that the tribes recognized as food, their seasonality of availability/reliability, and how these spatial realities can manifest in the archaeological record.

For much of the region, the various predictable and abundant runs of salmon and steelhead constituted the bulk of protein and lipid contribution to diet. But since this particular resource declines in both nutritional value and availability as distance from the ocean increases, variation in its dietary importance did exist. Not coincidentally, the relative importance of ungulates in subsistence economies increased with the declining availability of salmon. Fishing was seasonally predictable, albeit with annual variation in terms of net return on effort (Hayden and Mathewes 2009; see also Hay et al. 2007; Patterson et al. 2005 on precontact variability of habitat), and it was usually a low-risk provisioning strategy. Hunting, however, can be a high-risk provisioning strategy wherein a hunter may invest considerable search time with an unpredictable return for the effort. The Kalispel are an example of a non-salmon-centric tribe that substantially augmented individual and communal hunting efforts with both focused and opportunistic resident fishing harvests coupled with fishing for salmon in the homelands of the Spokane and Colville Tribes (Lyons 2015; Smith 1936–1938).

Fishing occurred throughout the Columbia River region, but larger groups of people from different regions gathered annually at specific areas of abundance (e.g., Celilo Falls, Kettle Falls) to harvest and trade. The timing of the runs of anadromous fish were carefully tracked so teams of people could be deployed to harvest and process large numbers of fish at the migratory choke points representing high-efficiency resource use. Certain locations were important because large fish were difficult to take midstream or from shoreline locations with limited access (e.g., canyons). The productivity of some fisheries and root patches (e.g., Tobacco Plains) was so high that it provided for residents' needs and those of visiting communities. Such coexploitation by multiple groups at these rich resource sites provided an opportunity for intergroup exchange. Such exchanges were not limited to the transfer of material objects but included interband marriage, development and continuation of commercial relationships, forging alliances among distant communities, and diffusion of skills and knowledge among communities.

In addition to fishing and hunting, many Tribes relied on geophytes found in various environments. Bulbs, roots, and corms such as camas, lomatia, bitterroot, and wapato not only provided the principal source of carbohydrates, dietary fiber, and the bulk of calories in traditional diets, but were the most reliable resource that could be attained in large quantities. Augmenting these "big three" food resources were various flowering fruits (e.g., huckleberry) and nuts that people consumed both in season and as overwinter provisions.

3.1.3 Habitation and Material Culture

Data on the habitations and material culture of different ethnic groups are of varying quality, and most studies carried out before the 1960s generated nominal descriptive data. Within these data collections, however, are descriptions of technologies and work practices associated with resource extraction, processing, storage, and consumption that have value for interpreting the archaeological record.

Regionally, domestic structures fall into two categories: conical mat lodges and oblong mat lodges. Conical mat lodges were portable, while the oblong lodges were larger and stationary. The oblong lodges varied in the depth and diameter of the floors, with some structures being semisubterranean and others occurring on the ground surface. Entry to these dwellings was either through a ground-level entrance or the roof. Those with a roof entrance used a four-post load-bearing structure to hold a superstructure of poles over which the roof/wall was placed, comprising composite materials including wood, earth, tule, and occasionally bark. Far more common were semisubterranean conical lodges, which had a tripod like structural support system sheeted with tule mats, hides, and/or bark (and later blankets). The physical properties of tule are particularly useful in lodge construction—its spongy cellular structure is very light, making it highly portable and providing reasonable insulation value. As a wetland plant, tule expands when wet, thus closing off drafts, and contracts when dry, allowing for ventilation during summer months.

Centrally placed within the conical structures was a hearth excavated into the floor used for both heating the structure and cooking meals. Radial to the hearth and in relative position of the entrance of the structure were sleeping areas, in-lodge storage food caches, and a food preparation (kitchen) area. A Kalispel example of the conical lodge had the food cache on either or both sides of the entrance, with the kitchen area between the hearth and entrance and the sleeping areas on the far side opposite the door (Smith 1936–1938).

Native people typically built lodges on either the terrace crown or below its toe, probably based on the potential of flooding from the river or lake waters. During winter months, both the terrace crown and “beach” zone of the winter encampment appear to have been equally used, whereas in periods of peak flows, only the terrace crown was accessible. During warmer months, outside activity areas could include bone-greasing/marrow-extraction hearths (Herbel et al. 2010), root-processing ovens (Herbel et al. 2010; Willis 2012), and aboveground and semisubterranean food caches.

Whereas the conical mat lodge was typically occupied by a natal group with closely related kin, the oblong mat lodge was a larger structure that housed multiple families and winter ceremonial gatherings. Smith recounts that the mat lodge was not an uncommon structure for the winter months and that the “chief . . . always occupied a long lodge” (2000:7.35). In outline, it was oblong to rectangular with round ends; a central ridge pole supported by multiple center vertical poles supported the superstructure. Wall frame poles leaned against the ridge pole and were crosstied at midslope for added structural strength. These structures were typically sheeted with tule mats and/or other locally available materials. In the case of tule mats, each residential family would provide mats used earlier in the season and would reclaim them after the period of co-occupancy had ended.

Under the center pole in the mat lodge’s floor, multiple hearths served the heating and cooking needs of families, typically two per hearth. Sleeping arrangements were oriented with the long dimension of the structure. Extant data are not explicit about placement of in-house food caches, but inhabitants may have used overhead or “rafter” storage, which would not persist archaeologically. Door placement appears to include both gable-end and lateral-entry forms.

Elmendorf's data from the Lakes Tribe shows that multiple doors were the norm and were gender specific (1935–1936).

Residential encampments included both sweat and menstrual lodges. Modern observations of sweat lodges reveal a willow-framed hemispheric structure standing approximately 1.4 meters tall sheeted with blankets with variable floor diameters and a 40-centimeter-diameter pit located immediately adjacent to the door of the lodge (Lyons 1999–2011). Smith recounts that sweat lodges were always erected if a group were encamped any longer than 14 days and ranged in size between 4 and 8 feet in diameter, with the larger lodges accommodating as many as 14 people (Smith 1936–1938:536). Ross recounts that among the Spokan, men and women never co-used sweat lodges. The cardinal direction of the door indicated which house belonged to which gender (Ross 2011). A hearth for heating stones sat just outside the sweat lodge and replacement stones (river-rounded stones were used until the rind began to spall or crack) and fuel wood was cached close by. Sweat lodges were traditionally built near a river or stream to have access to water for sprinkling on hot stones placed in the pit within the lodge (Smith 1936–1938:537) and for bathing.

Data pertaining to menstrual lodges are generally scarce, perhaps a result of the gender of most ethnographers in the early twentieth century. Smith provides the following description from the Kalispel: "For menstrual lodge, they build a little bit of a tipi, just big enough for the girl to lie in all day. It is covered with brush or grass, not with mats. Each woman built one for herself each time and burned it when she was thru. It was built close to the house but hidden from the camp by a bush or something. They gather grass in it to sleep on" (Smith 1936–1938:517).

Winter encampments also had associated special-purpose use sites such as cemeteries, food caches, and specialty work areas. Winter food caches had to be secure against predators (e.g., bears, coyotes). Within both Pend Oreille and Priest Lakes the Kalispel used midstream islands to reduce cache losses to bears. Native people used deeply excavated storage caches capped with logs, earth, and stone; they also dug storage pits in rock-shelters and on talus slopes throughout the CRB.

Intermixed within the residential structures and adjoining space were work areas for manufacturing and maintaining the technologies for family needs and wants. The vast majority of these technologies do not persist in the archaeological record. Archaeological investigations of sites that date from the late precontact period and into early historic times have documented changes in the material assemblages of residential sites. Changes had begun before Meriwether Lewis and William Clark's visit in 1805, but increased substantially as traders moved into the region. The Hudson's Bay Company (HBC) alone brought many changes to Plateau material culture. Their traders introduced metal knives "replacing those of stone, bone, and shell. The gun replaced the bow and arrow, dagger, and club. Tailored clothes and blankets replaced garments . . . of bark, wool, and skin . . . . New forms of fishhooks and nets replaced the old, as did new paints and dyes, fire-making equipment, traps, and jewelry. Even houses changed from large multifamily dwellings to smaller ones typical of Euro-Americans" (Walker and Sprague 1998:144). Native Americans often adapted items of trade for more traditional uses, making buttons into jewelry, for example.

3.1.4 Ceremonialism

The Plateau groups ethnohistorically included band-level societies along the eastern margin of the CRB (Brunton 1998; Malouf 1998; Teit 1930) and ranked societies based on wealth and lineages in the central Basin (French and French 1998), but there do not appear to have been large-scale corporate groups on the order of established chiefdoms (Prentiss and Kuijt 2004). Even for societies with permissive situational leadership that was acknowledged and adhered to by consensus, social controls were necessary for group survival. One of the principal means through which CRB tribes maintained organizational control and promoted collective well-being was through observance of a regular ceremonial cycle that emphasized resource harvest windows or provided specific individual redress to the community in times of social friction.

The following is a reduction of the rich and complex cosmological, spiritual, and heuristic patterns that evolved within each of the CRB societies and must be considered a minimalist description. In precontact times, Native Americans lived spiritually, and traditional practitioners continue this today, with many aspects of life conducted in a religious manner. Their oral history tells of constant interaction with spirits in objects, animals, the natural world, and in each other. Readers are encouraged to seek out the many books and articles examining the Tribes' connections to the world through their religion.

Broadly distributed throughout the CRB were First Foods ceremonies that celebrated specific resources that traditionally could not be harvested without supernatural and social consequences (e.g., bad health, failed harvest) until the required offerings and prayers by the local religious authority were complete. Individuals that violated this custom by prematurely engaging in what should otherwise be a group activity or that put the group's well-being at risk typically risked social sanction through isolation or marginalization.

The attainment of a spirit song was an individual rite of passage from childhood to adulthood, and children reaching a specific age were taken to a particular location to fast and meditate until their intrinsic talents attracted a specific spirit who then would guide and help the youth for the balance of their life. Not infrequently, personal objects an individual carried with them daily were imbued with the powers of a tutelary spirit and at death, the dead person's kin were responsible for dispersing these items. Some items were returned to the landscape from whence the spirit was associated, other items were buried with the person that had carried that song, and yet other items were gifted to peers that carried the same song. The stick game, still played today, is highly imbued with the concept of tutelary spirit. As a game involving wagering, the participation of the tutelary spirit through singing their power song while competing allows the most successful teams to take pride without being prideful and dissuades the notion that repeated wins are anything but the outcomes of unequally matched spirit-guided teams. Social-leveling mechanisms within hunter-gathering communities were stringent where expressing personal pride of one's ability could garner the enmity of peers. To deflect such envy, a successful person would attribute that proficiency to their tutelary spirit and would frequently and publicly invoke their spirit's involvement in a task through singing their power song and adhering to both behavioral and dietary restrictions incumbent to carrying that particular song (Lyons 1999-2011).

With the exception of rock art images, the archaeological signatures of ceremonialism are largely ephemeral, as much of this cultural legacy does not involve durable items or cannot be separated archaeologically from tool kits attributable to settlement and subsistence activities. The CRB rock art tradition includes diverse images: "stick figure humans, simple block-body animal forms, rayed arcs and circles, tally marks, abstract spirit beings or mythical figures, and geometric forms" (Keyser 1992:16), often in combinations. Particular petroglyphs found along the lower Columbia River late in the precontact period were almost certainly made for shamanistic purposes related to death cults in the wake of epidemics of diseases. Images of rayed arcs displayed in certain ways are interpreted to represent powers associated with shamans, including insuring hunting success, predicting the future, warding off evil, curing illness, and likely much of western Columbia Plateau rock art was made for such purposes (Keyser 1992:124).

The long lodge occupied by a community's leadership was typically the structure wherein the winter ceremony was practiced, and this can direct researchers to specific questions about the remnants of the ceremonial life that occurred there. The social isolation or marginalization of malcontents may manifest archaeologically in isolated households or hamlets in near proximity to a larger encampment. And the effects of even–odd wager games like stick game should level the accumulation of prestige items within communities that not only sought but also demanded parity among peers.

3.1.5 Intergroup Relations

The most definitive research to date examining the interconnection of the CRB's people was Anastasio's (1972, 1985) description of the ethnohistoric period, which revealed a robust series of relationships and a network of commercial connections through the region. As with all ethnohistoric studies, the extent and orientation of that network is highly colored by both the economic capacity of horse pastoralism and the effects of the fur trade on domestic production. Horses reduced terrestrial transport cost, while participation in the fur trade changed subsistence from direct to indirect consumption. Despite this, Anastasio provided a succinct definition of dyadic and polyadic relationships among the various ethnic groups of the CRB, as well as the probable network through which foreign materials and the spread of behaviors were transmitted along the lines of intergroup marriage, village proximity, co-residency patterns, co-utilization of resources, and mutual defense alliances.

The Lower Columbia River peoples had the highest number of redundant connections coincidental with their proximity of villages and propensity to co-utilize the same resource space (Anastasio 1985:Figure 13). Owing to their geographic location, the communities of the Wasco, Wishram, Wayam, Umatilla, Yakima, Walla Walla, and Nez Perce formed a gateway for foreign commodities originating from south and west of the CRB.

> Trade centers such as The Dalles and Kettle Falls saw large intertribal gatherings during the proto-historic period with roots in the prehistoric period. Even though all Plateau groups relied on similar substantive resources, there were sufficient regional variations to make trade within the Plateau both desirable and necessary. Traditional trading partnerships were reinforced by systematic intermarriage, travel by horse, regular trade fairs, and regional economic specialization. This traditional system of trade formed the basis for the later fur trade, which enriched an already established system (Stern 1993). [Walker and Sprague 1998:139–140]

In addition, the Lewis and Clark party found considerable evidence of trade into the Plateau from the Pacific coast. “The Chinookans demonstrated to Lewis and Clark their long familiarity with English and American traders by repeating many words of English” (Walker and Sprague 1998:141). The Chinookan groups became middlemen, trading with Euroamericans at the mouth of the Columbia River for items that were traded to upstream tribes, especially at The Dalles. Elsewhere in the Plateau-wide exchange network, the plurality of connections was not as robust, and the communities that were on the periphery of the gateway core (e.g., the Nez Perce) formed essential bridges to the Upper Columbia River peoples. Communities of the upper basin had more proximate access to resources originating from the east and the north.

Conceptually, intergroup relationships within a river basin should be linear, with the participation and investment in the system declining at its extremities, exhibited in the archaeological record in the form of a distance decay curve. But the socio-organizational role ceremonies provided, which took place at primary food hubs, improved the network’s fidelity by drawing the tribes in close and seasonally predictable proximity. The degree and extent of intergroup marriage for all of these communities set practical limitations on intergroup hostilities. Immediate neighbors rarely engaged in open hostilities. When violence did occur, it was often due to a social breach by an individual that compelled kinsmen and friends to take sides, resulting in raids and reprisal raids. Far more common were social breaches that resulted in a band fission event and subsequent establishment of a separate community (Lyons 2013).

Anastasio's (1972) description of the Plateau exchange network also reflected "the tribalization that occurred in the eastern Plateau due to the incorporation of the horse to the traditional social structure. While the horse culture spread rapidly throughout the Southern Plateau during the proto-historic period, its influence was less significant in the Northern Plateau" (Walker and Sprague 1998:139).

3.2 NRHP Evaluation under Multiple Perspectives

NHPA encourages an inclusive approach that validates numerous perspectives about the importance of places to an array of culture, and perception is a significant part of the NHPA evaluation process. History, after all, is in part a reflection of what a people think about their past and how they perceive their role in that past; however, that perception may not be the complete, unbiased reality of what actually took place in the past. Many Americans consider archaeological sites to be the abandoned locations of past human activities with the potential to contain important scientific information, whereas many Native Americans perceive of these places as tangible pieces of the past that have survived into the present and which embody and validate the traditional stories and sacred obligations of their ancestors' tenure on the land, in part because their ancestors remain there spiritually. Anthropologists value the scientific and historic value of historic sites, their importance for humanity and for studying other, often past cultures. For Tribes, they are a tangible record of their occupation of the landscape. In many cases, Native people view archaeological sites as places that are still inhabited and in which spiritual forces reside. Furthermore, these places are a physical testament to peoples' past relation with the land, as well as the events that occurred there. While these perspectives are different, they are not in disagreement, since both attribute historical value to these places, but the practices used in implementing regulatory compliance can be made to better incorporate Native American perspectives.

Native Americans' perceptions about the value of uses of historical knowledge being different from the Western viewpoint are widely documented. For most traditional Native Americans, history is revealed through oral traditions and ceremonies that have been handed down through generations. Important cultural teachings are embedded in these stories and ceremonies. Within each tribe, there is a broad range of opinion about whether and to what extent the scientific study of cultural resources is an appropriate or worthwhile endeavor. Some individuals feel that archaeological research is inappropriate and unnecessary. Others believe that archaeology can offer worthwhile information about where and how their ancestors lived.

Of paramount interest to all tribes, however, is for Western scholars to recognize that the artifacts and other physical remains left by their ancestors can be interpreted from a number of different perspectives. Above all, each tribe desires to have its own interpretation of the past acknowledged and respected, in addition to (and on equal footing with) that derived from a Western scientific perspective. Involving Native American as partners in the discourse about the interpretation of archaeological sites adds new dimensions to archaeological approaches and theories, thereby providing a fuller and potentially more accurate picture of the past.

In terms of NRHP criteria of significance, some Native Americans find that Criterion A (events important in history), Criterion B (individuals important in history), and Criterion C (embodies characteristics of types or artistic value or represents a collective not distinguished by its parts) are underused as significance criteria relative to the use of Criterion D in determining site significance. It is apparent that some resources can be historic properties under multiple criteria, and the procedure spelled out in the regulations state that all four of the criteria are to be applied when evaluating a property (see 36 CFR 800.4(c)(1)). Some examples follow. Symbolism as represented in imagery on basketry fragments that by themselves are too fragmentary to give a site eligibility (perhaps due to failing the integrity test) may contribute to understanding the iconography of an area and could be eligible under Criterion C. The same could be true of pictographs and petroglyphs that are incomplete or damaged due to weathering or vandalism; individually, they may not be NRHP eligible under other criteria but be eligible under Criteria A or C as they contribute to a larger collection of symbols. If the artist is known and provides an important connection to a living community, they also could be eligible under Criterion B. A single artifact (i.e., isolated find) is not eligible for inclusion in the NRHP under Criterion D, but if that isolated artifact bears an etching of a symbol or scene, it could be eligible under Criteria A or C.

One value of evaluating a resource under multiple criteria is that doing so may allow conservation of more of a resource (e.g., site) by avoiding archaeological testing, which is inherently destructive. The CRB Tribes prefer that impacts to their ancestral places, and the landscape as a whole, be avoided as much as possible. In the event that impacts cannot be avoided, however, they want to ensure that their views about their histories and the importance of these places and the landscape are acknowledged and integrated within the framework of studies that occur under the SWRD. To paraphrase Guy Moura (the Confederated Tribes of the Colville Reservation's [CCT] THPO), "Some locations/places can be significant on their own, but most are significant for how they are related to each other. Those individual places can seem insignificant, but all taken together at the landscape level are significant" (personal communication, January 26, 2015). The CSKT have noted a similar view, that archaeological sites have a "capacity to relate information important to history or prehistory in relation to landscape level analysis, TCP potential, and/or as districts." It is "necessary to note each site's significance in relation to the broader landscape and other archaeological sites when recommending eligibility" (CSKT 2015:2).

3.3 TCP and HPRCSIT Evaluation

Partly in response to the kinds of points made above, the National Park Service (NPS) expanded the term *cultural resources* to include landscapes, landmarks, and sacred sites, which may or may not have been modified by human agency but to which human beings nevertheless ascribe special meaning or significance. The inclusion of cultural landscapes and landmarks—also termed TCPs when they are tied to the perpetuation of specific traditional practices—is an important step toward incorporating Native American perspectives about cultural resources.

For consideration of potential TCPs or HPRCSITs, NPS Bulletin 38 (Parker and King 1990, 1998) provides guidelines for determining NRHP eligibility. Bulletin 38 describes a process similar to Section 106 evaluation of archaeological resources eligibility but with statements and examples intended to demonstrate how different the approach to TCPs should be. This includes emphasizing the need for inclusion of the cultural groups that identify with the resource, such as in the implementing regulations at 36 CFR 800.4(c)(1): "The agency official shall acknowledge that Indian tribes . . . possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance to them."

While archaeological resources can be evaluated under more than just Criterion D, as discussed above, tribes have also sought to broaden and reenergize the evaluation of nonarchaeological resources through the FCRPS Program.

The Agencies are obligated to follow a regulatory process and have to address tangible properties by law, but flexibility in the process is allowed. This SWRD proposes applying flexibility in how to recognize a "property" and gather the necessary information for evaluation. This involves examining Native Americans' connection to aspects of cultural continuity, including traditional practices, which are property-based. These can be any of the kinds of TCPs discussed in Bulletin 38 (e.g., places for obtaining spirit power or otherwise connecting with spirits, places to be avoided, travel ways, resource locations, living spaces, and cultural landscapes that may encompass all of these kinds of places and that may be interrelated) where cultural linkages can be demonstrated as a method of maintaining modern Tribal culture. This evaluation process looks at a Native American traditional lifeway, identifies how that lifeway's values and concepts have been affected by their history, and then looks for connections to those values in the form of places within the FCRPS Project Areas. In this process, the discovery of a connection to a property is akin to the inventory phase of NHPA compliance, and the assessment of the value of that connection to the community is the evaluation phase.

The connections to culture are decidedly personal awarenesses (traditional knowledge) that cannot be "found" or observed outside of the cultural group. Ethnography can suggest where connections may be found, but only the living culture can determine if the connections still exist. If the connection is a traditional practice that formerly occurred along the rivers in the Project Areas, only the living members of the community can know if it is a significant practice that has been maintained through the Tribes' separation from living along the rivers.

Although the Tribes have different backgrounds and varying points of view within the realm of CRM, Plateau Indians do share some worldviews and basic concepts about the past. Shared Native views reflect perceptions about the nature of the universe and the role of humankind within it. Traditionally, most Native American people view themselves as having a reciprocal relationship with the world in which they live. Plateau tribes' resource management philosophy reflects the traditional Native lifeway, which can be viewed through the concept of *Tamánwit* (in Sahaptin) and *Tamálwit* (Nez Perce) (Karson 2006:77). *Tamánwit* is reflected in Sahaptin oral tradition like this, with variation across the southern CRB that is common with ancient stories.

> The Creator spoke to "Coyote," who forewarned the other animals of what was to come: human beings who would be like infants and who would need to be taught how to live here. An animal council was held to determine how to proceed. Salmon volunteered to be the first to offer his body and his knowledge to. . . "the people." Many other species followed suit from the abundant animal and verdant plant kingdom, including the roots and berries. These decisions from the animal council demonstrate tamánwit . . . [and are] the foundation of a physical and spiritual way of life that would sustain Plateau peoples for thousands of years. This covenant between the Creator . . . the plants and animals who offered themselves to the people, and the people who promised to take care of all that was given them is the basis of native respect for all creation. [Karson 2006:23]

This philosophy can also be found in Plateau tribes' stories of mythological times, such as the San Poil Tribe's "Sweat Lodge" (CCT 2006:23). Sweat Lodge was a chief who created all the animals and birds and put them in the world. He told them that when humans are created, they are to instruct the human children how to live well when they grow up, how to do things easily in the world. At that time, Sweat Lodge would make himself available to humans who sought him when they were sick or dying or otherwise needed help. He would be in this world for the help of human beings.

When placed in a common Sahaptin phrase, the *Tamánwit* concept reads "at the time of creation the Creator placed us in this land and He gave us the voice of this land and that is our law" (Warm Springs 1992).

> Tamánwit is what we refer to as "our Indian law." This native view of traditional law is more than what we think of as "law" today. [Karson 2006:3]

> Tamánwit is essentially the "rules to live by" that come out of the Indian religion and that are espoused in song and ritual. [Karson 2006:77]
>
> If we teach our children by example about tamánwit "the Creator's laws" and our Indian foods, language, and lifestyle, then we will make a clear path for them to follow. They see and learn. It will be a path that leads them to a good life. It will also lead them to . . . "the spirit land." [Karson 2006:245]

As paraphrased from statements by Nakia Williamson and Pat Baird of the Nez Perce Tribe,

> Indians today want to live as their ancestors did; they want to preserve their heritage by drawing on the lessons taught in the past. However, the world has changed and requires accommodations; Indians are figuring out how to deal with those accommodations every day and adjust to them as they can. But the ancestors' lifeway as described by legend remains the necessary Indian way and is a pathway that is found in the land and water. This pathway is described in pieces in legends, stories, and histories.
>
> For example, the route that Coyote follows and the things he does in the course of a story provide a map that operates at different scales—the seasonal round (or portions of it) for the people to follow, and length-of-life direction as well. The stories impart resource gathering areas and activities that are to be done, at what times and in what order, and also serve as reminders to pass on this information and train the next generation in these lessons in the course of following the pathway (both seasonally and lifelong). A single trail is more than a way to get from point A to point B (e.g., winter village to spring root grounds); it is a sequence of places with associated lessons to be remembered and taught. This roots an oral culture to the landscape to preserve the lessons that must be passed on to preserve heritage and well-being, as well as intra- and intertribal relations.
>
> While the focus on cultural items/artifacts and "sites" and their management is the Agencies' needed approach, items and sites are limited in representing the lifeway. This is similar to how today's world is limited in providing Indians access to the pathway. [personal communications, 2014–2015]

These statements reveal a different meaning of "significance" in relation to NRHP eligibility: the need for Native Americans to maintain cultural continuity in the pursuit of the traditional lifeway. Connecting to the landscape, both physically and through the retelling of the oral history that describes Plateau peoples living in that landscape, is necessary for maintaining their culture and their pursuit of the lifeway.

The presence of archaeological sites may be helpful at the stage where physical representations of identified connections are looked for in the Project Areas. It is not necessary to have an archaeological site represent a specific location for a cultural connection, but archaeological data from a similar place in the Project Area may be melded with traditional knowledge (or vice versa) to support interpretations of cultural connection.

Section 5.1 notes differences between processual and postprocessual theoretical approaches to archaeology. Postprocessualist studies approach archaeological properties within a humanities tradition, and its methods derive in part from anthropological and literary theories, such as discourse analysis, symbolism, and structuralism. A postprocessualist tradition has not strongly emerged within CRM and compliance-driven archaeology, but if it did, it would benefit from the availability of ethnohistorical information, especially oral histories. Modern processual archaeologists responding to postprocessual critiques expanded topics of study to include questions of agency and the role of individuals, ideas, and identity politics in the past (Earle 1991; Earle and Preucel 1987; Hodder 2001). Conversely, fieldwork conducted by postprocessualists has employed all the same data-collection standards and precise taxonomies as that which processualists have undertaken. The question of agency at the level of individuals or identity groups forms the basis of much theorizing (Hegmon 2003).

A postprocessual approach can contribute to the identification and management of TCPs. As a way of understanding, identifying, and preserving cultural traditions tied directly to the physical environment, an emic approach is clearly useful. Christopher Tilley addressed exactly these kinds of cultural linkages to the landscape in his study of neolithic England (Tilley 1994, 2008). His way of viewing landscapes and human use of them emphasizes the role of repeated action in the creation of habits and ultimately, the meanings attached to a particular setting. As Tilley explained, "Space does not and cannot exist apart from the events and activities within which it is implicated. Space is socially produced, and different societies, groups and individuals act out their lives in different spaces" (Tilley 1994:10). To this end, the landscape can be "read" or interpreted within an emic framework. Space, he argued, is experienced individually; "Spatial experience is not innocent and neutral, but invested with power relating to age, gender, social position and relationships with others" (Tilley 1994:11).

The anthropologist's role is to "understand and recover" the landscape of seemingly neutral places into meaningful spaces that are "contexts for human experience, constructed in movement, memory, encounter and association. . . . Personal and cultural identity is bound up with place; a topoanalysis is one exploring the creation of self-identity through place" (Tilley 1994:15).

Tilley defined two types of space that seem to be of utility to the identification and management of TCPs: existential space, which is group space (i.e., territories); and cognitive space, which are the mental maps that people use in daily practice (1994:16–17). Research may reveal connections with particular places within a landscape that can be material, social, ceremonial, aesthetic, or economic, each interwoven in the peoples' living of a lifeway. The function of a place may involve all five of those factors and, thus, the evidence needed to describe the function of that place in a lifeway must reach beyond archaeology's inspection of the material assemblage.

An important place may be marked by a natural landform and have no archaeological materials marking it. For example, "the natural configuration of rocky ridges, sheltered hollows, isolated knobs and mesa tops provides a setting which possesses more cultural importance to the native peoples . . . than do the identifiable vestiges of the rock cairns and hunting sites" (Chatters and Cadoret 1989:2). The natural landform may be a stop along a seasonally used trail where elders annually recount a legend; the social and perhaps ceremonial function is clear, and the use of the trail to connect between economic resource areas is assumed, but none of these functions leave a physical mark. The physical trail's connection to culture is how it is used in tandem with other cultural activities while it is being used as a travel corridor. The natural landform and the story of its use may be eligible as a TCP, and a trail can be included in a cultural landscape as one of the actions that occurred within that landscape.

Postprocessualism can lead to identifying such physical remnants of the lifeway, but not necessarily in the places where researchers have been looking. Tilley wrote that "there is no space that is not relational. Space is created by social relations, natural and cultural objects" (Tilley 1994:17). One study from the CRB connects a number of these things, documenting complex, repeated actions that created a cultural landscape called the Mosier Mounds, and the importance of physical remains that demonstrate activities not discussed in written ethnographies (Connolly et al. 1997).

Ceremonialism is a form of social relations and an essential element of Plateau tribes' cultural continuity, and therefore part of "significance." Tribes continue to hold ceremonies associated with aspects of the traditional landscape. The importance of these ceremonies to the maintenance of their culture can be seen in that First Foods ceremonies are still held on many reservations around the CRB, even though the locations of the resources being celebrated have been destroyed (e.g., root grounds plowed under contemporary farms). Today, First Salmon ceremonies typically occur on reservations, few of which are at the fishing locations where the ceremonies traditionally occurred.

CRB Tribes have noted the need for agencies to acknowledge ongoing connections to landscapes as described by the CSKT in a letter to the Federal Aviation Administration and the Montana SHPO.

> The legacy of connection between the prehistoric utilization of the landscape throughout the [study area], intertwined with the unique development of modern tribal land-base as defined through historical era treaty and allotment policy and practice, further the cultural

> and knowledge value of any features on the landscape noted as culturally significant by the [Tribe]. [CSKT n.d.:6–7]
>
> Modern society needs to recognize that the traditional community's associated with landscapes have not lost connections with these areas. Rather, they have undergone an evolution that has been integrated by the people in a manner that will coalesce with their current needs, maintained traditional values, and the landscapes current ability to offer resources and places for these people to continue their relationships, internally and externally (Berkes, 2008). [CSKT n.d.:5]

Many tribes have echoed these points: "successive waves of anthropologists and linguists have attempted to distinguish their research by claiming that they have worked with 'the last generation to possess knowledge of the cultural history associated with these lands,' and 'the old people we have worked with represent the last generation . . . to experience such a close relationship to the lands' (Bouchard and Kennedy 1984:6)" (George 2011:7). Similar claims were made about the "degraded culture" being studied by ethnographers in the first decade of the 1900s, in the 1930s, and in the 1980s.

> According to the cumulative body of ethnographic literature, the culture of the CCT has ceased to exist in its authentic state in roughly thirty-year cycles since 1900. These repeated assertions assume a cultural inertia and a lack of multiple avenues of cultural transmission, including ignoring the impact of oral tradition. While subsistence and material cultural are integral to any culture, they by no means define it. These claims ignore intangible aspects of culture, such as; kinship, distribution of resources, parent-child relations, spiritual beliefs, etc., that allow cultures to adapt and persist. Indigenous groups do not have to stay isolated in order to maintain their culture. [George 2011:8]

"(T)he cultural perpetuation of the tribal people necessarily requires that any assessment of archaeological and historical sites, as defined by the NHPA, engages with this living element of the people. These archaeological sites represent a continuity of cultural beliefs and practices necessary for the tribal people to maintain their lifeways. Protecting land-based cultural resources is essential if the Tribes are to sustain Tribal cultures (CSKT, 1995)" (CSKT n.d.: 6). For this purpose, restoration of camas prairies and access to camas bulbs and other First Foods are priorities of many Native American communities in the Plateau; a number of other traditional subsistence and medicinal plants grow in association with camas as well. Such resources represent a continuation of the Tribes' connections to their traditions. In fact, the title of this domain as Native Peoples instead of Ethnography acknowledges that Plateau culture continues and is worthy of study beyond the ethnographic present, limited only by NHPA's restriction that historic properties need to be more than 50 years of age (unless they are of exceptional importance) and an enduring aspect of the community's culture.

A single TCP or HPRCSIT may have contributed to the Native peoples' lifeway in numerous possible ways. Few "sites" can describe the life lesson the pursuit of the pathway provides. Physical changes to the land brought about by building things (e.g., cairns) or excavating things (e.g., holes in rocks for fishing platforms poles) are documented as archaeological properties. Tribal peoples' "places," and why those places were selected, are described at the landscape level and may involve the interaction of other behaviors that may not be archaeologically detectable. For the purposes of property evaluations in the FCRPS Project Areas, river valleys necessarily represent appropriate landscape corridors for determining how "properties" represent the lifeway, either in whole or in pieces, since they are an important part of the lifeway, annual rounds, and individual catchment areas. This kind of significance may also be easier to demonstrate at the landscape level because the Project Areas have seen so much change since the days when the Tribes occupied them (e.g., reservoirs and other industrial development, agriculture and grazing, modern modes of transportation).

Instead of trying to narrow that understanding down to fit a form or regulatory definition, a broader approach to inventory and evaluation of such properties allows complexity to be revealed whether or not a resource ultimately can be defined as a "historic property" in NHPA terms. This approach utilizes research themes for organizing specific research questions (see Section 3.4), consistent with the other research domains of this SWRD, but looks for a larger context in which to understand properties as locations within a landscape of environment, topography, and varied, perhaps related, uses. In practice, a method of implementing this approach could examine Native American attempts to preserve culture through the perpetuation of traditional practices and then trace those efforts and the property types they address back into the Project Areas to identify whether they occur there and their importance to the Tribes.

Washington's State Archaeologist Robert Whitlam has suggested something analogous and cited an example from the Mississippi River. First, one acknowledges that changes have occurred to a location and its setting; in the Mississippi River example, the river's substantial channel movements in recent history were plotted geomorphically to assess the location and status of likely archaeological properties under the current reservoirs. Second, using that information, assess the effects to the factors of eligibility that might apply to a place or site, then ask specific questions to fill in potential gaps in information about that place (e.g., What was it like before the reservoir? Are there similar or analogous non-inundated landforms nearby?). Thus, a curve in the river that was a good fishing spot before inundation is still a curve in the river, and that space may be related to other places of interest whether or not they too are inundated. The importance of the general location (spaces) to a traditional practice may persist even if the specific location is no longer accessible because it is under the reservoir or the reason the practice occurred there is no longer present.

Examples of property-based cultural continuity include landforms that modern people use today for similar activities as those they pursued prior to displacement or disruption by historic occurrences. Living and fishing at Celilo Falls and the contemporary village there is one example; holding celebrations, making recreational visits, and fishing at Chief Timothy Park on the Lower Snake River is another. Fishing around the mouth of the Okanogan River and Foster Creek on the Columbia River below Chief Joseph Dam, and the camping that accompanies that activity has long roots in the past; annual gatherings at Kettle Falls, despite the loss of the fishery there, is another example. Although the archaeological sites at each of these places may be disturbed or eroded and therefore not qualify for the NRHP under Criterion D, peoples' contemporary connections to those places may better support an argument for eligibility under Criterion A and/or Criterion B.

The CCT engaged in a somewhat similar process related to place names research: "The Tribes efforts to identify both specific places of concern as well as general concerns regarding cumulative effects of projects [in the reservoir Project Area] on traditions and practices over time has revealed many specific cultural resources potentially affected by projects initiated on tribal lands [above the reservoir]" (CCT 2006:48).

The following Tribal statements offer insight for where researchers could begin to look for effects on Tribes attempts to maintain cultural continuity that may have historic property correlates in the FCRPS Project Areas:

> [T]he sites dispersed throughout the . . . River drainage are eligible for listing on the National Register of Historic Places. . . . The lifeway and cultural practices of the Salish, Kootenai and Pend d'Oreille were, and continue to be, dynamic and interrelated. Understanding the function and significance of any tribal site requires that the researcher view the location through a lens that incorporates layered meaning acquired through cyclical practices of incorporation. That is, site locations and the affiliated features can, and regularly do, represent multiple realities.
>
> The CSKT will argue that our lifeways continue and so do our associations with archaeological sites on the landscape. [CSKT n.d.:3]
>
> Legends are still used as a way to teach tribal morals and values and as a way to advise youth on preparation for life (coping with specific situations, "the birds and the bees" and so on). They also teach an understanding and respect for the relationship between man and nature. The telling of these stories provides a form of training in self-discipline for youth (they learn how to listen and pay attention) as well as a form of family recreation and entertainment.

These stories relate to tribal ancestors and historical and prehistorical events as well as to natural features of the land. [Warm Springs 1994:IV–3]

Cultural resource sites are a physical connection to the tribes' spiritual past. Tribal members go to archaeological sites to understand and connect both to the past *and* to their ongoing lifeways. To maintain the tribes' cultural integrity, access to sites . . . is crucial. [CTUIR 2003:5]

Analysis . . . is best undertaken through an ethnoarchaeology perspective that includes elements of landscape theory, and the Traditional Ecological Knowledge [TEK] of the [Native] people. Landscape theory and TEK fit well within the ethnoarchaeology framework described above due to the nature that hunters-gatherers primarily conceptualize rather than construct their landscapes, that is, they imbue features on the land with meaning rather than physically alter the land itself (Clark and Scheiber, 2008:8). It needs to be understood that the connections between indigenous peoples and their landscapes is more than mere exploitation, people regularly return to certain places for many reasons–some of them practical, some of them social, some of them ritual (Scheiber 2008:8). [CSKT n.d.:4–5]

Incorporating our traditional cultural knowledge of how cultural resources were managed in the past by our ancestors into our archaeological methods has given the archaeological community an insight into the fact that tribes have always managed archaeological sites, sacred sites, and traditional use areas. [CTUIR 2003:1]

Current strategies aimed at identifying individual sites fail to convey the true "value" of these areas in both an archaeological manner and to the traditional communities connected to them. It is through the relationship that these sites share that this landscape came into being, versus remaining merely an ecosystem that has sites scattered among it. Seeing sites, isolates, and/or features within their interdependent relationship that is their ethnographic landscape is what gives each of the individual sites their unique context beyond their temporal limitations to include their spatial and cultural associations. [CSKT n.d.:5]

[A] landscape approach directed at assessing each site's individual significance and their significance in relation to other resources is sufficient for a determination of eligibility. Land use patterns, resource extraction, camp organization, trail utilization, cultural events and historical era federal policy could all be analyzed in relation to the sites, their affiliations and spatial organization. Integration of tribal knowledge pertaining to the development, maintenance and utilization of sites in the . . . drainage could also inform future survey and management on the landscape. [CSKT n.d.:8]

An example of a TCP project conducted under an approach similar to the one we outline above was conducted by the Warm Springs Tribe. The Warm Springs Tribe conducts oral history studies in support of projects that require federal or state regulatory compliance using the broader definition of HPRCSITs (rather than TCPs) and focusing on identifying resources of traditional religious or cultural importance to the Tribe. An example of the methodology of such studies (Whipple and Smith 2011) includes:

- A literature search within the records of the Cultural Resources Department;
- Identification of families (within the Warm Springs Tribe and other Tribes) that have a known history in the vicinity of the project area;
- Interviews with as many identified elders as are willing to participate; and while interviews focus on the specific area of a given project, elders are encouraged to discuss anything they wish to share, whether out of area or off-topic;
- Sharing of place names, which can identify "locations utilized during precontact and historical times as well as through modern use. These areas may be identified as subsistence gathering, fishing sites, hunting sites, fishing villages—both temporary and permanent, ceremonial and travel ways" (Whipple and Smith 2011:4).

The Warm Springs' methodology emphasizes the fact that even information gathered in support of a project that perhaps does not pertain exactly to the specific project area may still illuminate understandings of, for example, "a travel route or a camping or food gathering area" (Whipple and Smith 2011:3) that may have been directly interrelated with activities that occurred within a Project Area.

CTUIR's Cultural Resources Protection Program (CRPP), CCT's History/Archaeology Program, and Kalispel Tribe's Cultural Resources Management program use similar approaches in conducting TCP studies to satisfy regulatory compliance projects, both on and off reservations. All of these programs limit nontribal information sharing and provide only those details that most closely address the client's specific permitting needs, while securing essential cultural information for tribal archives.

One methodology used by the CTUIR, as exemplified in a study performed for a small creek dredging project (CRPP 2010), in this case begins with a literature review focusing on broad archaeological, ethnographic, and historical sources, but then narrows to address spiritual and resource use areas in the project vicinity, with a particular focus on First Foods (CRPP 2010:2–11). Like the Warm Springs' methodology, the CRPP also uses previously recorded oral history information gathered by the Tribe to describe potential tribal cultural uses within a project area's boundaries and will conduct ethnobotanical surveys when appropriate for a specific project. For the small creek dredging project, the CRPP used a 6-mile buffer (the catchment area) around the specific project area, the CRPP describes the various functions of recorded archaeological sites and traditional cultural use areas, and looks for associations that may have left physical remnants of "core activities" in the project area in this one example (CRPP 2010:14–15). The CRPP also prefer the term HPRCSIT to TCP, but further emphasizes the importance of "place" as a concept that encompasses both of those terms as well as ethnographic and cultural landscapes and that can be studied with appropriate methodology and resources available.

3.3.1 The TCP Subcommittee Approach to Evaluation

FCRPS TCP projects have been conducted under an approach guided principally by Bulletin 38 for a number of years. The first two annual reports for the FCRPS CRP demonstrate a strong program focus on TCP studies in contrast with the archaeological investigations that dominated efforts in the 1950s–1980s, as a number of TCPs were identified from previous community history records and the collection of new oral histories.

The FCRPS TCP Subcommittee, made up of participants from the Lead Agencies, Tribes, other federal agencies, and SHPOs, has recommended a long-term approach to TCP management that emphasizes building relationships so that information can be exchanged in a trusting environment that both focuses on the information Tribes can offer and prioritizes sensitive and endangered properties. The subcommittee has developed an inventory form for TCPs that can be used throughout the FCRPS Program area to ensure consistency in how information gathered is presented. While historic property inventories do not typically involve assessments of the kind that contribute to determinations of NRHP eligibility, the subcommittee's inventory form includes a section titled "Site Significance." This section of the form addresses four categories of potential significance (but notes "that for some sites, not all categories will be completed") and the kinds of information they can represent:

- Ethnographic – "Describe evidence that demonstrates the site's significance with respect to practices and beliefs of a living community, as documented through appropriate ethnographic research. Provide in detail and attach appropriate narrative if necessary."
- Oral History – "Describe community affiliation, oral stories, and source of oral history. How is the place important in maintaining the continuing cultural identity of the community?"
- Archaeology – "Describe all archaeological investigations that have taken place here and list site reports."
- Historical Documentation/Literature Review – "Describe and list historical and literature documentation of site significance (e.g., Reports, Oral Transcripts, Historic Maps)."

In addition, the form includes an “NRHP Status” section for the user to identify under which criteria the TCP is recommended eligible (if any) and provide a narrative justification of their selection. The combination of all of these information types overlaps with the same information types in most states’ DOE forms (e.g., the NPS 10-900 form used in Washington State).

The TCP Subcommittee has also recommended that TCP evaluation priorities be:

- developing historic contexts that will facilitate DOEs for nonarchaeological sites;
- using multiple property determinations (MPDs) of eligibility to streamline the evaluation process, which can also address the difficulty Tribes have in prioritizing certain resources or sites (e.g., food gathering areas, legendary sites) over others for evaluation and treatment, since all are equally important; and
- referencing living cultures and their practices that maintain cultural identity (e.g., the State of Hawaii’s Criterion E).

This approach allows for a property’s potential eligibility under all four NRHP criteria.

The CCT has been conducting TCP projects in the Grand Coulee Dam Project area since the late 1990s. Their approach conceived of a multiphase investigation that emulates the general outline of archaeological site evaluations. Tribal staff gathered background information to aid in defining TCPs and identifying knowledgeable elders before inventory tasks were initiated. The accumulation of place-name data was an important part of the inventory phase of study. Place names relay traditional knowledge of land and resources (Hanes and Hansis 1995:3). The CCT’s study comports with postprocessual theoretical approaches as they can be a valuable first step in an emic study of landscape, because place names (aka *toponyms*) fix meanings to places. Tilley (1994:18) explained that “through the act of naming and through the development of human and mythological associations such places become invested with meaning and significance,” emphasizing that the cultural study of landscape is the study of relations (Tilley 1994:34).

The CSKT have recently developed a scope of work for inventory of HPRCSITs in the Libby Dam Project Project Area that meets the language of the regulations, follows NPS and Advisory Council on Historic Preservation (ACHP) guidance, and addresses the SWPA’s goal for HPRCSIT inventory (Stipulation V) (CSKT 2014). The project proposed to use the TCP Subcommittee’s inventory form, as described above, so completion of the CSKT’s scope of work for this inventory project should also accomplish the information gathering needed to evaluate the HPRCSITs identified in the Libby Dam Project area consistent with the Bulletin 38 approach.

It is expected that the CSKT’s report of the Libby Dam HPRCSIT inventory project will reflect their recent thoughts on NRHP eligibility criteria for all historic property types, as presented in a letter report to the Federal Aviation Administration and the Montana SHPO (CSKT n.d.). While principally concerned with the potential for archaeological sites to be eligible under both Criterion A and Criterion D, the arguments presented by the CSKT apply to nonarchaeological properties as well.

> Viewing a site or feature across space requires that they be viewed in relation to their immediate site area and within a larger landscape. The National Park Service (NPS) has found that an ethnographic landscape is one that contains “a variety of natural and cultural resources that associated people define as heritage resources” (Preservation Brief 36). Similarly, assessing a site and/or feature diachronically necessitates that historical significance and modern connections be evaluated and understood. The connections between historical and modern can be addressed to evaluate significance that will suffice the “broad patterns of history” [Criterion A] justification required by the National Register for a site to be listed.
>
> To understand the . . . River watershed and its correlating historic and prehistoric archaeological sites, you need to view them as linked, evolutionary and cyclical. [CSKT n.d.:3–4]

Another example of a TCP project conducted under a Bulletin 38 approach is the Palus Village evaluation, which resulted in preparation of a report that represents a Consensus Determination (USACE 2015). Palus Village was identified as part of a cultural landscape with the surrounding Palouse Canyon and found eligible under all four NRHP criteria. Four Tribes have a cultural connection to the land, and all submitted significance statements, which the USACE held in confidence but provided abbreviated versions in the DOE that were adequate to support its eligibility conclusions. This is an example where identified archaeological sites provide support for the findings related to the nonarchaeological TCPs, and vice versa, in reaching a decision of NRHP eligibility. In this case the archaeological sites represent contributing resources that demonstrate the length, continuity, and activities of the use of the river canyon. This may be the case for many TCPs in the FCRPS Project Areas and other research domains may provide avenues for collecting applicable archaeological information that may serve as a complement for the purposes of evaluating HPRCSITs.

3.4 Research Themes and Questions

Unlike the other research domains in this RD, the Native Peoples research themes and research questions focus on the information potential in ethnographies, ethnohistorical accounts, and oral history. Ethnohistorical information, such as that discussed earlier in this chapter and in the 1998 Smithsonian *Handbook of North American Indians* for the Plateau (Walker 1998b), provides the context information for this research domain. But these should be read with caution, as descriptions of the lifeways of the Plateau Tribes differ for various reasons. In particular, explorers, missionaries, and eventually, ethnographers encountered different tribes often at different times in the Native peoples' own adjustments to the effects of contact with Euroamerican and other immigrant cultures. Some of these effects arrived before Euroamericans themselves: diseases, horses, and material items relayed by neighboring tribes from both the coast and interior of the continent. Each of these things had the potential to alter the indigenous culture. Few people would have been shielded from the effects, even if they resided in relatively isolated territory (e.g., not on a main-stem river used by the earliest Euroamericans), since intertribal exchange systems were robust (Jones 2003) and adoption of the horse would have enhanced these interactions (Walker 1998b). Whether infectious disease arrived as late as the 1770s (Boyd 1999) or prior to 1600 (Campbell 1985, 1989), all Native cultures would have experienced the effects of disease by the time Euroamericans documented the Plateau people in writing.

As introduced above, NRHP evaluation under the Native Peoples domain is based on demonstrating how the connection of the Tribe(s) to a resource (acknowledging the continuity of CRB Tribal cultures and Native Americans' efforts to maintain their culture through traditional practices) demonstrates the importance (significance) of the property. Several research themes are suggested here to focus examination of potential properties that relate tribal connections to cultural practices for evaluating eligibility.

1. Lifeways at Euroamerican Contact
2. Beginning of Euroamerican Colonization
    - Population and Resettlement
    - Ceremonialism and Spirituality
3. Effects of Immigrants' Changes to the Region's Environments

Like all of the SWRD's research themes, the Native Peoples themes provide direction to research questions that relate the domain to data types that allow evaluation of potential historic properties. For this domain, research themes address parts of Native American culture history available in Tribes' oral histories beginning just as Euroamerican influence began. The research questions seek to stimulate consideration of important traditional practices associated with the Project Areas that perpetuate Tribal culture and may represent a connection to the lands in the Project Areas.

3.4.1 Lifeways at Euroamerican Contact

Information on lifeways just before contact is available in archaeological sites that date to the protohistoric period because some effects of contact—for example, diseases, the introduction of the horse, and some trade goods—appeared before Native people had direct contact with Euroamericans. Ecological changes that affected lifeways are somewhat treated in Section 7.1, but from the precontact view, not during historical times as these research questions note. A variety of sources (including archaeology, oral history, historic records, and other written accounts of early encounters) document changes to Native peoples' use of their usual and accustomed territory.

1. *What part of the Native peoples' lifeways, as described in ethnographies and ethnohistorical documents, occurred in the FCRPS Project Area(s)? Which aspects of those lifeways left physical remnants and which are retained only in memory?*
2. *How does the late precontact archaeological record comport with the Native peoples' lifeways as described in ethnographies and ethnohistorical information?*
3. *When did Euroamerican diseases arrive and how did they vary across the region?*
4. *How did Native American society adapt to disease and death? Did catchment areas and the seasonal round change (prehorse)? Did leadership methods change? Did exchange networks dissipate?*
5. *How did Native peoples use horses in the seasonal round, and how did this differ from the patterns that were in place before the horse arrived? How did this change catchment-area size and resource choices?*
6. *Did the horse contribute to abandonment of pit houses as a residential structure and/or end the large village communities?*
7. *How did introduction of the horse change social interaction throughout the region?*

Native Americans experienced a great deal of change from the earliest effects of Euroamericans' arrival in the Americas. These changes (e.g., Euroamerican goods as wealth items, depopulation) are discussed in some ethnographies and subsequent studies but have not been translated to the "property" level for Section 106 evaluation purposes. Oral history study can help define factors of change in Native American culture that may be reflected in the FCRPS Project Areas. Archaeological components dating to before, during, and after contact with Euroamericans can reveal the changes in material items. An example is residential structures that had already adapted to greater mobility in late prehistory. Mat-covered lodges became common but left less of a physical signature than did pithouses. However, they were still in use across the Plateau when the first Euroamericans and the immigrants that followed arrived. At the same time, Native Americans were also adapting in style to teepees such as were in use in the Plains and which were similar in construction to conical mat lodges.

3.4.2 Beginning of Euroamerican Colonization

Colonization did not begin with the first contacts between the Euroamerican explorers and traders but can be said to have taken root when the trading posts were established, as this correlated with the aboriginal people altering their economies to take into account the opportunities for regular trade for foreign-produced items.

3.4.2.1 Population and Settlement

8 *How did the introduction of Euroamerican goods and people alter Native peoples' adaptive strategies?*

9. *How did the presence of Euroamerican trading posts alter the preexisting settlement pattern?*

10. *How did other work for Euroamericans affect settlement and subsistence patterns? For example, initially as guides to explorers and the military and later as paid laborers?*

11. *Did Native Americans move from traditional village locations to places better able to participate in the new exchange system? Did they move as a collective community, dissipate into smaller groups, or consolidate from various groups?*

12. *Is there evidence of historical Indian deposits on top of precontact deposits, and what resources or other factors account for the persistent use of some sites?*

13. *How did the diminishment of the reservations affect Native peoples' connections to places?*

14. *What routes and methods of travel did tribal groups use to access areas now within Project Areas?*

3.4.2.2 Ceremonialism and Spirituality

15. *Did ceremonies change in response to Euroamerican influences? For example, were First Foods ceremonies conducted less often as Euroamerican foods became widely available?*

16. *Did spiritual leadership and beliefs change in response to Euroamerican influences? How did this affect political leadership? How did this affect spiritual training and preparation of youth?*

17. *How were Euroamerican religious beliefs incorporated into Plateau culture?*

18. *How have Native peoples protected culturally important places and resources?*

Archaeology can trace the meeting and melding of different cultural groups like the Plateau tribes and Euroamericans by the items they exchanged, and how they adapted them into their own lives. Archaeological inquiry can also describe in broad terms how the relationships among the peoples altered each ones' lives by noting the changes in the places they stayed when they were influenced by one another. An example is the choice of Natives to stay in villages near where trading posts were established longer into the spring than before and to pursue economic resources of interest to the traders, rather than traditional subsistence resources. This pattern extended to Native peoples working as wage laborers for traders and then farmers, before and after resettling on the reservations. At each step along the way, they learned new skills and gathered new tools, the former being implied by the latter, which are physical items available for archaeological study.

But the social changes such alterations brought, and the impacts on some of the incentives Native people had for following traditional ways, cannot be teased out of objects and sites. Written records can describe changes observed but reflect the view of the early Euroamericans and other immigrants, not Native people. Ethnographers made more nuanced observations about the cultural changes, but these observations came from later accounts written well after many changes had occurred. The timing of ethnographic studies did allow them to speak directly with many who experienced the transition to reservation living and to hear about the variations in how people tried to maintain previous aspects of their lives.

3.4.3 Effects on Native Peoples of Immigrants' Changes to the Region's Environments

The presence of Euroamericans and other immigrants affected the environments of the CRB. As noted in Chapter 5, these changes were both deliberate (e.g., logging, mining, livestock grazing) and inadvertent. Overhunting affected microenvironments (e.g., removing beaver from wetlands), which had macroenvironmental effects that altered the ecology of the Plateau. Access to former resource areas, including those within the FCRPS Project Areas, were often restricted, limiting the physical imprint that could be left to mark the continuation of old practices. Euroamericans converted some traditional resource areas for different uses, blocking Natives' continued use. In some cases, Natives took allotments at the locations of traditional resources, including cemeteries. But many of the best plant-gathering areas were plowed for agricultural use, and good fishing and hunting areas were overused, depleting once-abundant resources. Euroamericans did not continue many of the resource-management practices Native Americans had used and therefore, once-prolific resource areas ceased to produce. Tribes and bands already decimated by disease lost more members through violence and warfare. In addition to oral history, data needed to address this theme also is available in historical records, paleoecological data such as that described in Section 6.1, and historical archaeological data.

19. *What changes did immigrants make to the environment that changed Native peoples' uses in the Project Areas? What is the chronology of the changes?*
20. *Did immigrants' activities in the Project Area lead to the disuse or loss of Native peoples' legendary places and/or other culturally important places, minerals, plants, and animals? If so, did Native peoples change their use of the Project Area because resource availability changed, or did the immigrants' activities restrict what Native peoples could do there?*
21. *How did the changes affect Native peoples' own modifications of plants, animals, and other aspects of the environment? Are there comparable sources of information (e.g., ethnography, ethnohistorical, archaeological) of landscape modification for Native peoples' resource-management purposes from before and after contact?*
22. *Did Native peoples adopt or modify immigrants' resource practices (e.g., farming, grazing)? If so, did they do this in their usual and accustomed areas in the Project Area, or were they displaced by others?*
23. *What is the correlation between ethnohistorical and modern Native American traditional stories and features of the natural environment?*

3.5 Data Needs

Study of these research questions may find that Tribes have adapted important cultural concepts and practices to current centers of Tribal living (e.g., reservations or other more accessible resource locations than the Project Areas), this adaptation has served the Tribes' culture adequately, and a connection of those practices to within the Project Areas is not necessary to maintain their importance. In fact, all communities review their past on an ongoing basis; some cultural elements are considered historical occurrences that are intriguing enough to be remembered or that become points in time to measure the length of the community's history, but which are not significant to their continuing culture. However, where research into those questions finds that an important cultural practice persists in the community, NRHP evaluation should assess how Native People enacted the cultural practice or tradition in the Project Areas, and whether it is tied to a specific place or nonspecific spaces there. The following applied inquiries may help in this process.

- *Does the traditional practice have a name that carries meaning and demonstrates the peoples' connection to it?*
- *Is there a legendary context that overlaps with ongoing tribal connection to the place or practice?*

- *How do tribal members remember the uses of this place or practice? Are there markers or icons/symbols that help the community communicate about the place or practice?*
- *Did this traditional practice occur at a specific, identifiable location within a Project Area? What evidence is there for the Tribe's use of this location/place in the past? Do place names and traditional stories describe landmarks, tribal activities, or activity areas in the Project Area?*
- *If not at a specific location, at what kinds of places did the traditional practice occur? Is a specific landform type and/or plant resource necessary to the practice?*
- *Who was known to use it and what did they do there?*
- *Who uses it now? If the use(s) have changed, is there an identifiable reason for the change? For example, are there now or have there been barriers to use by tribal members?*
- *What is the connection of this place or the traditional practice to other places recognized by the group? If the connections between places are physical, can they still be seen (even if not used)?*

CHAPTER 4—ENVIRONMENTAL VARIABILITY DOMAIN

Understanding the environmental setting at the time that people used the FCRPS Project Areas can aid in understanding their choices in site and resource selection. Studying environmental factors also helps for interpreting how the environment conditioned site use, and how it affected site preservation. The results help establish cultural chronologies and to identify where sites (including buried sites) may occur.

4.1 Physiography and Geology of the FCRPS Project Areas

The following discussion of the physiography and geology of the Columbia Basin draws from Lasmanis (1991), Orr and Orr (1996), and Washington State Department of Natural Resources (WSDNR) (2015) and uses data from A. D. Reed et al. (2005). The physiographic provinces defined for this document are based on the Level 3 Ecoregions of the continental United States, as delineated by the U.S. Environmental Protection Agency (EPA) (EPA 2013). The EPA defines ecoregions based on patterns and composition of biotic and abotic phenomena, including geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology (Omernik 1987, 1995). Physiographic regions pertinent to the FCRPS Program area include the Canadian Rockies, Northern Rockies, Columbia Plateau, Cascades, and Eastern Cascades (Figure 4–1; Table 4–1).

Two major river systems are found in the FCRPS study area: the Columbia River and its largest tributary, the Snake River. The Columbia River drainage area measures approximately 258,000 square miles (Kammerer 1990) and discharges an average of 190,000 cubic feet of water per second at The Dalles, Oregon (Washington Department of Ecology 2015). The river has a relatively uniform slope along much of its length, with the steepest portion of the river between Chief Joseph and Priest Rapids Dams (approximately 0.45 meters per kilometer) (Dauble 2001). Downstream of Priest Rapids, the slope levels to an average of approximately 0.25 meters per kilometer. Prior to dam construction, rapids and waterfalls were more common along the Columbia, in particular along the mid-Columbia between Wenatchee and Pasco, Washington, and in the Columbia River Gorge between John Day and Bonneville, Oregon. Dams also affected flow regime: flow velocity was higher, and flows were much higher in the spring and lower in the winter before dam construction (Washington Department of Ecology 2015).

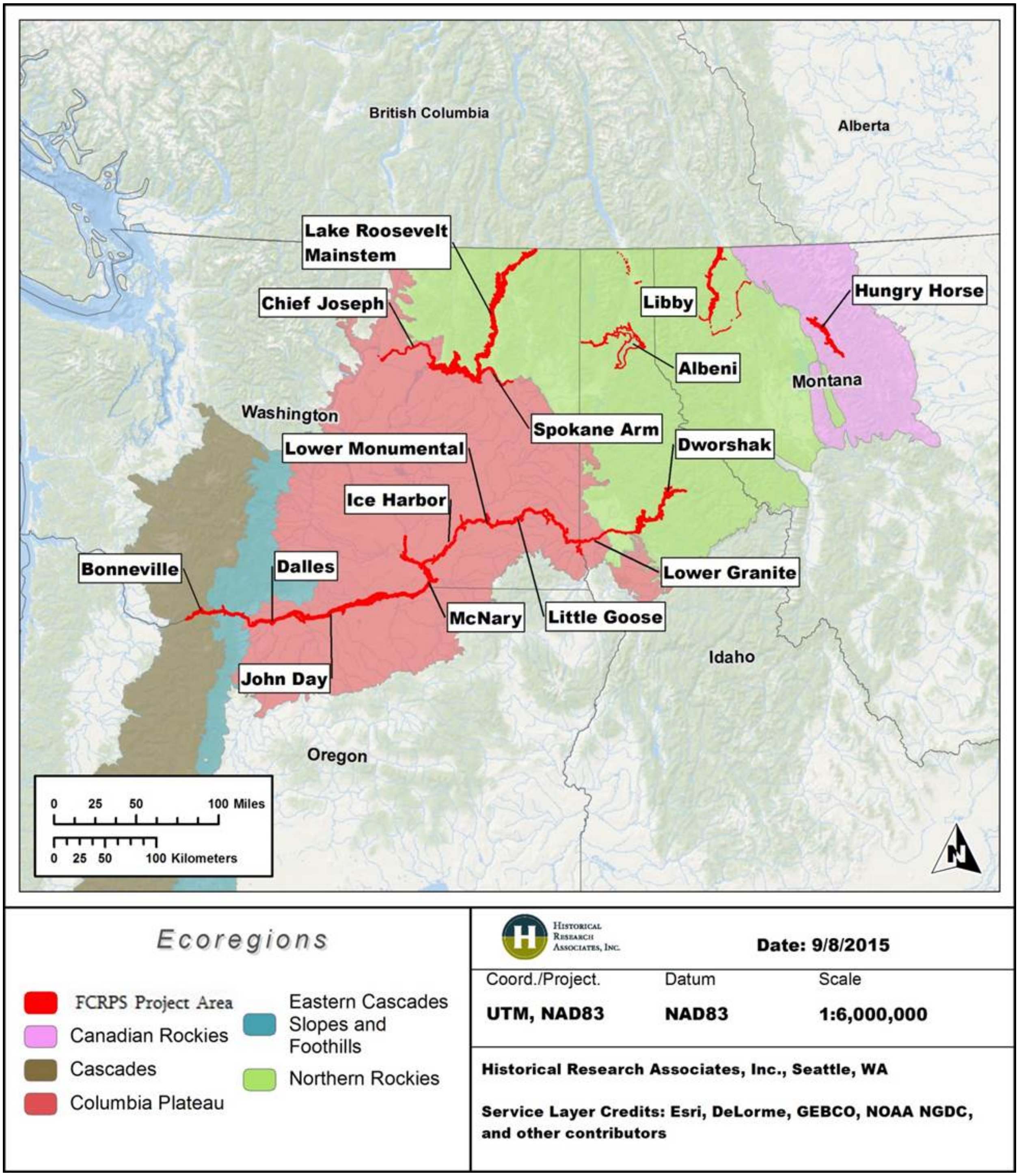


Figure 4-1. Level 3 Ecoregions of the FCRPS Project Areas (EPA 2013).

Table 4-1. Project Location Relative to Ecoregion/Physiographic Province and River.

	Columbia River Stems and Tributaries						
Ecoregion/ Physiographic Province	Kootenai River	Flathead River	Pend Oreille River	Clearwater River	Snake River	Upper and Middle Columbia River	Lower Columbia River
Canadian Rockies		Hungry Horse					
Northern Rockies	Libby		Albeni	Dworshak	Lower Granite	Grand Coulee	
Columbia Plateau					Little Goose, Ice Harbor, Lower Granite, Lower Monumental	Chief Joseph, Grand Coulee	McNary, John Day, Bonneville, The Dalles
Eastern Cascades							Bonneville
Cascades							Bonneville

Much of the Columbia River, from its headwaters in British Columbia to near Bonneville, Oregon, is found within steep-sided mountain valleys or deeply incised basalt bedrock uplands. The Columbia is joined by the Kootenai River, one of the uppermost major tributaries of the Columbia River in British Columbia. The Libby Project Area is located upstream of this confluence on the Kootenai River where it flows north in Montana. The Columbia River crosses the United States–Canadian border just south of the river's confluence with the Pend Oreille River, along which the Albeni Falls Project Area is located, in the Northern Rockies physiographic province. This area is deeply dissected by downcut rivers, although the river valley floors are generally somewhat rounded due to the advancement and retreat of glacial lobes (Easterbrook and Rahm 1970). The Flathead and Clark Fork Rivers join the Pend Oreille River to the east. The Hungry Horse Project Area is positioned on the South Fork Flathead River in the Canadian Rockies physiographic province in Montana.

The Columbia River flows generally south from the United States–Canadian border, then turns abruptly to the west at its confluence with the Spokane River in northeast Washington. Here the Columbia River flows through a deep canyon along the northern edge of the thick basalt lava flows of the Columbia Plateau physiographic region. Along this stretch, the Columbia is joined by the Sanpoil and Okanogan Rivers. The Chief Joseph and Grand Coulee Project Areas are found along this portion of the Columbia River drainage. Construction of the Grand Coulee Dam and creation of Lake Roosevelt completely inundated one of the most important fishing sites on the Columbia River, Kettle Falls (Chance 1986; Pouley 2010).

After the Chief Joseph Dam, the Columbia turns south, skirting the eastern edge of the North Cascades on its way to its confluence with the Snake River near Pasco and Kennewick, Washington. Along the way, it is joined by the Methow, Wenatchee, and Yakima Rivers. Just north of its confluence with the Yakima River, the Columbia takes an abrupt eastern turn. In this area, the river valley opens up onto a relatively level, upland plateau that stretches to the east and southeast. This vast plain of glacial outwash is shallowly dissected by small, tributary streams and overlain by aeolian materials. The Columbia turns south from here, entering the Pasco Basin where the Yakima and Snake Rivers join the Columbia and large alluvial terraces flank the channel margins.

With a drainage area of almost 108,000 square miles and an average discharge of over 56,000 cubic feet per second at its mouth (Kammerer 1990), the Snake is the largest tributary of the Columbia River. The Snake River is one of the largest rivers in the United States, originating in western Wyoming and flowing over 1,000 miles before joining the Columbia River near Kennewick, Washington. The river flows down from its headwaters in Yellowstone National Park, across the great Snake River Plain of southern Idaho, through Hells Canyon along the border of Oregon and Idaho, and onto the Columbia Plateau. Major tributaries of the Snake River in the FCRPS study area include the Clearwater, Tucannon, and Palouse Rivers. The Dworshak Project Area is located on the North Fork Clearwater River.

Alluvial terraces, gravel bars, and islands are differentially distributed along the lower Snake River largely depending on local structural, geological, and geomorphic variables. While most of the Snake River in western Idaho is deeply incised into the surrounding basaltic uplands, the floodplain widens significantly as the slope of the river lowers and it enters the Lewiston Basin near Lewiston, Idaho, and Clarkston, Washington (Dauble 2001). Here, at the confluence of the Clearwater and Snake Rivers, thick Bonneville and Missoula Flood deposits form most of the wide terraces upon which the cities have been built (Webster et al. 1982). Downstream of Lewiston, the rolling hills of the Palouse flank the basalt cliffs along the river until it meets up with the Columbia River.

Four dams and associated reservoirs are located along the lower Snake River, including the Lower Granite, Little Goose, Lower Monumental, and Ice Harbor Dams. This series of dams and reservoirs form a nearly continuous zone of elevated waters through this stretch of the Snake, inundating lower elevation alluvial landforms that once lined or were located within the river. Prior to installation of the dams, alluvial landforms within and along the flanks of the Snake River in the FCRPS study area would have represented prime locations for resource extraction and seasonal occupation (Reid 1991). Islands clustered in the vicinity of the Ice Harbor, McNary, and John Day Project Areas provided stable, in-stream landforms for use by humans occupying the area. Upstream, large alluvial bars lined the river's edge. Alluvial fans and terraces were common at the mouths of tributary streams. Although many of these alluvial landforms have been inundated as a result of the formation of reservoirs, slightly higher elevation river landforms still exist along the river margins in some areas (Harris 1998).

Downstream of its confluence with the Snake, the Columbia River turns abruptly to the west and begins its journey to the Pacific Ocean in earnest. The Columbia is joined by the Umatilla, John Day, and Deschutes Rivers that flow over the plateau of eastern Oregon before entering the Columbia River Gorge, a deep bedrock canyon cut by the river as the land around it uplifted to form the Cascade Mountains (Orr and Orr 1996).

Along this stretch of the river, four FCRPS dams and reservoirs are found: McNary, John Day, The Dalles, and Bonneville. As with the Snake River, this section of the Columbia River has been heavily impacted by construction of dams and reservoirs. In-water and stream-side landforms have been inundated, and river features vital to the cultures that called the river their home have been drowned, most notably the series of falls and rapids at Celilo, The Dalles, and Cascade Falls (Aguilar 2005; Barber 2005; Boyd 1996; Smith 1979; Ulrich 2007).

4.1.1 Canadian Rockies

Located in the northeastern corner of the CRB, the EPA (2013) describes the Canadian Rockies as "higher and more ice-covered than the Northern Rockies." The Hungry Horse Dam Project Area is found in the Canadian Rockies ecoregion. This portion of the Rocky Mountain Range formed as a result of uplift of Precambrian continental shelf sandstones, mudstones, and limestones (Alt and Hyndman 1995; Ross 1959). Crustal extension formed nearly vertical, northwest–southeast trending faults. Between faults, blocks of land downdropped, forming elongated valleys such as the Flathead Valley, located just west of the Hungry Horse Dam and Reservoir. Mountain ridges in the area run roughly northwest–southeast, and the southwestern flanks are considerably steeper than the opposing northeastern flanks of the mountainsides. Streams have cut deeply into the mountainsides, coalescing in the intervening valleys. As with other mountainous areas in the north, the Canadian Rockies were heavily modified by glaciers during the Pleistocene, as evidenced by steep ridges and peaks, U-shaped glacial valleys, and glacial sedimentary deposits in valleys and along former glacial pathways.

4.1.2 Northern Rockies

The Northern Rockies ecoregion is positioned in the north-central portion of the CRB. The Libby, Albeni, Dworshak, Lower Granite, and Grand Coulee Projects are found within or along the border of this province. A varied history of tectonic deformation, volcanic activity, and glaciation in the Northern Rockies has created a moderate-relief landscape composed of roughly north–south trending valleys between deeply dissected mountain ranges. The Northern Rockies are composed of two north–south landform belts, the Omineca to the east and the Intermontane to the west (Orr and Orr 1996). These belts formed as a result of Precambrian accretionary action as the Intermontane superterrane collided with the ancestral western margin of North America (Orr and Orr 1996:22). Most of the Northern Rockies of the United States are within the Omineca Belt.

Both the Omineca and the Intermontane Belts are composed of metasedimentary and marine deposits that have incurred metamorphosis, uplift, and folding. Deposits of the Omineca Belt, in particular, have been deformed over time by tectonic structures such as the Kootenay Arc and the Purcell Trench and anticlinorium, which are related to collision processes. After accretion of terranes during the Jurassic, further modification of the land included tectonism, plutonism, volcanism, sedimentation, and the development of massive grabens and gneiss domes.

During the Pleistocene, the Northern Rockies supported vast glacial systems that helped carve deeply incised drainage systems and glacial valleys. Glacial deposits are common throughout the Northern Rockies and include drumlins, macro-flutes, till lineations, eskers, and moraines (Easterbrook 2003). The most recent advance of the Cordilleran ice sheet began approximately 25,000 years before present (B.P.) (Booth et al. 2003). The last glacial maximum occurred around 14,000 B.P. (Waitt and Thorson 1983).

4.1.3 Columbia Plateau

The Columbia Plateau represents a low-elevation basin positioned between the surrounding uplands of the Cascade Range, Rocky Mountains, Idaho Batholith, and Blue Mountains. The Plateau represents a large part of the CRB and is located at its center. The Lower Granite, Little Goose, Ice Harbor, Lower Monumental, Chief Joseph, Grand Coulee, McNary, John Day, The Dalles, and Bonneville Projects are found within or along the border of this province (see Figure 4-1, see Table 4-1).

The relatively level topography of the Plateau reflects the underlying bedrock geology—thick basalt flows that blanketed the majority of the ecoregion. Between approximately 17 and 6 million years ago (Mya), eruptions from dike-vent swarms in the vicinity of the modern-day Idaho/Washington/Oregon border created a series of enormous basaltic lava flows (Reidel et al. 1989b; Tolan et al. 2009). These flood basalts flowed eastward, covering an area of 101,905 square miles and filling the intermontane valley between the Rocky Mountains to the east and the Cascade Mountain Range to the west (Tolan et al. 1989). The resulting bedded flood basalts measure up to 2.8 miles in thickness in some parts of the Plateau (Reidel et al. 1989a).

Other geomorphic forces that have impacted the topography of the Plateau region include catastrophic flood events at the end of the last glacial period, as well as pre- and postglacial aeolian erosion and deposition (Figure 4-2). During the late Pleistocene, cataclysmic floods stripped surficial sediment from much of the surface of the Plateau and scoured deep channels into the basalt bedrock, creating what J. Harlen Bretz (1923) called the “Channeled Scablands.” These cataclysmic floods—referred to as the Missoula or Bretz Floods—originated from glacial Lake Missoula, which formed during repeated blockage of the Clark Fork River in Montana by glacial ice. The lake periodically drained when the ice lobe failed, resulting in massive flood events that swept across western Idaho, eastern Washington, and parts of Oregon. Based on stratigraphic sections analyzed in the Walla Walla and Sanpoil River valleys, Waitt et al. (2009:782) argue that the number of floods originating from glacial Lake Missoula at the end of the last glaciation may have numbered 95 or more. The flood events likely occurred between 15,500 and 13,000 B.P. (Benito and O’Connor 2003; Waitt et al. 2009), although the last bounding date is likely closer to 13,500 B.P. (Booth et al. 2003; Waitt et al. 2009).

The Missoula Floods stripped the land surface of sediment; eroded deep, vertical-walled coulees and cataracts; and deposited vast gravel deposits, including rippled gravel beds, fans, and massive gravel bars (Baker 2009). Scour-related features, such as caves and rockshelters, were created along steep coulee walls as flood waters ripped blocks from basalt wall faces (Lillquist and Powell 2014). The amount of water released during each flood varied, but an estimated peak flow of up to 82 million cubic feet or more may have occurred (Denlinger and O’Connell 2010; Waitt et al. 2000). The most common landform on the eroded scabland landscape is butte-and-basin topography, with top-to-base relief of 98 to 328 feet (Baker 2009:396).

Missoula Flood waters traveled various routes across the landscape, funneling into the Columbia River near its confluence with the Walla Walla River in the Pasco Basin (Waitt 1980). The floodwaters were constricted at this point by Wallula Gap, an uplifted anticlinal ridge that has been bisected by the Columbia River (Carson and Pogue 1996). A large body of water formed behind this hydraulic constriction, Lake Lewis (Allison 1933), whose elevation may have reached up to 1,250 feet, approximately 900 feet above current water level (Bjornstad et al. 2001). Although this lake would have been an ephemeral feature (lasting only five days during the largest Missoula Flood event [O’Connor and Baker 1992]), massive amounts of rhythmically bedded slack-water sediments, or Touchet Beds, were deposited in its wake (Waitt 1980).

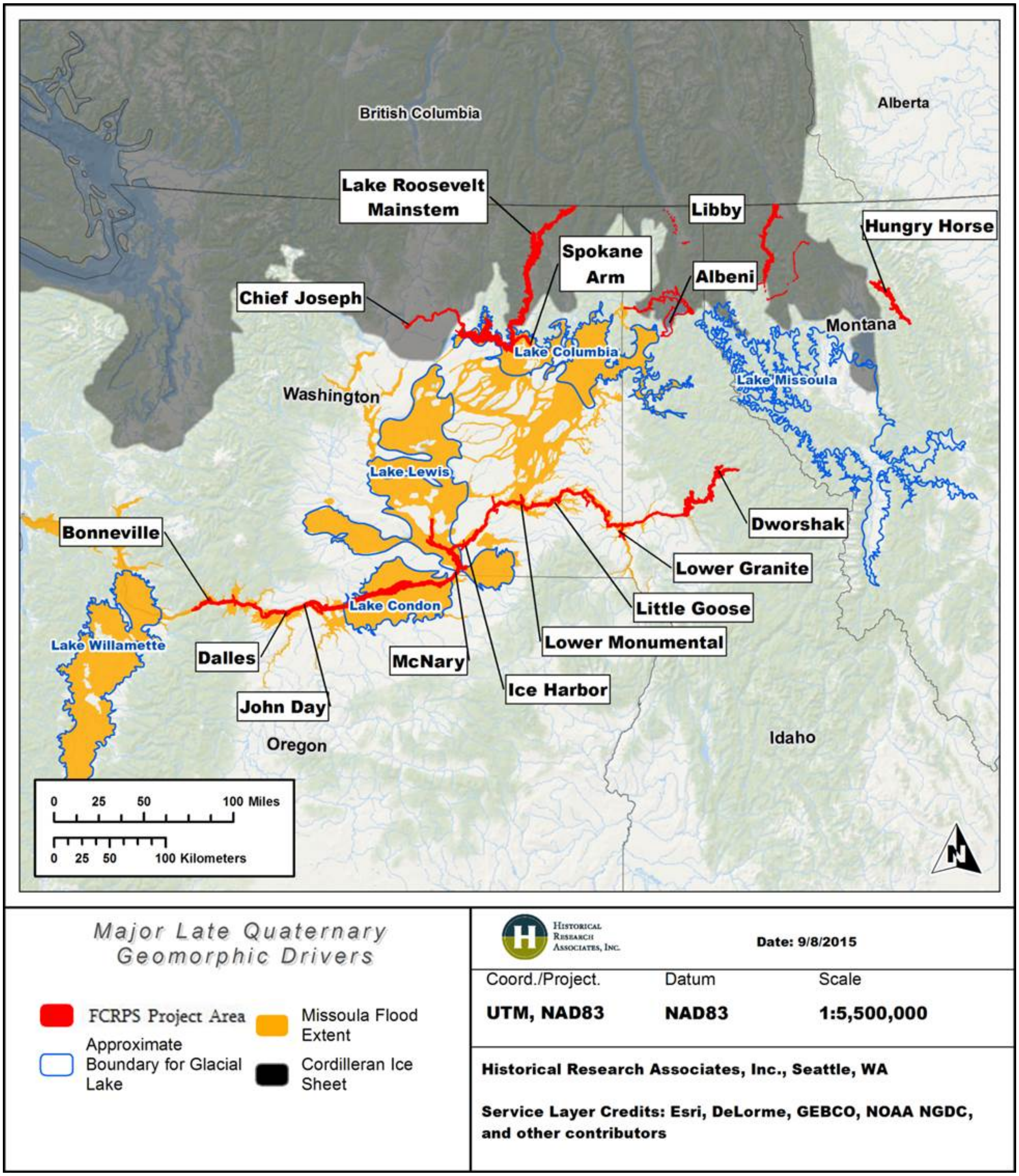


Figure 4-2. Major late Quaternary geomorphic drivers that impacted the FCRPS project area. The extent of Glacial Lake Missoula is outlined in blue, the areas scoured by catastrophic flood events are depicted in orange, and the approximate maximum extent of the Cordilleran Ice Sheet during the last ice age is shown in dark gray. Modified from Waitt (1985:Figure 1).

In addition to glacial Lake Missoula, lobes of the Cordilleran ice sheet advanced in areas west of the Purcell Trench lobe. Glacial Lake Columbia formed behind the Okanogan lobe of the ice sheet. This lake, containing up to 37 cubic miles of water at its height, catastrophically released its floodwaters centuries after the last glacial Lake Missoula outburst floods (Atwater 1987; Waitt 2009). Glacial Lake Kootenay (or glacial Lake Purcell [Peters 2012]) formed as the Cordilleran ice sheet retreated through British Columbia and may have released massive floodwaters down the main stem of the Columbia River from near Chelan (Waitt 2009; Waitt et al. 2009).

At the front edge of the glacial ice, near Grand Coulee, end moraines and drumlins are common deposition landforms, as are outwash deposits, fans, and evidence of braided channels, abandoned after ice melt and retreat (Easterbrook 2003). Glacial meltwater-related features, such as eskers, kames, and kettles, in these areas attest to widespread glacial stagnation during glacier retreat (Easterbrook 2003:283). Extended postglacial saturation of sediments in such settings represented attractive water sources for late Pleistocene occupants of the land (e.g., the Lind Coulee Site), including animals and humans (Lenz 2004).

The floodwaters of the Bonneville Flood also affected the Columbia Plateau at the end of the Pleistocene, although the effects were relatively confined to the river channels by the time the flood reached the FCRPS study area. The Bonneville Flood resulted from spillover of Pleistocene Lake Bonneville into the Snake River drainage around 14,500 B.P. (O'Connor 1993). The floodwaters entered the Snake River near Pocatello in southeastern Idaho and flowed west through the steep-walled Snake River canyon.

While floodwaters overtopped the river canyon near the beginning of the flood route in eastern Idaho, maximum discharge and flood levels were greatly attenuated by the time they reached western Idaho and and the FCRPS Project Areas in Washington. Consequently, flood effects were generally confined to the river channel. Within the narrow gorge of Hells Canyon to where the river widens near Lewiston, Idaho, flood deposits on the valley bottom are sparse, although marginal deposits can be seen at tributary mouths' canyon reentrants (O'Connor 1993:9). To the west, where the river valley widens, the floods deposited large bars within the floodplain. For example, hydraulic ponding and deposition of flood sediment around the city of Lewiston resulted from downstream constrictions in the flow path. Some of these flood features are still preserved along the river margins, but many were eroded by or are difficult to distinguish from Missoula Flood deposits.

Loess (windblown glacial silt) covers an extensive area of the plateau, known as the Palouse. Over 40,000 square miles of land in Idaho, Oregon, and Washington is draped by the fine-grained deposits. Rivers draining the Palouse, including tributaries of the Columbia River, carry large amounts of suspended sediment as they meander through the erodible hills and valleys of the Palouse.

Loess deposition in the Palouse began as early as 2 Mya (Busacca 1991) and continued through the late Pleistocene (McDonald and Busacca 1989). Source material for the loess included primarily fine-grained cataclysmic flood deposits with minor contributions from more local sources such as the Miocene-Pliocene Ringold Formation (McDonald and Busacca 1989; Sweeney et al. 2002, 2006). Stratigraphic unconformities in the loess sequences mark major episodes of regional flooding (catastrophic flood events) occurring as early as the Illinoian (ca. 130,000 to 200,000 B.P.) (Bjornstad et al. 2001; McDonald and Busacca 1989).

4.1.4 Eastern Cascades and Cascades

The Cascade Range stretches from California to British Columbia, passing through the west-central portions of Washington and Oregon. The Bonneville Dam Project Area is located in both the Eastern Cascades (or High Cascades) and the older Cascade Range (or Western Cascades) to the west (see Figure 4-1; see Table 4-1). While the Eastern Cascades are typified by high, jagged mountain peaks and steep-sided buttes, the Cascades to the west are more rounded, with less relief between peaks and valleys. The Cascades originally formed around 40 Mya as a continental volcanic arc along the western edge of the North American Plate (Orr and Orr 1996). Large volumes of ash and lava erupted from the chain during that time, creating a rugged terrain likely similar to today's Eastern Cascades. Over time, erosion and reshaping by repeated glaciations have smoothed the rough topography of the Cascades, and rivers have deeply dissected the mountainsides.

The Eastern Cascades, in contrast, display high jagged peaks that have been little eroded since their formation by volcanism that began approximately 10 Mya and continues to the present (Orr and Orr 1996). The Eastern Cascades are positioned within the rain shadow of the Cascades to the west (EPA 2013), resulting in markedly less precipitation affecting the peaks and slopes. Columbia River Basalt flows lapped up the eastern flanks of the Eastern Cascades and have been subsequently warped upward due to uplift of the mountain range (Lasmanis 1991). Some of the highest mountain peaks in the Pacific Northwest, including Mount Rainier, Mount Adams, Mount St. Helens, and Mount Hood are part of this active volcanic mountain range. The Columbia River passes through the Cascades, cutting a low-elevation gap that has been a major corridor for movement of plants, animals, and peoples for a very long time.

4.2 Ecological Regimes

Depending on the region and microclimates therein, multiple plant associations can be defined and described. The following categories are broad descriptions of ecological zones available to people living within the Plateau Culture Area (Walker 1998b). Four major vegetation types—steppe, woodland transition, forest, and meadows—are present across the FCRPS research area and have been previously defined in various ecological publications (Daubenmire and Daubenmire 1968; Franklin and Dyrness 1988).

Annual and seasonal precipitation constrains the distribution of plant communities across the Columbia Basin, Eastern Cascades, and Northern Rockies. Differing temperature also influences the extent of vegetation communities along latitudinal gradient as well as by elevation (Chatters 1998). Parent soil materials also have some effect on distribution of plant species, primarily in the Eastern Okanogan, where glacially derived sediments confine the distribution of some arboreal species (Franklin and Dyrness 1988).

4.2.1 Steppe

Lying in the rain shadow of the Cascades, the Columbia Basin and the eastern Cascade foothills support vegetation adapted to dry conditions. Arid to semiarid steppe environs comprise the majority of Plateau Culture Area and can be broken into two subtypes: shrub steppe and bunchgrass steppe.

4.2.1.1 Shrub Steppe

There are a total of nine shrub-steppe plant associations whose distribution is confined by temperature and precipitation across the Columbia Basin. Of the nine, sagebrush is the dominant species. The big sagebrush–bluebunch wheatgrass (*Artemisia tridentata* and *Agropyron spicatum*) habitat type, is the most commonly found plant association in the Columbia Basin (Franklin and Dyrness 1988:212). This association of species is found in the driest areas in the center of the Columbia Basin.

An association of three-tip sagebrush–Idaho fescue (*Artemisia tripartita–Festuca idahoensis*) is found in the steppe environment of the foothills of the eastern Cascades and the drier and cooler areas of the northern Columbia Basin. Rabbitbrush (*Chyrsanthomus* sp.) is also common. The transition from sagebrush–fescue to sagebrush–wheatgrass is influenced primarily by total annual precipitation (Franklin and Dyrness 1988:219).

The shrub-steppe environments of the Columbia Basin also support a variety of flora traditionally utilized by people indigenous to the Plateau for subsistence, including balsamroot (*Balsamorhiza* spp.), bitterroot (*Lewisia rediviva*), wild onion (*Allium* spp.), and yellow bells (*Fritillaria pudica*). Shrub-steppe habitats also support a variety of forbs of the genus *Lomatium*, including biscuitroot, that were gathered by the Upper Chinookan (Spier and Sapir 1930), Umatilla (Stern 1998), Nez Perce (Walker 1998a), Palus, and Spokane, among others. Riparian areas and transitional zones within the shrub-steppe region support a variety of fruit-bearing plants, including wax currant (*Ribes cereum*), chokecherry (*Prunus virginiana*), and serviceberry (*Amelanchier alnifolia*). Marshes and wetlands contain various species used in textiles, including tule (*Scirpus acutus*), cattail (*Typha latifolia*), sedges (*Carex* spp.), and rushes (*Juncus* spp.) (Chatters 1998:35).

The following FCRPS Project Areas include shrub-steppe habitat: Bonneville, Chief Joseph (Campbell 1985), The Dalles (Wernz et al. 2005), John Day, McNary, Ice Harbor, Grand Coulee, and Libby.

4.2.1.2 Bunchgrass Steppe

The other major steppe habitat within the FCRPS research area is the bunchgrass steppe. The most common association is that of the blue bunch wheatgrass–Idaho fescue type (*Agropyron spicatum–Festuca idahoensis*) that inhabits portions of the semiarid northeastern Columbia Basin (Franklin and Dyrness 1988). These areas receive more annual rainfall and support meadow-like plant communities, including wild rose (*Rosa* spp.)

Arguably, the most important plant species Native American people used that can be found in the moist meadows of bunchgrass steppe habitats is common camas (*Camassia quamash*), also referred to as blue camas. Camas is one of several geophytes, a perennial plant that reproduces via underground tubers, corms, or bulbs, that was incorporated into the diet of Plateau peoples (Chatters 1998; Turner 2014a). Camas is found in areas of the Columbia Basin, foothills of the western and eastern Rockies, and the Okanogan. Bunchgrass steppe areas that support camas are considered key resource environments that, in the past, seasonally tied hunter-gatherer groups to specific locations on the landscape (Thoms 1989).

In addition to camas, other edible plants and forbs associated with the bunchgrass steppe include balsamroot, snowberry (*Symphiocarpus albus*), wild onion, and wild rose (Chatters 1998).

The following FCRPS Project Areas include bunchgrass steppe habitat: McNary, Ice Harbor, Grand Coulee, Lower Monumental, Little Goose, and Lower Granite.

4.2.2 Woodland Transition

While not necessarily defined as an ecological community, the transition from steppe/meadow to woodland creates a rich ecotone that supports a diversity of plants and animals traditionally important to various Plateau tribes. The most common woodland transition across the CRB is from sagebrush steppe to lower elevation–open ponderosa pine parkland. In some areas, steppe or meadow environs grade into Garry oak (*Quercus garryana*) and deciduous tree communities (Chatters 1998:36). Oak habitat is a key resource environment for many Plateau tribes as it not only provided productive acorn patches but the open understory may also support geophytes such as camas. The intersection between woodlands and open meadows also created yards and corridors important for hunting and travel (Lewis and Ferguson 1999). The native range of Garry oak, also known as Oregon white oak, communities includes the foothills of the eastern Cascades, isolated pockets of the Yakama Valley, and the Columbia River drainage downriver of McNary Dam (Agee 1993:352).

Fire, both natural and anthropogenic, has played a critical role across much of the Plateau Culture Area in maintaining the woodland transition. Scharf (2010) notes that sagebrush encroachment of ponderosa pine parklands, or conversely, forest encroachment of the shrub steppe, was maintained by frequent fire within the Chief Joseph Reservoir watershed. A similar situation has been suggested for woodland–steppe boundaries in the eastern Cascades and the western Rockies, where modern fire suppression has altered landscapes that once supported lowland to upland transitional habitats (Agee 1993; Fischer and Bradley 1987).

The following FCRPS Project Areas include woodland transition habitat: Albeni Falls, Bonneville (Wernz et al. 2006), Chief Joseph, Grand Coulee, Lower Monumental, Little Goose, Lower Granite, and Libby.

4.2.3 Montane Forest

Montane forests are, generally, situated at higher elevations or, in the case of the Canadian Rockies, at higher latitudes, across most of the FCRPS research areas. Like steppe environs, annual and seasonal precipitation is the main driver of plant species distribution. Both overstory and understory species were used by various groups living in the region. Montane forests can be divided into two different overstory associations of either drier (xeric) or wetter (mesic) forest types.

4.2.3.1 Xeric Forests

Xeric forests within the FCRPS research area are located primarily in the eastern Cascades and northern Columbia Basin. Low seasonal snowpack, milder winters, and low annual precipitation support a *Pseudotsuga menziesii* plant association dominated by Douglas fir, while dry ponderosa pine forests are common in the northern Columbia Basin and in the foothills of the eastern Cascades (Agee 1993). Generally, in the eastern Cascades, dry conditions also support a belt of ponderosa pine (*Pinus ponderosa*) and lodgepole (*P. contorta*) parklands at lower elevations (approximately 2,000–4,000 feet) and grand fir (*Abies grandis*) dominant forest above 4,265 feet in elevation (Franklin and Dyrness 1988:168). The dry forest environments of the eastern Cascades are in part a product of frequent natural and anthropogenic fires that have created and maintained an open understory (Franklin and Dyrness 1988; Robbins 1999).

Ponderosa pine dominant forests contain relatively open understories of bunchgrasses, pine grass (*Calamgrostic subescens*), and Idaho fescue, with some Oregon grape (*Mahonia nervosa*). In some locations, Garry oak may also be present. While Douglas fir–dominant forests contain a more diverse understory of oceanspray (*Holodiscus discolor*), ninebark (*Physocarpus* sp.), and serviceberry (*Amelanchier alnifolia*), several species of huckleberry (*Vaccinium* sp.), snowberry (*Symphorocarpus albus*), beargrass (*Xerophyllum tenax*), and kinnikinnick (*Arctostaphylos uva-ursi*) are also associated with dry conifer forests in the eastern Cascades (Hummel et al. 2012).

The following FCRPS Project Areas include xeric montane forests: Bonneville and Grand Coulee.

4.2.3.2 Mesic Montane Forests

At the lower elevations in the more mesic Northern Rockies, communities of western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) are common (Franklin and Dyrness 1988). Western red cedar is also found in some areas of the eastern Cascades where valleys create conditions that trap warmer air and moisture (Agee 1993). At higher elevations in montane environments, western birch (*Betula occidentalis*), paper birch (*B. papyrifera*), and quaking aspen (*Populus tremuloides*) are common (Chatters 1998). Understory species common in mesic forests include Oregon grape, huckleberry, and ferns.

The following FCRPS Project Areas include mesic montane forests: Dworshak, Hungry Horse, and Libby.

4.2.4 Subalpine Forest

Although none of the FCRPS Project Areas are located directly within subalpine forest, the vegetation type is important to consider since past climates supported subalpine forest in the Bonneville, Hungry Horse, and Libby Projects vicinities. Indigenous people traversed subalpine locations for both hunting and gathering activities; these locations also may have been the sites of tool-stone outcrops that provided raw material for stone tools.

Subalpine forests are found primarily on the eastern slope of the Cascades and in the Northern and Canadian Rockies and, like montane forests, subalpine forests can be further divided into xeric and mesic communities. The drier eastern Cascades primarily support krumholtz subalpine fir (*Abies lasiocarpa*) and larch (*Larix* sp.), with fewer numbers of lodgepole and whitebark pine (*Pinus albicaulis*). Heavier snowpack and longer winters, such as those experienced in the Rockies, support a mesic overstory of mountain hemlock (*Tsuga mertensiana*) and Pacific silver fir (*Abies amabilis*) (Chatters 1998). Understories composed of woody shrubs, including big huckleberry (*Vaccinium mebranaceum*), are common (Pojar and Mackinnon 1994). The subalpine zone also supports traditionally important plants such as beargrass (Chatters 1998:37).

4.2.5 Meadows and Montane Meadows

Meadow complexes can be found across the Plateau Culture Area. Similar to the woodland transition, meadows provide habitat for culturally important plant species and provide key habitat for ungulates such as elk and deer.

Albeni Falls and the Bonner's Ferry portion of the Libby Project Areas contain the most meadow habitat of all the research areas. Albeni Falls is situated in a broad, wet peat meadow complex in broad river bottoms surrounded by mixed conifers including a variety of pines, larch, western red cedar, and deciduous species such as alder (*Alnus* sp.) (Miss and Hudson 1987; Moseley et al. 1992). Key vegetation within the wet meadow complex of the Albeni Falls watershed includes camas, huckleberry, willow (*Salix* sp.), and various grasses and sedges used for textiles.

Moving out of the valleys, montane meadows are commonly found at the edge of forested areas at mid- to high elevations in mountain environments and represent the only plant communities within the FCRPS research areas that may be located above the tree line. Common plant association include grasses (*Stipa* sp., *Agropyron* sp.), particularly the culturally important bear grass.

The open structure in some montane and subalpine meadow complexes has been attributed to natural and anthropogenic fire (Agee 1993; Franklin and Dyrness 1988:284). Removal of indigenous human populations from these areas and their use of fire for maintaining meadows, along with modern fire suppression, may explain the encroachment of subalpine forest into these areas (Agee 1993). In the Northern Rockies, specifically areas surrounding the Libby Lake watershed, ethnohistorical accounts of indigenous burning practices to promote grasses for ungulate and horse browse have been reported (Barrett and Arno 1999:54). Similar burning practices have been documented in the Canadian Rockies (Lewis and Ferguson 1999; Pyne 2007). Shifts in modern climate and the movement of more cold-adapted arboreal species to higher elevations may also explain the prevalence of subalpine tree recruitment in areas that were once meadows (Farge et al. 2003).

The following FCRPS Project Areas include meadow/montane meadows: Libby, Albeni Falls, Dworshak, and Hungry Horse.

4.2.6 Riparian Environments

Areas along rivers, streams, and surrounding waterbodies support a variety of riparian plant and animal species. While these locations can be present in all of the ecological zones described above, riparian areas deserve special mention since these environments were present in all of the FCRPS Project Areas.

In bunchgrass steppe environs of the CRB, areas near water courses support often dense communities of hawthorn (*Crataegus douglasii*), snowberry (*Symphiocarpos albus*), serviceberry (*Amelanchier alnifolia*), and chokecherry (*Prunus virginiana*) (Franklin and Dyrness 1988:228). Aspen (*Populous tremuloides*), cottonwood (*Populus deltoides*) and alder (*Alnus* sp.) can also be found along riverbanks in most of the riparian environments in the FCRPS Project Areas. All of these species were utilized by Plateau people for foodstuffs, medicines, and textiles (Turner 2014a, 2014b). In the arid sagebrush-steppe, riparian environments are similar to that in the bunchgrass-steppe. Ponds and shallow wetland marshes in the Columbia Basin and northern Plateau may also contain communities of broadleaf cattail (*Typha latifolia*), tule, rushes (*Juncus* sp.), and sedges (*Carex* sp.). These locations provided a variety of plant materials used in the construction of mats, baskets, clothing, and other textiles, and supported a variety of habitat for year-round and migratory fowl.

Prior to the construction of dams and other hydrologic features, broad glacially carved valleys like the Calispell Valley supported meandering river systems and deep floodplain deposits. Riparian zones contained diverse plant resources that were used by the all of the Tribes that occupied the broad river valleys peripheral to the central CRB (Kennedy and Bouchard 1998). Trees and tules were used in the construction of watercraft (Teit 1930). Tule rafts were also used by the Spokane (Ross 1998).

Elsewhere, landscapes of volcanic origin, such as the central CRB, are more confined, with narrow riparian zones between the rivers and the uplands. Due to this topography, many locations in steep valleys would have fewer riparian zones and limited plant resources. Groups living along the Columbia River used the riparian zones for much needed wood fuel including the harvesting of driftwood and alder for smoking and cooking salmon (Hunn and French 1998)

4.3 Fauna

Discussion below includes information on animals that inhabit the Columbia River system within the FCRPS study area. It relies heavily on modern biological studies (e.g., Wisdom et al. 2000) and focuses on taxa that are represented in archaeological deposits (Butler and Campbell 2004, and others) in the region and those represented in ethnographic literature (e.g., Ross 2011).

4.3.1 Mammals

Wisdom et al.’s (2000) study of terrestrial vertebrate habitats in the interior Columbia Basin provides a well-rounded view of the terrestrial mammalian fauna in the region. Native American groups in the area most commonly exploited elk or wapati (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*) black bear (*Ursus americanus*), raccoon (*Procyon lotor*), cottontail rabbit (*Sylvilagus nuttalii*), beaver (*Castor canadensis*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), coyote (*Canis latrans*), northern pocket gopher (*Thomomys talpoides*), jack rabbit (*Lepus americanus*), pronghorn (*Antilocapra americana*), and mountain goat (*Oreamnos americanus*).

Aquatic mammals are known throughout the Columbia River system. As with the fish and avifauna, the lower reaches of the Columbia include a different suite of animals than areas farther upstream. Lower reaches of the system include Steller sea lion (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), and harbor seal (*Phoca vitulina*) (NOAA 2006). These animals primarily exist in this tidally influenced portion of the system because they prey on migrating salmonids.

4.3.2 Birds

The Seattle Audubon Society has identified over 200 native bird species in the Columbia Plateau, Canadian Rockies, Okanogan, and Blue Mountain regions of Washington State (Seattle Audubon Society 2015). These include passerine and nonpasserine birds that both inhabit the area and use the region as a stopover during migration. Avifauna near the mouth of the Columbia River include some sea birds as well as a suite of birds seen farther inland.

4.3.3 Fish

The native ichthyofauna found in the Columbia River system is highly varied and includes fishes with significantly different life histories; anadromous salmonids often receive the majority of attention in conservation and biological publications, but resident fishes are an important component of the aquatic landscape. Nearly 15 Linnaean families from two superclasses *Osteoicthyes* and *Chondricthyes* are represented in the system. The discussion of fish below does not include all known fish in the system but illustrates the diversity in taxa and life history.

Pacific salmon and trout (*Oncorhynchus* spp.) display both anadromous and resident life histories within the CRB. Anadromous forms that currently use the region include steelhead trout (*O. mykiss*), Chinook (*O. tshawytscha*), coho (*O. kisutch*) and sockeye (*O. nerka*) (Dauble 2009). Common names for these fish are varied and can cause some confusion during review of historic documents for biogeographic studies (for examples, see Butler 2004). A number of natural impediments to migration (e.g., hydrologic features like waterfalls) exist within the Columbia River system (e.g., Z Canyon on the Pend Oreille River, Spokane Falls, Similkameen Falls [Elder 2010; Elder and Butler 2008]).

Other salmonids in the Columbia River system include mountain whitefish (*Prosopium williamsoni*), bull trout (*Salvelinus confluentus*), cutthroat trout (*Oncorhynchus clarkii*), and the resident form of steelhead, rainbow trout (*O. mykiss*). In waters blocked from anadromous runs, these other salmonids display a resident life history pattern, filling niches in tributary systems that anadromous salmonids fill in the main stem of the Columbia River and as a result, often grow larger than systems where the two life histories co-occur (Lyons 2015).

Other anadromous fish that live in the Columbia River system include Pacific lamprey (*Lampetra tridentata*) and white sturgeon (*Acipenser transmontanus*) (Wydoski and Whitney 2003). Interestingly, lamprey are rarely seen archaeologically (Smith and Butler 2008), although they are known to be important culturally (Close et al. 2002). Eulachon (*Thalyicthys pacificus*) migrate in the lowest reaches of the Columbia River system. Western brook lamprey (*L. richardsoni*) are also found in the system but are not anadromous.

Resident fishes in the Columbia River system include members of the Salmonid family (see above) as well as fish from the following families (Dauble 2009; Montana Natural Heritage Program 2015):

- Cyprinids (e.g., northern pikeminnow [*Ptychocheillus oregonensis*] and tui chub [*Gila bicolor*])
- Catostomids (e.g., mountain sucker [*Catostomus platyrhynchus*] and largemouth sucker [*C. macrocheilus*])
- Gadids (e.g., burbot [*Lota lota*])
- Gasterosteids (e.g., three-spine stickleback [*Gasterosteus aculeatus*])
- Percopsids (e.g., sand roller [*Percopsis transmontana*])
- Cottids (e.g., prickly sculpin [*Cottus asper*] and mottled sculpin [*C. bairdi*])
- Pleuronectidae (e.g., starry flounder [*Platichthys stellatus*])
- Embiotocidae (e.g., striped surfperch (*Embiotoca lateralis*))
- Osmeridae (e.g., surf smelt [*Hypomesus pretiosus*])

The native fishery has been dramatically impacted by the introduction of nonnative game fish. Beginning in the late nineteenth century, game fish were imported to the region and planted in area lakes and streams (Wydoski and Whitney 2003). Introduced fishes in many cases outcompete native fauna for food and present serious threats to native fish populations. In the Pacific Northwest, as across the world, private individuals, as well as federal and state programs, introduced non-native fish species for recreation (Butler 2004; Cambray 2003). According to Dauble (2009), invasive fish in the Columbia River system include:

- Clupidae (e.g., American shad [*Alosa sapidissima*])
- Salmonidae (e.g., lake trout [*Salvelinus namaycush*] and brown trout [*Salmo trutta*])

- Esocidae (e.g., northern pike [*Esox lucius*])
- Cyprinidae (e.g., carp [*Cyprinus carpio*] and tench [*Tinca tinca*])
- Ictaluridae (e.g., channel catfish [*Ictalurus punctatus*] and yellow bullhead [*Ameiurus natalis*])
- Cyprinodonitidae (e.g., banded killifish [*Fundulus diaphanous*])
- Poecliliidae (e.g., western mosquitofish [*Gambusia affinis*])
- Centarchidae (e.g., largemouth bass [*Micropterus salmoides*] and pumpkinseed [*Lepomis gibbosus*])
- Percidae (e.g., yellow perch [*Perca flavescens*] and walleye [*Sander vitreus*])

4.3.4 Invertebrates

Invertebrates in the Columbia River system include insects, freshwater bivalves, and univalves, as well as freshwater crustaceans like crayfish. The discussion below is limited to a consideration of invertebrates that Native American groups likely used as food sources.

Three genera of freshwater mussels are native to the region: *Margaritifera*, *Gonidea*, and *Anodonta* (Nedeau et al. 2009). Each taxon has very specific environmental preferences and biogeographic distributions (see Nedeau et al. 2009 for detailed discussion). In short, *Margaritifera* prefer fast-moving water, *Gonidea* prefer water that moves less fast, and *Anodonta* like slack-water environments. These preferences can provide a useful basis for establishing foraging patterns and paleoenvironmental reconstruction, although these genera can be found in relatively close proximity in streams where gradients vary widely.

Grasshoppers, crickets, and katydids (*Orthpterids*) inhabit nearly every biotic zone in the region (Haggard and Haggard 2006) and were commonly used as fishing bait (e.g., Ross 2011).

Native crayfish include the pilose crayfish (*Pacifastacus gambelii*), Snake River pilose crayfish (*P. connectens*) and signal crayfish (*P. leniusculus*) (Larson and Olden 2011).

4.3.5 Reptiles and Amphibians

Native reptile and amphibians in the region include frogs like the northern leopard frog (*Rana pipiens*) and Oregon spotted frog (*R. pretiosa*) (ODFW 2006). The western painted turtle (*Chrysemys picta*) and the short horned lizard (*Phrynosoma douglassii*) are known in the region as well. Snakes, including the gopher snake (*Pituophis cantenifer*), are found from Oregon to Montana (ODFW 2006; Werner et al. 2004). The western rattlesnake (*Crotalus oreganus*), found in Oregon and eastern Washington, are replaced by the prairie rattlesnake (*Crotalus viridis*) in Montana (Werner et al. 2004).

CHAPTER 5 – CULTURAL DOMAINS

This chapter begins with discussion of theory applicable to this RD's domains and themes, and is followed by definitions of the cultural domains (the Native Peoples domain is in Chapter 3, and the Environmental Variability domain is in Chapter 4) as they relate to the research themes presented in Chapter 6. The status of existing research on those themes, as it is relevant to the evaluation of resources in the Project Areas for the FCRPS Program, is also presented.

In general, a domain is an area of knowledge about a particular time, place, or theme. Domains can be defined for any research purpose; there is no singularly accepted method for how this is to be done, but the scientific method should be employed to define domains that are built on conclusions reached from previous research in the field. This SWRD builds on a decades-long body of research that uses domains appropriate for advancing the Agencies' effort of addressing NRHP eligibility. The domains presented here are intended to define some of the historical contexts and data gaps necessary to begin to address the Agencies' NRHP eligibility goals.

5.1 Theoretical Basis

A theoretical framework is necessary for discussing cultural resources, especially as the discussion applies to broad historical patterns. Without such a framework, and even within a framework that has not been explicitly defined, investigations can often be only descriptive or post hoc. This limits both the power of the data in addressing research questions and its comparability across sites, regions, and time periods. Much of the work to be done in the study area will be conducted under the auspices of cultural resource compliance work, where data collection often proceeds in a piecemeal fashion. For this reason, it is even more imperative that a coherent larger framework exists into which smaller bits of data can be fit. This type of framework has been called a "paradigm" by philosopher of science Thomas Kuhn (1970), and is a prerequisite for what he calls "normal science."

Kuhn observed that in the early formation of any body of knowledge, different researchers explore a number of competing explanatory frameworks. Eventually, one theory fits the known body of facts more completely than competing theories. The more successful theory becomes the "dominant paradigm" in the field. Kuhn describes the paradigm as being like a block of Swiss cheese, with individual researchers trying to fill in the holes and gaps in what is known in order to complete the paradigm. The general acceptance of a paradigm allows for the definition of key questions or expectations that can be explored through additional data collection.

Following the acceptance of a paradigm, according to Kuhn, a period of "normal science" ensues in which researchers work in isolation yet still contribute data to the larger body of knowledge. When facts and data emerge that do not fit into the current paradigm, it triggers the search for a new theory that does fit all the data (Kuhn 1970:97). This has come to be known as a paradigm shift. For example, a paradigm shift in archaeology was caused by the discovery of generalized hunter-gatherer sites at dates earlier than the Clovis period (Dillehay 1989; Jenkins et al. 2011; Pringle 2011). These finds took a while to be generally accepted, but they ultimately overthrew the "Clovis first" paradigm, which argued that Clovis tool-using people were the earliest settlers of the Americas.

CRM is well suited to the conduct of normal science when data is collected methodically and an appropriate theoretical framework is used to guide the work. A clearly articulated common research paradigm allows daily work to be carried out with an awareness of the gaps that need to be filled in within the paradigm. While the profession rarely generates new paradigms, CRM archaeologists are perfectly poised to find the kind of data that might force a paradigm shift. Compliance work will sample every type of terrain in the FCRPS Project Areas and requires investigation of every kind of site. Simply put, the reach of cultural resource work positions it to make unanticipated discoveries, which can be used to generate better and more complete paradigms to explain the past.

Archaeology in the CRB study area (and the United States more generally) tends most often to be conducted within a processual theoretical paradigm. Beginning in the 1960s, the so-called processual school explicitly studied "process" with the implication that patterned processes that occurred in the past can be isolated and studied through the scientific method. The "new archaeology" school associated with Lewis Binford[3] (1962, 1965) and also made possible by the introduction of radiocarbon dating[4] (Libby 1955) inspired a generation of archaeologists to seek predictable "laws" about the relationships among past human activities and the material record (Clarke 1968). Often these relationships were expressed through mathematical formulas and modeling, with a strong reliance on human behavioral ecology (Butzer 1976; Thomas et al. 1979; Winterhalder 1981), which is discussed below. In this framework, human activities and culture were conceived of in functionalist terms. New archaeologists viewed culture as another tool to help people survive; essentially, another means of adaptation (Binford 1962:218; White 1959:8). This approach attempted to "explain" cultural traits by showing how they were an adaptive benefit that enhanced individual or group survival. When a cultural trait is analyzed from an external, rational, and ultimately material/economic point of view, archaeologists refer to it as an *etic* approach (Harris 1976).

[3] His work was in the anthropological tradition of Julian Steward (1953, 1955), Elman Service (1962), and V. Gordon Childe (1936, 1951) and recapitulated a critique of the "Culture History" approach to archaeology made in a doctoral dissertation by Walter Taylor (1948) and demonstrated in practice by Gordon Willey (1953).

[4] The ability to assign absolute dates to hearth features and other stratigraphic markers relieved archaeologists of the burden of constructing chronological sequences from morphological changes in time-sensitive artifacts (e.g., ceramics or projectile points). This energy and attention to detail could then be shifted to larger questions of culture process (Willey and Sabloff 1980).

Processualism views archaeology as a physical science, rooted in the scientific method (Nola and Sankey 2014). The archaeological processualism method is essentially a sequence of steps that begins with data collection and observation. This leads to the formation of a model based on inductive reasoning. Through induction, the researcher proposes a model that is simply a plausible explanation (or best guess) for the phenomenon being observed. Once a plausible hypothesis has been suggested, deductive reasoning is used to generate ways of testing it.

Middle-range theory is used to develop hypotheses by making the link between large-scale theories of social process ("grand theory") and archaeological data sets (Ellen 2010; Smith 2011). Borrowing from sociology (Merton 1968; Parsons 1951), Binford (1964, 1965) and processualists adopted middle-range theory as a way to link empirical observations to theories of social process (e.g., causes of the agricultural revolution or links between population size and other aspects of culture). Binford used ethnographic (ethnoarchaeological) observations of modern hunter-gatherers to generate bridging arguments between larger social theory and observable elements of the physical record (Binford 1978b, 1980). Such bridging arguments can then be framed as hypotheses testable via archaeological methods.

Evolutionary or human behavioral ecology (HBE) is a scientifically based explanatory and predictive framework (Stephens and Krebs 1986) that has proved fruitful in anthropological settings (Smith 1991; Winterhalder and Smith 1992). Its use in archaeology has been predominantly oriented toward questions of subsistence and diet (Bird and O'Connell 2006; Broughton 1994, 1997; Grayson and Cannon 1999). The framework contains a number of models that provide a springboard for inquiry and are effectively ready-made hypotheses for testing. Optimal foraging theory is the most commonly applied model derived from HBE and holds that decision making on the part of rational actors seeks to attain the most benefit at the least amount of cost (i.e., hunting and processing).[5]

Over time, humanistically oriented anthropologists and archaeologists found the processual approach to be excessively reductionist (Gero et al. 1983; Hodder 1985, 1986; Shanks and Tilley 1987). They asserted that human beings are not simply biological beings responding to the daily necessities of survival. Instead, people are meaning-creating individuals with agency (i.e., free will) to direct their own lives, often through the power of ideas (Dobres and Robb 2000; Gramsci 1992). Within this framework, anthropologists and archaeologists have attempted to understand cultures on their own terms (Geertz 1973) as conceptual systems that create meaning in what would otherwise be a chaotic and indifferent universe. Rather than attempting to appropriate the methods of the hard sciences, anthropologists working in a postprocessual tradition favor

[5] For more lengthy considerations of the theory in general the reader is directed to Stephens and Krebs (1986), for its application in anthropology (Winterhalder and Smith 1992), for its application in archaeology (Bird and O'Connell 2006), and response to critiques (Winterhalder 2002).

methods derived from the humanities, such as structuralism, phenomenology (predominantly derived from Bourdieu 1980), Marxism, and gender studies (Trigger 2006). Such approaches are termed *emic*, meaning that they take the viewpoint of a member of the culture being studied (Goodenough 1970).

The postprocessual approach is also in the tradition of the French *Annales* school of history which developed in the early twentieth century (Bloch 1964; Braudel 1949; Febrve 1973). It emphasized a broad multidisciplinary approach to the study of history, incorporating ideas from psychology, literature, and other social sciences to reconstruct the *mentalités* of a time past (School of Advanced History 2008). From the *Annales* school also comes the idea of studying the *longue durée*, or long historical periods, which has influenced processualists and postprocessualists alike (e.g., Ames 1991b).

Postprocessualism has been criticized for lacking a rigorous methodological program (Earle and Preucel 1987). Ian Hodder, who launched postprocessualism into archaeology, has suggested hermeneutics or a "contextual approach" as the appropriate method for interpreting cultural meaning in archaeology (Hodder 1986, 1991). The contextual approach first makes an inference about the symbolic system of a past culture and then uses that to "break into the hermeneutic circle" (Hodder 1985:30) of the culture. Once within the circle, there ensues a process of comparing the proposed emic viewpoint against the archaeological record, which leads to further emic insights, which are again compared to archaeological phenomenon. Hodder derived this approach from Collingwood's (1946) ideas on historical interpretation and relies on the logic of structuralism. In concept, the hermeneutic circle is similar to inductive observation and hypothesis testing, although without explicit thresholds of falsifiability (Kosso 2001).

5.2 Domain: Tracing Temporal Dimensions/Chronology

In archaeology, one of the most basic elements of explanation is regional cultural history—the story of human activity and cultural development over time. While this is a very simple concept, the development and clarification of such a cultural timeline is never simple and forms the bulk of the analytical work in archaeology. To facilitate understanding of the past as a coherent narrative, archaeologists use temporally sensitive (or "diagnostic") artifacts, features, and settlement types that identify and date the appearance of specific, culturally meaningful changes in the societies under study. Thus, we can speak of a "Clovis period" as shorthand for the time between 11,500 and 10,900 B.P., when human activity produced a very specific and recognizable fluted projectile point alongside a larger assemblage of tool and artifact types indicative of a transhumant large-game-oriented forager subsistence strategy. In Central America, archaeologists have defined a "Classic Maya period" as taking place between A.D. 300 and 900 and characterized by competing polities supporting large populations and producing characteristic architecture, art, and earthworks. The greatest utility in this type of periodization is that it allows a great deal of information to be conveyed quickly to those familiar with the chronology.

In the Plateau, one of the current challenges to this kind of a productive normal science is the lack of a commonly accepted cultural chronology for the region as a whole. Such a chronology would provide a common language for archaeologists to organize an abundance of data, while targeting anthropologically meaningful gaps within them. There are many reasons for this lack, originating in the nature of the archaeological materials, as well as structural limitations imposed by the history of research in this region.

The first stumbling block is in the nature of the data. For example, there are few ceramics. The changes in ceramic forms and motifs, in many parts of the world, form the basis of chronology. In the Plateau, and the Pacific Northwest more generally, local traditions have emphasized perishables, primarily basketry and woodworking. These were often elaborated to a high level of technical expertise and aesthetic expression, but rarely survive the elements. No wet sites (anaerobic deposits that preserve organics) have been reported in the FCRPS Project Areas (Ames 2000); however, basketry, textiles, and wood artifacts have been recovered in varying states of preservation from rock-shelter sites (e.g., Daugherty and Riddell 1948; Endacott 1992; Hicks 1995, 1996, 2004; Hicks and Morgenstein 1994). A comprehensive study of basketry contained in private and museum collections is lacking for this region, although one has been carried out in the Great Basin (Fowler 1994). Furthermore, in North America, strict limits are placed on the excavation of human burials, with which dateable plant-based artifacts may persist, and are not available for FCRPS studies. Additionally, the precontact inhabitants of this region saw fit to utilize a semi-mobile and politically decentralized lifeway, which leaves an archaeological record that requires greater subtlety of interpretation than one in which complex chiefdoms or states anchor themselves to a prime center and proceed to replicate themselves at greater and greater distances.

So the archaeological record in the Pacific Northwest presents a challenge to periodization, in that there is no ceramic chronology and basketry does not typically preserve. But beyond the nature of the assemblages is the history of work in the region. Academic studies in the 1940s did not appreciate the time depth of occupation in the Plateau. The earliest chronologies envisioned a 4,000–6,000-year sequence of occupation, which subsequent discoveries proved wrong. This was followed by a period of large-scale salvage projects carried out under the River Basin Surveys, a post–World War II public works project that, while it produced work of variable quality, did identify major sites and reveal the significant time depth in the Plateau. Not all the excavations were reported, and many of the site records are superficial by today's standards. However, some of the work resulted in important, published synthetic reports at the river valley or catchment area level.

The SWRD proposes a regional chronology with the intent of avoiding “reinventing the wheel” by simply creating another set of terms with which to describe the Plateau culture history. The goal is only to make explicit the core organization concepts that recur in the literature. Good work toward synthesizing these subregional chronologies has already been done (e.g., Ames 2000; Andrefsky 2004; Chatters 1995; Prentiss et al. 2005; Schalk and Cleveland 1983; Solimano and Gilmour 2014). A reasonable amount of consensus exists regarding the general outlines of cultural history, with smaller remaining areas of disagreement. However, terminology and periodizations have not been standardized. In Kuhn’s terms, this goal is not to create a new paradigm but to make explicit the paradigm that is already in use and which Plateau archaeologists share. For example, researchers in the Plateau generally agree on the utility of a Binfordian approach to describing hunter-gather settlement systems, as is embodied in the forager versus collector concept (Binford 1980). This general point of epistemological agreement is a boon to normal science in that it facilitates communication and allows Plateau archaeologists to make use of continued theoretical work within this paradigm (e.g., Kelly 1992; Perreault and Brantingham 2011).

The existing detailed subregional chronologies are all bottom-up schemes, based on intensive excavations within particular subregions. This RD instead attempts a top-down approach, drawing on what is known of the process of peopling, settlement, and resources intensification across the Americas. These broader patterns are tied into their regional expression across the Plateau.

5.3 Domain: Economies and Resources

Archaeological investigations and interpretation often begin by attempting to reconstruct the past economic system. This is because the economy underwrites all other cultural activities and provides a structure to the society under study (i.e., the “Culture Core,” as described by Steward 1955). The economy provides a bridge between the natural and cultural worlds, and is an arena of human life that most often leaves a recognizable physical record. While a strong economic determinism has been rightly criticized as too reductionistic (Resnick and Wolff 1982), it is hard to deny that human choices are circumscribed by what is available in the physical environment (“affordances,” as defined by Escobar 1999), and are also constrained by the limitations and hazards of the physical world. This section describes the approaches that have been used in the reconstruction of economies of the Plateau. These are most commonly HBE and processual in theoretical orientation.

5.3.1 Subsistence

In this research domain, subsistence is focused on methods of obtaining resources, and includes food stuffs, medicinal uses, and technological resources.

5.3.1.1 Subsistence—Food Resources

The classic anthropological division of increasingly complex social forms is the band–tribe–chiefdom–state progression (Service 1975). This is widely criticized as unilinear and deterministic in a way that is often inaccurate and not useful for describing developments in the Plateau. In this region, it is more apt to discuss socially complex versus simple or generalized (Hayden 1995). A generalized hunter-gatherer society is defined as egalitarian with a high sharing ethic, with residential mobility, and organized as bands with flexible membership. In contrast, complex hunter-gatherers are less residentially mobile (even fairly sedentary) with formal group membership based on kin and fictive kin measures such as lineages, age grades, and religious fraternity (Hayden and Cousins 2004). Ascribed (inherited) status and other measures of social inequality are found in more complex social arrangements. Leadership can include control over non-kin labor (Arnold 1993, 2004). Subsistence strategies based on delayed return and trade networks also mark complexity (Arnold 2001). Another measure of complexity is economic intensification that allows demographic increase beyond the carrying capacity of a generalized forager routine (Binford 2001). This involves manipulation of labor through debt relations, feasting, reciprocal exchange obligations, production of surplus, trade networks for the supply of prestige goods (Hayden and Schulting 1997), production of labor intensive goods, and prestige foods (Dietler and Hayden 2001). These forms of social organization are obviously not binary states, and a continuum of social forms from simple to complex is found in ethnographic and archaeological contexts (Burch and Ellanna 1994; Speth 1990).

Resource depression and intensification are research themes commonly discussed in the archaeological literature of the Plateau and lower Columbia River (Butler and Campbell 2004; Chatters 1989; Prentiss et al. 2005; Rousseau 2004). Resource depression is a concept that arises out of HBE models of optimal foraging (MacArthur and Pianka 1966) and proves helpful in addressing change without ascribing motivation or drivers for change. Calories are the typical currency that provides an avenue for evaluation of resource value. For example, all other things being equal (resource population being key), a deer is more valuable to a person than a mouse. Investigators across the world (e.g., Lindstrom 1992; Simms 1987; Stevens 2000) have generated data to provide this kind of cost-benefit analysis; the body size of the target resource is commonly applied as a useful proxy for value because it is positively correlated with caloric content (Broughton et al. 2011). Deployment of mass capture techniques and facilities (*sensu* Oswalt 1976) can increase the overall value of smaller resources (e.g., Madsen and Schmitt 1998). As very high-value animals are killed and populations decrease, their value also decreases because it takes a hunter longer to find them. At this point, two things happen: 1) the value of the particular resource decreases (i.e., resource depression occurs), and 2) the once lower-ranked resources are added to a hunter's diet (i.e., diet breadth expansion). The outcome of resource depression and diet breadth expansion can be resource intensification or generalized diet breadth expansion.

Varying and imprecise applications of the term *intensification* and its governing concepts have led to confusion surrounding the nature of resource use in the region (this problem is not limited to the Plateau). Ames (2005) has provided a detailed consideration of the implications of various applications of the term. In short, the term has two general applications: 1) an absolute increase in productivity (e.g., more salmon equals salmon intensification), and 2) intensification is an increase in the use of one resource with a relative decrease in use of other resources (e.g., more salmon less other dietary resources equals salmon intensification). In short, for some, intensification simply means increased production/exploitation, while for others (e.g., Butler and Campbell 2004:337), it means "increasing specialized resource use" or "specialization." The latter application is in keeping with early usage of the term (e.g., Boserup 1965) and with detailed consideration of diet breadth (Broughton 1994, 1997; Butler and Campbell 2004).

Generally, intensification includes an increased amount of effort put into production, which results in decreased overall returns unless technology (e.g., nets, storage) can be deployed to buoy returns. New technology increases general efficiency but then also creates a more complex relationship between resources and value than a simple catch-a-salmon-eat-a-salmon scenario. And complex interpretations may be unnecessary when simple ones are available. In comments on a draft of this document, Ken Reid notes evidence supports a hypothesis that salmon fishing with seines was most successfully practiced in stream reaches where islands or braided channels are common. There is a fairly good correlation between the distribution of islands and fishing villages.

Interestingly, mass capture facilities not only have been argued to allow realization of economies of scale but have also been suggested to be part of intentional conservation activities. Campbell and Butler (2010) have recently argued that facilities such as fish weirs not only allow for increased harvest efficiency but may also play a role in conservation-like behavior, although conservation may be unintentional. Smith and Wishnie (2000) note that conservation for the sake of conservation may be extremely rare in small-scale hunter-gatherer societies, simply because it is a less-than-optimal strategy in the near term.

5.3.1.2 Subsistence—Medicinal Uses

A wide variety of plants were used by Plateau tribes as remedies for illness and ailments. Medicinal plants were used for both physical remedies and to support spiritual healing (Turner 2014a). Remedies were conveyed as aromatics, tonics, pulstices, powders, or ingested in their natural state. Healing remedies were created from all parts of a given species, including roots, bark, leaves, cambium, flowers, fruits, and seeds. Fungi were also incorporated (Hunn et al. 1998). In addition to healing a specific illness or injury, plants were used to maintain good health and well-being. For example, tea made from species such as Labrador tea or black currant was used to maintain good health (Turner 2014a:420). The pitch of some trees was also chewed as gum as a curative for various ailments. For an excellent, and exhaustive, review of medicinal and ritual uses of plants used by people of the Pacific Northwest see Turner (2014a, 2014b).

5.3.1.3 Subsistence—Technological Resources

The vast majority of artifacts recorded within the CRB are lithic (stone) tools and debitage (waste material). Debitage is the discarded material detached from an artifact during its production and includes flakes, flake fragments, and shatter; some archaeologists also consider discarded cores as waste material (Crabtree 1982). Lithic debitage and fire-modified rock (FMR) are often the only artifact type remaining at sites.As noted above, while ethnographers have described Plateau tribes having a rich material assemblage made of various woods, plant fibers, and animal products, little of these materials have persisted in Plateau sites. As a result, much of archaeological assemblage analysis has focused on lithic items, with extrapolation of assumed organic items based on the functions and site types interpreted from the lithics, site features, and landforms. Most CRB site types include some amount of lithic material. Only a few site types within the CRB do not contain discarded lithic materials in the form of distinguishable tools or waste material from tool manufacturing. Often a stacked-rock cairn or rock alignment includes no artifact assemblage aside from the feature itself; these sites, however, can be categorized as lithic features.

Lithic studies have, for the most part, followed the same course as anthropological research in general. The first half of the twentieth century was a time of artifact classification and descriptive analysis. Research was centered on taxonomic systems in an analytical effort to reconstruct the trajectory of stone tools chronologies. Research in the middle part of the century refined regional chronologies through the use of newly developed and refined dating techniques. Spectrographic analysis explored the elemental composition of usable toolstone, and statistical analysis improved research designs and lead to behavior analysis and an understanding of spatial distributions within lithic assemblies. During the 1950s and 1960s, replication studies became an important step to understanding processes and techniques employed in the production of stone tools. The knowledge gained in these studies provided archaeologists with the framework to produce reduction sequences and interpret lithic assemblages. By the 1980s, replication studies began to wane, in part, as archaeologists felt the big questions had been answered and critics felt replication studies were more concerned with the craft of stone working than the science of human behavior. That is, many of the replication studies were focused on descriptions of technique, but did not bridge artifacts to behaviors.

Lithic analysis in the last decades of the twentieth century and into the present has concentrated more on use-wear studies, residue analysis, and toolstone sourcing, typically focusing on the microregional or site-specific level. Lithic studies within the CRB by federal and CRM researchers have remained primarily within artifact classification and descriptive analysis, with projectile points being the key temporal markers.

Analysis of stone tools at its most generalized form is the classification of artifacts based on overall morphological attributes. This stylistic approach is the basis for most stone-tool chronologies and classification models. Studying the evolution of form and function of tools and the process of stone-tool manufacturing and use enhances our understandings of human behavior and organization (Andrefsky 2000). This approach to lithic analysis models reduction sequences from procurement to end use. Sellet (1993) and Van Peer (1992) developed this approach, termed *chaîne opératoire*, to describe the succession of behavioral actions and mental processes required to manufacture an artifact and maintain it throughout its use life.

While formed tools (such as projectile points) encode a great deal of meaning related to chronology and function, they also tend to be among the first items looted from archaeological sites. Thus surface assemblages of artifacts can be less than representative with regard to the number and diversity of diagnostic artifacts originally present. Fortunately, full assemblage lithic analysis can provide significant information even in the absence of formal tools. For example, the number of Folsom points that had been present prior to looting at the Agate Basin site in Wyoming was determined by carefully recording and refitting channel flakes and flake fragments made during the fluting process (Sellet 2004). Research designs for the CRB need to explicitly formulate approaches to and goals of lithic analysis.

Toolstone

The manufacturing of stone tools is always a reduction process. The initial step is to obtain suitable stone. Tool-stone industries require stone types that have the necessary properties of texture, elasticity, and flexibility. Furthermore, the raw material must be relatively homogenous in texture and free of cracks, inclusions, cleavage planes, and grains in order to withstand the proper amount of shock and force required to detach a flake or blade from its parent source.

The most common flaked toolstone used within the CRB is cryptocrystalline varieties of silica (CCS). Some of the more common CCS stone types found in archaeological assemblages include chalcedony, agate, jasper, flint, and onyx, as well as petrified wood, which is easily identifiable and widespread throughout the CRB. Although visibly similar, these varieties of CCS have very different lithologies and efforts should be made to record them in ways that do not mask variability. Another group of stone represented in this report is crystalline varieties of silica. The materials in this group are easier to identify. Common toolstone from this group includes rock crystal and quartzite.

Varieties of igneous rocks used for stone tools include andesite, rhyolite, obsidian, ignimbrite, tuff, breccia, and basalt. Andesite and rhyolite are closely related to basalt and sometimes reported as basalt. Likewise, ignimbrite and obsidian are volcanic and best distinguished microscopically in a geological lab. Volcanic glass is common in the southern Plateau, with substantial surface-accessible sources in central Oregon but also elsewhere outside of the central basin. Most stone tools along the Snake River Plain in eastern Idaho are manufactured of obsidian due to the abundance of source sites located in that region. Some varieties of obsidian are recognizable to their source based on color patterns, but confident identification requires determining their chemical signature.

In addition to bedrock sources found throughout the Plateau, numerous quality toolstone pieces from sources to the north were deposited in the region by glacial activity and then sometimes redistributed by the floods at the end of the glacial period. These are often found as cobbles in river beds or in higher elevation areas to where they were rafted by ice flows and dropped in place as the ice melted from around them.

Reduction Industries

Flaked-stone artifacts can be classified as core-based or flake-based tools. Muto (1976) offers a regional-specific approach to Cascade lithic technology. Andrefsky (2000) defines a core as a piece of stone from which flakes are detached for use or modification. Cores can be unidirectional, multidirectional, bipolar, or characteristic of specialized blade-core industries. Blade cores can be conical, wedge shaped, informal, or multidirectional (Andrefsky 2000). Additional discussion of lithic technology can be found in Appendix A.

Throughout the CRB and North America at large, bifacial core industries are the most common. A bifacial core is flaked on two faces to create a single edge (lateral margin) outlining the core. This edge serves as the platform from which flakes are removed from two opposing sides. The removed flakes can then be formed into a tool, or the core itself can be reduced and refined into a formal tool (Andrefsky 2000; Crabtree 1982). Blade core industries are less common. Blade cores have multiple blade removals around the circumference of the core. A conical core for example, has a single striking platform at one end, and blade facets are oriented with the long axis of the core at approximate right angles to the platform (Andrefsky 2000; Collins and Lohse 2004). Some Clovis sites (outside the CRB) contain conical cores, and large scraping and cutting tools were manufactured from the blades. At the same time, Clovis spear points were bifacially manufactured. Diamond cross-sections sometimes observed on other early point forms like Haskett and Windust are suggestive of blade technology. A small tool-blade industry did exist on the Plateau (Daugherty et al. 1987), as indicated by microblades found in some sites from as early as 8000 B.P. to no later than 4000 B.P. Suggested functions of these small blades has included engraving tools, cutting tools, and slotted composite barbs for projectile point barbs or harpoons (Pokotylo and Mitchell 1998).

The chosen reduction strategy of a people directly ties to lithic procurement strategies, as does the evolutionary framework of projectile point forms through time. Jennings et al. (2010:2156) state: "The link between hunter gatherer mobility and stone tool-core reduction strategies lies in decisions regarding stone transport." As toolstone sources are distributed unevenly across the landscape and not necessarily in locations suitable for lengthy habitation or other resource extraction, hunter-gatherers had to devise strategies for carrying toolstone to ensure needed tools were available while minimizing transport costs (Bamforth 1986; Beck et al. 2002; Binford 1980; Goodyear 1989).

Biface cores played three important roles in hunter-gatherer mobility. They minimized transport weight compared to blade cores but maximized flake tool cutting-edge potential due to the numerous flakes that may be detached from the core. Biface cores themselves make long use-life tools as knives and digging tools because of their durability and can be resharpened as needed. Bifaces can also be refined and incorporated as parts of complex composite tools (e.g., spears, darts, and arrows) (Kelly 1988).

5.3.2 Settlement and Habitation Systems

In the conceptual framework put forward by Binford (1967), peoples of the Plateau over time utilized varying degrees of seminomadic and semisedentary strategies to obtain resources. At one end of the spectrum were foraging economies, which had the highest degree of residential mobility and mapping on to a succession of resource patches throughout the year. At the other end of the spectrum were subsistence economies that seasonally moved to abundant resource patches, forming a succession of base camps. Examination of the region's archaeological record through time indicates that foraging orientations were eventually replaced by collector strategies (Andrefsky 2004); how this came about as either a case of punctuated equilibrium, gradual evolution, or repeatedly reversed and independent local adaptations remains a topic for ongoing research.

How a group selected resource priorities from the mosaic of opportunities they recognized was not random but grounded in cultural factors, such as tradition, cultural knowledge, taboos, and social connections, as well as ecological factors that can be observed and measured: relative rank of accessible biomass, seasonality and reliability of resource availability, proximity to the residential base camp, and the number of frost free days in a watershed (the inverse of the watershed's overwinter period, when foragers are vulnerable to hunger). Humans make decisions about what to eat and consider the costs of attaining that food. In some manner, communities calculate whether one resource will provide a sufficient reliable return on their efforts to collect it compared with another resource. Search and transport costs associated with predation are fundamental considerations in this calculation. Collector-oriented economies select locations within a watershed that balance the calculation for various resource patches.

5.3.2.1 Catchment Areas

Named after the geomorphological term referring to a watershed, or the various surrounding drainages from which a stream draws water (Dasgupta 2006), the term *catchment area* refers to centralized places (sites) accessible to multiple surrounding resources. In archaeology, the catchment area of any given site is the area from which the residents draw resources. Unlike its geomorphological application, a cultural catchment area is not exclusively defined by a single watershed, as it may also comprise upland areas within a reasonable time circuit that contain valuable resources. Site locations commonly draw people to them based on access or proximity to resources.

In archaeological terms, catchment areas are where one is most likely to find evidence for the occupation and activities of people, simply because the centralized location with access to multiple resources makes for a desirable habitation locale. Catchment areas tend to be relatively compact. Ethnoarchaeological measurement in the Kalahari desert showed that foragers (in that case, the !Kung) rarely travel more than 10 kilometers (2 hours) from the base camp. The exception are hunters, who will set up overnight camps if they are required to travel further than 10 kilometers in pursuit of game (Banerjee 2013; Lee 1969).

Transportation was through a variety of pedestrian and riverine modes of load transfer. Dugout canoes would have been the principle mode of portage (Chenoweth 2008). However, there were also some technologies created to assist in carrying burdens on foot included pedestrian tumpines and pack baskets. After the introduction of the horse, land transport of goods became more practical (Mitchell 2015). In earlier periods, dogs may also have been utilized in a limited way as pack animals (Fiedel 2005; Yohe and Pavesic 2000).

In the CRB, the catchment area related to a residential site might encompass springs or streams, upland meadows, or a more descriptively complex topography. They may also relate to cultural features, such as access to trade routes or defensible locations. Examples of these might include a centralized hilltop or plateau that provides a broad view of the surrounding lowlands; a confluence of rivers that provides exceptional access to seasonally migrating fish; an alpine valley that provides access to berry picking, root gathering, and good hunting grounds; or a lakeside marine terrace at the base of a forest upland/lowland ecotone that is well positioned at the crossroads of multiple trade networks.

A hypothetical catchment area in the CRB may be envisioned to spread out from a residential base camp on a well-established river terrace both east and west along the river, and extending away from the river to encompass forested valley hills and prairie with terrestrial mammals, birds, and food and technological plants. The boundaries of a catchment area are not likely to be equidistant from the residence base because different methods of travel would be used (e.g., canoeing versus walking), and the topography may have barriers to travel (e.g., log jams in the river, cliffs, and talus slopes) in some directions. Figure 5-1 represents a simplified catchment area analysis of a stretch of the Pend Oreille River in the Calispell Valley.

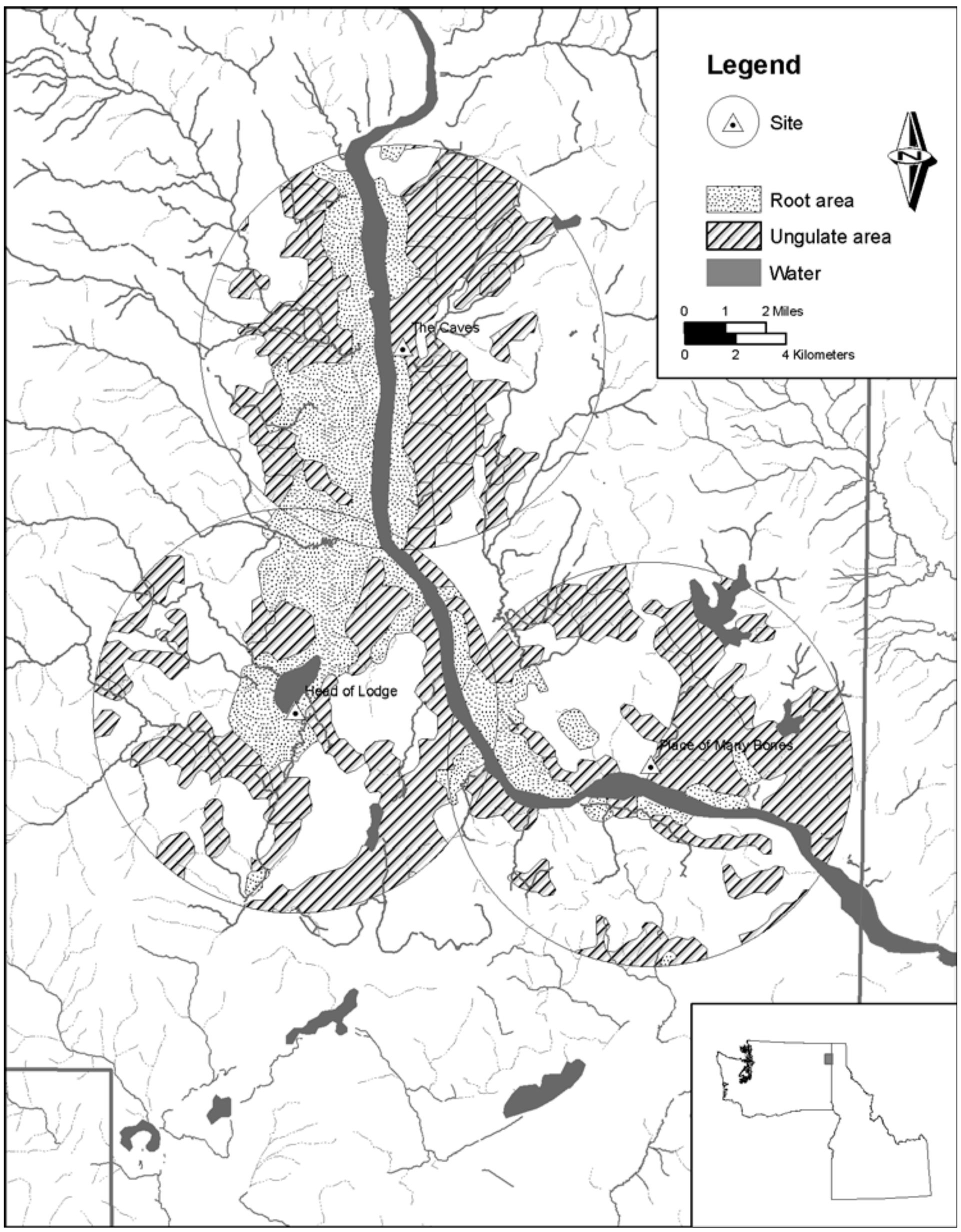


Figure 5-1. Simplified subsistence catchment analysis for the ethnohistoric Lower Pend Oreille watershed (Lyons 2015).

Variability in paleoclimates is integral to assessing a location's potential as a catchment area during any specific moment of prehistory, as wetlands, plant regimes, and other conditions often varied greatly depending on prevailing climatic conditions. For instance, a few thousand years ago, what may currently be low sagebrush steppe may once have been a productive inland lake and surrounding marshes.

5.3.2.2 Mobility, Predation, and Technology

The identification and evaluation of hunter-gatherer adaptations is often discussed in terms of three important concepts: mobility, predation, and technology (Chatters 1987).

Mobility describes human movement across the landscape and is measured in terms of type, frequency, stability, demography, scheduling, and range (Chatters 1987:339). Mobility encompasses the ways groups move across the landscape in order to identify the patterns and tempo of daily, seasonal, annual, and even generational activities. Theoretical models of hunter-gatherer mobility are central to the creation of research-driven data collection and analytical plans. Archaeologists can test assumptions about settlement strategy and land use via the material record.

A survey of global ethnographic data shows that there was greater variability in subsistence and settlement patterns among hunter-gatherer populations than is reflected in a simple forager-collector dichotomy (Kelly 1992, 2013). Further useful distinctions have been made between "*free wandering groups,* with no territorial boundaries: *restricted-wandering groups,* constrained by territorial limitations: *center-based wandering groups,* who seasonally return to a central village; and *semi-permanent sedentary groups*, who occupy a village year-round but move it every few years" (Kelly 1992:44).

Predation describes the primary subsistence acquisition strategy of hunter-gatherer peoples: utilization of nondomesticated plants and animals. The range of predatory strategies can be described in terms of the prey spectrum (measured in taxomonic richness), mode (or evenness), scheduling, and hunting tactics (Chatters 1987:339, 349). Chatters (1987) proposed empirical measures of many of these dimensions. Predation studies attempt to understand variability in resource acquisition and utilization and are integral to an understanding of past human behavior and decision making. Choices regarding which resources to use, and how and when to use them, may elucidate patterns of behavior that can be valuable in assessing archaeological materials in a larger context.

Observations about mobility and predation lead to a testable set of expectations in the archaeological record. Many archaeologists who study hunter-gatherer cultures have focused on lithic technology as a means to measure and evaluate changes in mobility strategies over time (Andrefsky 2009; Holdaway et al. 2004; Kuhn 2004). *Technology* relates to the means and methods of engaging with the physical environment. The Chatters model considers time budgeting and storage dimensions of technology (Chatters 1987:339, 352). Other researchers have focused on measures of reduction and conservation of toolstone, assuming that highly mobile foragers have access to high quality lithic sources as parts of their large territories but that they only contact them periodically, once a year or so, during their seasonal round. Thus they develop curated tool kits and tool forms that can be sharpened many times before they are considered exhausted. Archaeologists have theorized that the extent of reduction of early stage items in the tool-making process implies mobility, since it is assumed that people who travel more frequently will carry only preferred toolstone and use it more intensively. Biface core blanks, prepared microblade cores, and other low mass–high utility preforms are expected to be among the "personal gear" of very mobile populations (Binford 1979). Additionally, archaeologists anticipate that these cores would have been utilized to the greatest extent possible prior to being discarded. The most mobile populations likely extensively resharpened and recycled formal and informal tools. Therefore, metrics that allow for comparison of reduction (see below) have been developed in order to gauge the relative intensity of material use (Braun 2005; Clarkson 2002; Kuhn 1990).

Cross-cultural studies have led to results and methods with applicability to the CRB. For example, a survey of lithic technologies among mobile populations shows that biface-core technology is strongly correlated with greater mobility in western North America (Kuhn 1994), and microblade industries were likely an adaptation to high mobility in the late Pleistocene in Beringia (Yesner and Pearson 2002).

Archaeologically, the relationship between technology and its counterparts (mobility and predation) is complex, as technological adaptation in the form of changing materials and artifacts is what most often survives in the archaeological record. Thus, knowledge of relevant technologies in their temporal and spatial contexts is integral to our understanding of past human behaviors because it often informs our interpretation of mobility and predation, among other practices.

When considered in tandem, the mobility, predation, and technology concepts form the basis of an optimal foraging theory of hunter-gatherer adaptation. For instance, circa 4,500 years ago on the Columbia Plateau, people began slowly moving toward a pattern of semi-sedentism (Ames 2000; Chatters 1995). These people appear to have assembled in small groups of only a few, presumably kin-based family units, and congregated primarily along wetland, riverine, and lacustrine shorelines and river terraces in semisubterranean pithouses. Faunal assemblages from such sites indicate increasing use of riverine resources, particularly shellfish and anadromous fish (Ames et al. 1998). Over time, people invented more specialized tool assemblages to better fit the local resources and developing craft industries. Some of these tools allowed for more efficient resource acquisition (e.g., dip nets or smaller projectile points that allow for greater accuracy at greater distances). The ability to more easily access important resources within a localized radius enabled populations to remain sedentary for increasingly longer periods of time, which facilitated increased population density and the emergence of small villages (Andrefsky 2004).

5.3.2.3 Tethering or "Mapping-On" to Resources

Another concept relevant to an HBE discussion of the prehistory of the Interior Plateau, and particularly to research on complex hunter-gatherers in the region, are the concepts of "mapping-on" to particular resources (Binford 1978a, 1978b, 1980), and the practice of "tethered foraging" (Ames 2004; Cannon 2002). These ideas are fairly simple in their most basic logic. They differ in the sense that mapping-on is a process of directing labor activities toward specific goals, while tethered foraging is more a process of concentrating efforts on a particular resource/locale and utilizing the surrounding area as needed. Both present important implications to interpretations of hunter-gatherer lifeways in the past.

Binford (1980) suggested that foragers "mapped on" to resources relatively close at hand, sending individuals and groups out to obtain particular materials and bring them back to a residentially mobile base camp. Alternatively, collectors remained at base camps that provided access to the most potentially valuable resource, sending "logistical" foraging parties out to acquire other necessary commodities on an as-needed basis. In the case of "tethered" foragers, generally a certain resource or perhaps location was of particularly high value and/or abundance, causing people to want to stay in that area for a greater length of time, perhaps indefinitely. In essence, they became "tethered" to that particular location because it was a strategically good place to be for culturally determined reasons.

5.3.2.4 Site Types

The designation of "site types" is a way of describing sets of associated artifacts, features, and spaces that are commonly observed in close association with one another and which collectively indicate a particular activity or set of activities. The development of site types as analytical units is a heuristic device for interpreting the most likely purpose(s) of a particular set of archaeological remains. Site types are determined by the materials manifested in the archaeological record as the result of various practices and activities in specific contexts, associated with place, time, and various material remains. Site types are useful in order to broadly categorize a site and to group it analytically with other generally similar sites for comparison.

See Sections 6.3 and 6.4 for differentiation of site types within the Precontact and Historic Periods respectively.

5.4 Domain: The Historic Period

Historical archaeology is a subfield of anthropological archaeology that "studies the emergence, transformation, and nature of the Modern World" (SHA 2007). The so-called modern world encompasses a number of related social and economic systems, including nation-states, capitalist world economies, global population movement, industrialization, and urbanization, which introduce research topics specific to this period. The archaeological investigation of aspects of the modern world involves interpretation of data from multiple sources: the documentary record, oral histories, and material culture (including aboveground and excavated resources). Integrating data from all available sources allows for a stronger, more nuanced evaluation of a historic-period site and its significance (Church 2007; Hardesty and Little 2000; Schuyler 1978; Weaver 2014).

Because they are more recent, historic-period sites are generally more abundant than precontact sites; thus, they are more likely to be identified during archaeological surveys (Hardesty and Little 2000:3). Due to their relatively recent formation and prevalence, historic-period sites suffer from common misconceptions that influence how they are viewed and evaluated under Section 106. The first misconception is that the documentary record provides a complete view of the historic period. As a result of this misconception, the information potential of archaeological sites, particularly common site types, often goes unrecognized. Histories based solely on the documentary record overlook important subsets of the American population—for example, squatters, who did not file land claims and are not represented in the official land records for the region, and industrial laborers and other populations that were not the focus of written records. A second misconception stems from the mass production of material culture during the industrial revolution. Artifacts found at historic-period sites—glass, ceramics, metal, rubber, etc.—are similar to material culture used in the present. Due to assumed commonality between historic-period and modern artifacts, potential data related to historic-period seasonality, use wear, and consumer behavior is often overlooked. Researchers may also inadvertently disregard details on historic-period artifacts that indicate accurate occupation or deposition dates for a site (Hardesty and Little 2000; Horn 2005; Little 2007).

Within the context of Section 106, historical archaeologists' goals include site preservation and interpretation, reevaluating and broadening histories described in the documentary record, investigating lifeways of historic-period populations, developing archaeological methodology, and understanding social and economic systems of the modern world (Little 2007). Sites may be eligible for inclusion in the NRHP under Criteria A through D.

As historical archaeology developed (see Section 6.4), critics argued that the subfield was Eurocentric and that the polarization of precontact and historic sites implied that Native

Americans and other populations without written documents lacked history. For the purposes of this RD, the Historic Period is treated as a separate domain from previous domains due to the qualitatively different data sets available: written histories, media, built environment, and emic knowledge of the Euroamerican cultures that produced the materials. Despite this, it is important to remember that “no single, clear temporal or disciplinary boundary exists between historical and [precontact] archaeology” (Church 2007:8). The Native Peoples domain in this RD emphasizes the continuity of Native American populations from the precontact period into the present. As historical archaeology grew, practitioners sought to study the contributions of all participants in the modern world including, but not limited to, European explorers (PSI 2015), Euro- and Anglo-American fur traders and missionaries (Lightfoot 2004), Chinese laborers (Fagan 1993; Longenecker and Stapp 1993; Voss 2015), and other socioeconomic populations not well documented in the archival record (Askins 1988; Baumann 2004a, 2004b; Baxter 2005; Brandon 2004; Casella and Fowler 2005; Wegars 1991).

For the purpose of historical context, this RD refers to the 1998 Smithsonian *Handbook of North American Indians* for the Plateau (Walker 1998b) for much of the information published prior to approximately 1995. The *Handbook* contains two excellent chapters on the Historic Period: “History until 1846” (Walker and Sprague 1998), and “History since 1846” (Beckham 1998). Because the intent of the *Handbook* series is to focus on the history of Native Americans, those chapters review the experiences of Native Americans on the Columbia Plateau during the Historic Period. The following sections (5.4.1–5.4.12) provide a regional context for the CRB inclusive of the entire historic-period population. At such a broad scale, highlighting all of the ethnic, socioeconomic, gender, age, and other personhood categories that shaped people’s lifeways in the CRB is not feasible; this overview should be supplemented by research specific to local histories as appropriate during investigations pertaining to individual historic-period sites.

5.4.1 Exploration

In May 1792, Robert Gray secured his place in the history of the Pacific Northwest as the first American to record seeing the mouth of the Columbia River. Gray and his crew were on an expedition acquiring furs to trade in China. They sailed across the bar at the mouth of the river, spent nine days exploring the estuary and trading with the Native Americans in the area, and named the river after their ship, the *Columbia Rediviva*. Back in the Pacific Ocean, Gray encountered British Captain George Vancouver and mentioned the Columbia River during their meeting. Tasked with searching for the fabled Northwest Passage, Vancouver and his fleet reached the mouth of the Columbia River in October 1792. Lieutenant William Broughton, a member of the Vancouver expedition, sailed HMS *Chatham* beyond the bar and surveyed the lower Columbia River in that year. By 1800, the Columbia River had become an important locus of trade along the Pacific Coast; over 100 ships entered the mouth of the Columbia River to trade with native inhabitants before the Corps of Discovery, headed by Captain Meriwether Lewis and Lieutenant William Clark, reached the Columbia Estuary in 1805 (Dietrich 1995; Durrenberger 1998; Rochester 2003; Schwantes 1996).

As the first American-sponsored cross-continent expedition, the Corps of Discovery (also known as the Lewis and Clark Expedition) traveled with three related goals: exploration, trade, and the formation of political alliances with Native American groups throughout the Louisiana Territory. The journals of Lewis and Clark record the geography and environment through which the Corps of Discovery traveled, as well as their observations of and interactions with various Native Americans the party encountered during their journey. The Corps of Discovery reached the Snake River in October 1805; they first saw the Columbia River on October 16 that year. They traveled down the Columbia and established their winter camp in the Columbia Estuary. After wintering in the estuary, the Corps of Discovery traveled back up the Columbia River on their way back to St. Louis. Seeking to avoid the rapids of the Snake River on their return trip, the Corps of Discovery obtained horses and followed a trail along the river. They reached St. Louis in September 1806 (Dietrich 1995; Meinig 1968; Moulton 1988; Schwantes 1996; White 1991).

5.4.2 Fur Trade

Economically, the first half of the nineteenth century in the CRB, and in the North American West more generally, was dominated by the fur trade. Two British companies, the Northwest Company (NWC) and the HBC were in direct competition throughout the British territory in North America. The year after Lewis and Clark left the Columbia River behind, NWC employee David Thompson explored and mapped the upper Columbia River in an effort to establish transportation routes and trading posts throughout the region. Thompson established trading posts in Idaho and Montana and reached the source of the Columbia River in 1807 (Dietrich 1995; Emerson 1994; Lang 2015; Meinig 1968).

John Jacob Astor, an American entrepreneur, entered the fur trade by establishing the Pacific Fur Company (PFC) in 1810, sending employees to the Columbia River. The PFC began construction of Fort Astoria at the mouth of the Columbia River in 1811. Seeking to keep Americans out of the region, the NWC sent David Thompson to prevent PFC from building its trading post. With that goal, Thompson became the first European to travel the entire length of the Columbia River in 1811. He reached the mouth of the Columbia too late, however, to prevent PFC from building its post (Dietrich 1995; Lang 2015; Meinig 1968). Though the two companies were competitors, the employees joined forces to travel up the Columbia in search of inland locations for new trading posts. The PFC employees established Fort Okanogan at the confluence of the Okanogan River with the Columbia River (Nisbet and Nisbet 2009). One PFC employee, Alexander Ross, documented that journey, along with his other experiences as a fur trader in the

Pacific Northwest in *Adventures of the First Settlers on the Oregon or Columbia River* (1849). Despite the company's promising start, the PFC was an isolated American enterprise when the War of 1812 began. Unable to defend its territories from the British military, PFC abandoned its posts in the Pacific Northwest in 1813, selling all of its assets to NWC (Emerson 1994).

Under the direction of the British government, HBC and NWC merged under the former's name in 1821. Following the merger, Sir George Simpson toured the former NWC posts, implementing changes to improve transportation between posts as well as increased self-sufficiency at each post. Faced with the decline of the fur trade during the second quarter of the nineteenth century, the HBC introduced agriculture to the region. Other industries evident at HBC posts in the CRB included commercial logging, blacksmithing, and mining. The network of trading posts and related sites in the region was extensive. By 1834, at least 34 trading establishments were situated in the CRB. Small American ventures designed by Nathanial J. Wyeth failed to thrive or compete with the HBC during the 1830s. The HBC continued to enjoy its monopoly over the fur trade in the Pacific Northwest through the mid-1840s (Caywood 1967; Emerson 1994; Meinig 1968; Ross 1975; Simpson 1847).

5.4.3 Missionaries

In 1831, the Nez Perce and Flathead Nations sent a delegation of seven tribesmen to St. Louis, Missouri, in search of the "white man's Book of Heaven." Inspired by news of the delegation, and fueled by the enthusiasm for Oregon that had been growing among the American public throughout the 1820s, Protestant missionaries eagerly traveled to the CRB, seeking to spread their religion. In 1834, Methodist minister Jason Lee set out for the Columbia River in order to meet fur trader Nathanial Wyeth. Upon reaching Fort Vancouver, Lee decided to establish a mission in the Willamette River valley. Other Protestant couples who established missions in the CRB included the Whitmans, Spaldings, Eells, Smiths, and Walkers. None of the Protestant missions, however, could claim great success in attracting converts (Dietrich 1995; Schwantes 1996).

Foreshadowing the U.S. government's attitude toward Native Americans during the second half of the nineteenth century, Elkanah Walker wrote, "We must use the plough as well as the Bible if we would do anything to benefit the Indians. They must be settled before they can be enlightened" (as quoted in Dietrich 1995:175). The missionaries increasingly focused on promoting white settlement in the territory over converting Native Americans to Christianity. In 1840, Lee returned from the East Coast with 51 New Englanders, the so-called Great Reinforcement, and helped the pioneers settle at The Dalles and in other locations. In 1843, Whitman led 1,000 Americans along the Oregon Trail, in what became known as the Great Migration. The overland route effectively ended at The Dalles, where the pioneers would raft down the Columbia River to Fort Vancouver (Dietrich 1995; Schwantes 1996).

In 1838, two Franciscan priests traveled to the CRB at the request of retired HBC employees who had settled along the Willamette River. Their arrival initiated the era of Roman Catholic missions in the region. In subsequent years, 24 Roman Catholic missions were established in the CRB. Differences in religious doctrine between the Protestant and Catholic faiths, as well as allegiance to opposing national interests in a contested territory, fueled distrust among the missionaries. Sectarian disagreements between the missionaries confused the Native Americans, who were also concerned by the increasing stream of settlers arriving along the Oregon Trail in the early 1840s (Dietrich 1995; Karson 2006; Schwantes 1996; Utley and Washburn 2002).

In 1847, an immigrant train instigated a measles epidemic that killed up to half of the Cayuse population living near the Whitman Mission. In retaliation, the Cayuse killed Marcus and Narcissa Whitman and 11 others on November 29, 1847. This event marked the end of the mission era in the CRB and the beginning of 30 years of war between the tribes and the United States (Dietrich 1995; Karson 2006; Schwantes 1996; Utley and Washburn 2002).

5.4.4 International Boundaries, Territories, Tribal Treaties and Reservations

The United States' development as a nation-state coincided with its expansion in the CRB during the nineteenth century. This territorial expansion involved a series of negotiations with both England as well as sovereign Indian nations. In the years following 1792, American Robert Gray's and Englishman George Vancouver's activities at the Columbia River were used by their respective governments to lay claim to the Oregon Territory. On the one hand, after the 1804 Louisiana Purchase, the United States claimed all of the lands south of the 49th parallel. Great Britain, on the other hand, used the Columbia River as the southern boundary of their territory. The success of the NWC and the HBC throughout the region supported Britain's claim. Neither country devoted the military power to resolve the dispute, opting to rely on diplomatic negotiations, which stretched out for decades (White 1991).

By 1845, American settlers south of the Columbia River had their eyes on the HBC properties to the north. Negotiations over the British–American border resumed. Aware of the pressures from the increasing tide of American pioneers, the HBC relocated its headquarters from Fort Vancouver on the Columbia River north to Fort Victoria on Vancouver Island. On June 15, 1846, the United States and Great Britain signed the Treaty of Oregon, which established the international boundary at the 49th parallel (perhaps ironically, Victoria and part of Vancouver Island are south of that boundary). Two years later, Congress established the Oregon Territory, which encompassed the entire Columbia Plateau (Harrison 2008e; White 1991).

The 1850s were a turbulent period in the Oregon Territory. By 1850, over 11,500 emigrants had entered the region by way of the Oregon Trail. By the middle of the decade, settlers branched off of the Oregon Trail, traveling overland routes from the Walla Walla Valley to new settlements around Puget Sound. The federal government's actions continued to be reactionary to American settlers, rather than clearing the way for them, a pattern that caused significant strain throughout the region. In response to the Whitman Massacre (1847), a volunteer militia gathered at The Dalles in January 1848, built Fort Lee, and traveled to the Walla Walla Valley in search of the Cayuse who conducted the killings. The Cayuse War stretched from 1848 to 1850, concluding with the execution of five tribal leaders who surrendered and were found guilty for the Whitman murders. Seeking to maintain a presence in the valley, a strategically important point along the Oregon Trail, the Territorial Superintendent of Indian Affairs encouraged the militia members and their families to settle there. In 1850, Congress passed the Donation Land Law (also known as the Oregon Donation Act) as further incentive for occupying the Oregon Territory. Under the new law, each settler could claim a 320 acre tract (married couples could claim 640 acres) of land not yet legally acquired by the U.S. government (Beckham 1998; Karson 2006; Meinig 1968; Rochester 1998; Utley and Washburn 2002; White 1991). American settlers north of the Columbia River petitioned for a separate territory in November 1852. In spite of the low American population density north of the river, Congress created Washington Territory in March 1853.

Upon his arrival in 1853, Isaac Stevens held joint appointments as the Washington territorial governor, Superintendent of Indian Affairs for the Washington Territory, and representative of the Northern Pacific Railroad. Joel Palmer, who served as commissary-general of the volunteer forces during the Cayuse War, was appointed Superintendent of Indian Affairs for the Oregon Territory, also in 1853. Products of their time, Stevens and Palmer sought to clear the way for the influx of American settlers by negotiating treaties that established reservations for Native Americans in the territories. Between 1853 and 1855, Governor Stevens and Superintendent Palmer traveled from the Pacific Coast to the Rocky Mountains, conducting treaty negotiations with various Native Americans within the Washington and Oregon Territories. As representatives of the United States government, they structured the treaties, mostly incorrectly, on assumed political structures among the seminomadic tribes of the region, including the existence of leaders with the authority to sign away the lands within the tribes' usual and accustomed areas. Through the treaties, Native Americans ceded territory to the U.S. government in exchange for reservations, where residents were expected to adopt Christianity and sedentary agricultural lifestyles, and received promises of funding and education to help reservation residents develop that agricultural lifestyle (Beckham 1998; Harrison 2008a; Meinig 1968; Oregon Historical Society 2002; Washington State Historical Society 2015; White 1991).

Americans in the Pacific Northwest began settling on the land before the treaties were formalized. Unfortunately, the U.S. government did not ratify the first treaties until 1859. The discovery of precious metals near Fort Colville in 1854 exacerbated tensions between American emigrants and Native Americans because American settlers began to claim Indian lands. Fatal confrontations between miners and Native Americans in the CRB during the initial gold rush escalated into the Yakima War (1855–1858) (Arksey 2010; Beckham 1998; Meinig 1968; Tate 2004).

When the Yakima War began, Fort Dalles, established in 1850, was the only American military post between Wyoming and the Pacific. Between 1855 and 1880, four additional posts were established in the CRB: Fort Cascades (1855–1861); Fort Walla Walla (1856–1910); Fort Spokane (1880–1929); and Fort Colville (1859–1882) (Lindholdt 2011; NPS 2015c; Oldham 2003).

General William S. Harney lifted the settlement ban for the region east of the Cascades in 1859. Within a year, miners discovered gold at Oro Fino Creek on the Nez Perce Reservation. The Clearwater gold rush ensued. Congress created Idaho Territory on March 4, 1863, to appease miners who believed the seat of the Washington Territory's government was too far away to protect their economic interests (Idaho's present boundaries were established in July 1868). The final territory occupying a portion of the CRB, Montana Territory, was created in 1864 (Schwantes 1996).

Three reservations currently overlap FCRPS Project Areas: the Nez Perce Reservation, the Colville Reservation, and the Spokane Reservation. Representatives of the Nez Perce attended Governor Stevens's treaty council in Walla Walla in 1855. The Nez Perce signed a treaty granting them 7.5 million acres within their ancestral territory. A second treaty, signed in 1863, reduced the reservation to 770,000 acres after American prospectors discovered gold within the boundaries of the original reservation. The Dawes Act (1887) redistributed land within the reservation to individuals and opened the reservation to homesteading (Idaho Indian Tribes Project 2015; Schwantes 1996). A minority group of non-treaty Nez Perce (about one-quarter of the population) refused to settle on the reservation. The non-treaty Nez Perce, known as the Chief Joseph Band, were pursued by the U.S. Army across Idaho, Montana, and Wyoming during the Nez Perce War (1877). Upon their surrender, the Chief Joseph Band was initially sent to Indian Territory, before being allowed to return to the CRB in 1885. Some members of the Chief Joseph Band returned to the Nez Perce Reservation. Others settled on the Colville Reservation (Haines 1998; Kershner 2009).

Representatives of the groups who would come to be known as the CCT attended Governor Stevens's Yakima Treaty negotiations in 1855 but did not sign a treaty. The original Colville Indian Reservation, created by President Ulysses S. Grant in 1872, was located east of the Columbia River on land that American settlers viewed as prime territory in the CRB. Within three months of the first Executive Order, President Grant moved the Colville Indian Reservation to a smaller territory along the west bank of the Columbia River. Further reductions to the reservation occurred in the 1890s when the "North Half" was removed. The United States opened the reservation to homesteading in the twentieth century (Finley 2014). Representatives of the Spokane Tribe also did not attend Governor Stevens's treaty councils. In 1881, President Rutherford B. Hayes created the Spokane Reservation, consisting of approximately 159,000 acres northeast of the confluence of the Columbia and Spokane Rivers (Spokane Tribe of Indians 2015).

5.4.5 Gold Rushes

Two major mining rushes occurred in proximity to the Project Areas during the second half of the nineteenth century: the Colville gold rush (1855) and the Clearwater gold rush (1861). After HBC employees found placer gold near Fort Colvile in 1855, hundreds of miners rushed to the upper Columbia, trespassing across the Yakima Reservation in order to strike it rich. The Colville gold rush was relatively short lived and did not produce a substantial amount of wealth (Tate 2004). Miners moved on in search of their fortunes elsewhere. In 1860, Elias Davidson Pierce discovered gold on Oro Fino Creek within the Nez Perce Reservation. This discovery led to the Clearwater gold rush (1861), which produced enough wealth to shape settlement patterns in the CRB through the mid-1860s and into the present. Communities boomed in Lewiston, Pierce City, Oro Fino City, and Walla Walla as thousands of prospective miners traveled to the Clearwater River. Between 1861 and 1864, the Oregon Steam Navigation company transported 93,000 passengers and over 60,000 tons of freight on the Columbia River above Celilo. Approximately $3 million in gold dust was carried back down the Columbia River in 1861 alone. By the mid-1860s, the Clearwater gold rush had run its course. A few of the newly established communities stabilized and endured as permanent settlements, but most were abandoned as quickly as they had appeared (Meinig 1968; Schwantes 1996; Tate 2004).

5.4.6 Settlement

After the removal of the Native Americans to reservations and the lifting of the settlement ban in 1859, American settlement in the CRB followed a regional pattern. Towns were established near existing army posts and small rural zones, often arranged linearly up streams and creek beds in the best agricultural land, and were densely settled. Beyond the prime agricultural plots, more thinly occupied regions developed (Meinig 1968). In 1862, Congress passed the Homestead Act, designed to encourage settlement across the American West. The Homestead Act allowed any citizen or alien who declared his intention of becoming a citizen and who was head of a family and over twenty-one (this also meant women, many of whom were widowed during the Civil War) to claim 160 acres of land from the surveyed portion of the public domain. After residing on this land, adding improvements, and paying a small registration fee, he would become its owner (Bruce 2001).

Promoters of the 1862 Homestead Act and its subsequent amendments envisioned a class of small farmers spread across the nation. The act initially applied only to surveyed portions of the public domain. In 1880, Congress extended the act to include portions of the public domain yet to be surveyed. Between 1862 and 1890, 372,659 farms were claimed through the Homestead Act. By 1940, homesteads occupied 285 million acres of formerly public lands (Gilbert 1968:61, as cited in Bruce 2001; White 1991). While the Homestead Act is the most well-known piece of federal land distribution legislation, it is only one in a series of acts passed to promote settlement in the American West (Table 5-1). The success of each law varied.

Table 5-1. Chronology of U.S. Public Land Legislation (adapted from Church and Clark 2007:265).

Date	Legislation
1785	The Land Ordinance of 1785 established the township and range survey system.
1841	Pre-emption Act (repealed 1891) allowed settlers to stake a claim to 160 acres of public land, establish residency, and pay cash for it before it was made available in public auction.
1862	Homestead Act made surveyed land available in 160-acre parcels, either after five years residence and nominal payment, or after a six-month period and cash payment of $1.25 per acre.
1862	Pacific Railroad Act provided lands as a subsidy for Transcontinental Railroad and telegraph lines between Missouri and California.
1862	Morrill Act provided land grants by federal to state governments (excepting Confederate states), which states could sell to fund higher education in engineering, agriculture, and military science. This act was the basis for the state school section withdrawals from the public domain, and State Trust lands.
1864	Pacific Railroad Act modified to reduce the alternating sections provided the railroads from 10 to five miles on either side of the track.
1873	Timber Culture Act (repealed 1891) provided 160 acres provided the settler would plant a quarter of the land in trees.
1877	Desert Land Act provided 640 acres for $1.25 per acre, with $0.25 down, if the settler irrigated it within three years.
1878	Timber and Stone Act allowed people to buy 160 acres of nonagricultural land for $2.50 per acre.
1878	Timber Culture Act modified to require 10 acres planted with trees.
1880	Homestead Act was extended to unsurveyed lands.
1880s	The government moved against large ranchers who were illegally fencing public lands.
1887	Dawes Severalty Act was intended to end the reservation system through allotting land to individual tribal members.
1891	Pre-emption Act and Timber Culture Act are both repealed.
1902	Newlands Act/Reclamation Act of 1902 provided government help for irrigation of land. The federal government would plan, construct, and manage irrigation projects for the purpose of reclaiming marginal lands. Money for these projects would be generated by the sale of public lands. The lands to be sold were identified as being irrigable by the reclamation project, so were withdrawn and then earmarked for entry specifically keyed to the project. The ongoing expenses of the projects would be supported by fees paid by farmers and ranchers using the water.

Table 5-1. Chronology of U.S. Public Land Legislation (adapted from Church and Clark 2007:265).

Date	Legislation
1909	Enlarged Homestead Act doubled the available land for homesteads to 320 acres.
1912	Borah Act reduced the residency requirement from five years to three, and to seven months of each year. It facilitated homesteading of upland and forested areas.
1916	Stock-Raising Homestead Act increased the grants to 640 acres, without the cropping and residency requirements of the original Homestead Act.
1934	Taylor Grazing Act established grazing allotments, permitting, and fee system to regulate and manage grazing on public lands.
1935	Depression-Era Resettlement Administration, later known as the Farm Security Administration, resettled displaced farmers and ranchers from the areas hit hard by the Dust Bowl onto productive lands elsewhere.
1937	Bankhead-Jones Land Utilization Act was a government buy-back of marginal farmland. This act took lands most adversely affected by the Dust Bowl out of production.

5.4.7 Agriculture

5.4.7.1 Ranching

Already practiced by HBC employees and some Native American groups in the region, herding spread throughout the CRB in the early 1860s. Cattle and sheep were the major species in the region, though settlers also raised horses, mules, burros, and hogs. The cattle industry boomed along with the mines in the mid-1860s, then leveled out as the Clearwater gold rush tapered off and the mining communities raised their own herds in valleys adjacent to the mines. Exporting to new markets around Puget Sound and in the East, the range cattle industry peaked during the 1870s before being replaced by smaller ranches during the 1880s (Meinig 1968). By the 1930s, overgrazing, controlled burns to stimulate grass growth, and wildfires presented challenges for the livestock industry in the CRB (National Research Council 2004).

5.4.7.2 Farming and Irrigation

The HBC introduced subsistence farming to the Pacific Northwest in the 1820s, as the company sought to increase the self-sufficiency of their trading posts. Missionaries and settlers arriving in the 1840s also brought agricultural methods and cultivars with them, planting orchards, gardens, and grain on early homesteads along the river valleys. Missionary Marcus Whitman constructed the first recorded irrigation ditch in the CRB in the early 1840s. Small scale irrigation occurred in the CRB through the early 1890s. Settlers along the rivers, creeks, and streams diverted water to irrigate their orchards and gardens (Meinig 1968; Pfaff 2002).

Similar to the livestock industry, farmers responded to the booming demand for oats and wheat during the Clearwater gold rush. The early 1860s were marked by increased production of wheat throughout the CRB and agricultural experiments to determine the optimal planting and growing conditions for the crop. As the Clearwater gold rush ended, farmers began exporting their crops to markets as far away as London by way of the Columbia River. By 1870, agriculture had become the primary industry in the CRB. The construction of railroads across the region (primarily in the 1880s) furthered industrial growth. The railroads attracted new settlers and opened up additional routes through which they could export products to distant markets. This coincided with a peak in individual and cooperative irrigation ventures in the 1880s. This type of irrigation was generally inexpensive and easily constructed. When local farmers formed cooperatives to build an irrigation ditch, their purpose was to improve their own lands (Meinig 1968; Pfaff 2002).

Larger-scale irrigation projects began in earnest in the 1890s, as regional boosters promoted crops beyond the primary wheat fields. Construction of the Sunnyside Canal, the largest private canal system in the Washington Territory at the time, commenced in the Yakima Valley in 1890. Attempts to irrigate the Quincey Valley, east of the Columbia River, began in 1898. In each case, outside investors joined with railroad companies to finance irrigation efforts designed to attract settlers to the CRB. Each of these initial ventures failed due to financial difficulties. Construction of the Sunnyside Canal recommenced and was completed in the twentieth century (Matthews 2006; Meinig 1968; Pfaff 2002).

Private irrigation companies were responsible for watering approximately 2.3 million acres in the region by 1910. By the turn of the twentieth century, farmers successfully supplied alfalfa, apples, cherries, peaches, grapes, beans, potatoes and a number of other fruits and vegetables to regional markets (Meinig 1968).

The federal government recognized that state and local incentives for irrigation were not strong enough to create large-scale irrigation projects. The Newlands Act of 1902 authorized the Secretary of the Interior to construct irrigation works to reclaim arid lands in the American West before opening those lands to settlement. The newly formed United States Reclamation Service (later the Bureau of Reclamation) considered and surveyed several potential projects in the CRB. The Columbia Basin Project (CBP) was deemed too expensive at the time. Early twentieth-century Reclamation projects focused on the Okanogan and Yakima Rivers instead. The success of the wheat industry in the CRB continued through World War I, as the United States exported crops and other foodstuffs to European markets. After the war, cycles of overproduction and falling prices were exacerbated by drought conditions throughout the United States. Between 1910 and 1930, the population in the western half of the Columbia Plateau dropped by 40 percent. Social and economic conditions in the United States during the Great Depression led to a new era of farming and irrigation in the CRB. Small homesteads gave way to larger agricultural ventures, financed by outside investors. Irrigation projects considered too costly before World War I, the CBP and associated Grand Coulee Dam, provided jobs for out of work Americans during the Great Depression. By the twenty-first century, over 6.5 million acres (37 percent of the total cropland in the region) was irrigated. Ninety-three percent of water use in the CRB was for agricultural purposes and ten percent of households in the CRB were occupied by farmers, farm tenants, and ranchers (Dietrich 1995; Meinig 1968; National Research Council 2004; Pfaff 2002).

5.4.8 Logging

As with the other major historic-period industries, the HBC was the first entity in the Pacific Northwest to conduct commercial logging operations in the CRB. Employees at Fort Vancouver began logging in 1827 to supplement company profits as the fur trade dwindled. Commercial exports of timber began in earnest in 1848, when a mill was established in Oregon City. By 1850, 37 sawmills had been established in the Northwest, most near the mouths of the Columbia and Willamette Rivers. The industry dominated the region during the second half of the nineteenth century and through the first half of the twentieth century. In 1899, all but seven towns in western Washington depended on lumber for their economic livelihood. With a few exceptions, nineteenth-century logging was centered in the forests ranging from the Pacific Ocean to the Cascades, where Douglas fir, cedar, spruce, and hemlock were prevalent. During the twentieth century, the logging industry expanded east of the Cascades, where ponderosa pine and western white pine dominated (Harrison 2008d; Holbrook 1990).

Having depleted the forests of Michigan, Minnesota, and Wisconsin, investors from the Midwest set their sights on pine forests in the CRB. When Frederick Weyerhaeuser and his associates purchased 900,000 acres of timberland from the Northern Pacific Railroad in 1900, they initiated a rush of investment and speculation on timberlands in the Pacific Northwest. Throughout the first half of the twentieth century, the timber companies were forced to adjust their Midwestern business models and logging practices to handle the new challenges the geography, ecology, and forest fires of the CRB posed. Though individual companies experienced varying levels of success or failure in meeting those challenges, the timber industry remained (and still remains, although to a lesser extent) essential to the economy in the region. In 1914, logging provided 55 percent of payrolls in the Northwest. The timber industry boomed during World War II, resulting in the introduction of new technologies in the region and logging farther from primary river tributaries. By the 1970s, the environmental impacts of over a century of logging in the CRB became a scientific and popular concern. As a result, laws were enacted to try to minimize the ecological damage done by the timber industry (Harrison 2008d; Hidy 1962; Holbrook 1990; Schwantes 1996).

5.4.9 Fishing

At its peak, fishing was the second largest industry in the Washington and Oregon Territories (behind the timber industry). The HBC shipped barrels of salmon to London in 1827, the first recorded fish exported from the CRB. Missionaries and other settlers joined the salt-salmon trade, but they struggled to find ways to store and preserve the fish being transported to Hawaiian, British, and other distant markets. As methods improved, salt-salmon fisheries continued to operate in the CRB through the 1880s (Schwantes 1996; Smith 1979).

Implementation of canning technology transformed the fishing industry in the CRB. Hapgood, Hume & Company built the first cannery on the Columbia River in 1866. In its first year of business, the company packed and sold 4,000 cases of salmon. At $16 per case, each case contained 48 one-pound cans of salmon. The fish industry experienced steady growth over the next two decades. By 1885, 39 canneries employed over 3,500 fishermen and packed 629,000 cases of salmon. The mid-1880s marked the peak of the fishing industry in the CRB (Smith 1979).

Technology associated with the salmon industry ranged from gillnets and dipnets to fish wheels, canneries, and fish hatcheries. As early as the 1870s, industry officials realized that the large supply of salmon would not last. Overfishing, decreased habitat due to irrigation, and the experimental nature of the hatcheries in the nineteenth century were among the factors that led to a decrease in salmon exports during the early twentieth century. Demand for canned salmon increased during World War I and remained consistent through World War II, as canned fish cost less than other meat. Though consumer demand for salmon remained high, the salmon supply continued to decrease through the 1940s. After World War II, salmon became a luxury food item rather than a household staple. By 1970, only six canneries operated in the CRB. The last major cannery shut down in 1980 (Harrison 2011; Petersen and Reed 1994; Smith 1979).

Centered in Astoria, Oregon, most of the salmon industry was located beyond the Project Areas. One major exception was the Seufert Brothers Company, who operated facilities between The Dalles and Celilo Falls. Francis Anthony Seufert arrived in the CRB in 1880. His brother Theodore arrived the following year. They installed their first fish wheel in 1884. In total, The Seufert Brothers Company owned and operated 19 stationary fish wheels and 17 scow wheels (portable fish wheels) in the CRB until fish wheels were outlawed by Oregon (1926) and Washington (1934) (Fisher 2015; Smith 1979). Francis Seufert's (the son of Francis Anthony Seufert) *Wheels of Fortune* (1980) is an excellent source on the company history and the salmon industry in the CRB. The Seufert Brothers Company closed in 1954, during construction of The Dalles Lock and Dam (Fisher 2015).

5.4.10 Hydroelectricity

Throughout the nineteenth century, settlers sought, to little avail, government assistance in modifying both the Columbia and Snake Rivers to ease transportation over dangerous rapids and to irrigate fertile soil in the region (Meinig 1968; Petersen and Reed 1994). Puget Sound Power and Light Company, a private entity, constructed the first dam on the Columbia River at Rock Island between 1929 and 1931. Simultaneously, the USACE River Basin Survey (RBS) team surveyed the CRB and devised a plan that would develop the resource potential of the river along multiple fronts: navigation, flood control, irrigation, and hydroelectric power. The RBS report laid out a plan for the construction of 10 multipurpose dams in the CRB. Faced with national unemployment rates around 25 percent when he entered office, President Franklin D. Roosevelt approved funding for construction of both the Bonneville Lock and Dam and the Grand Coulee Dam in 1933, putting thousands of unemployed Americans to work. Construction of Bonneville Lock and Dam was completed in 1938. The Grand Coulee Dam, the largest concrete structure in the world at the time, was completed in 1941 (BPA ca. 1980; Dietrich 1995; White 1991).

The impacts of the dams on demographics in the CRB cannot be overstated. The Grand Coulee provides a case study. Construction of the dam began in 1933. By 1934, 7,000 people lived and worked in Grand Coulee, Washington. In addition to dam construction, populations and infrastructure within the planned storage reservoir behind the dam (Lake Roosevelt) were relocated or abandoned. Reclamation identified thousands of acres of land, 2 railroads, 3 state highways, 14 bridges, 4 sawmills, 4 telegraph and telephone systems, power lines, cemeteries, and 11 towns (population centers large enough to have a post office) that the Grand Coulee dam project would affect. Some of the impacted residents reestablished their towns at higher elevations in the region, others moved away from the CRB entirely (Dietrich 1995; White 2014). Upon its completion, Grand Coulee stimulated population growth (due to irrigation and hydroelectricity production) and tourism within the CRB. In 1946, the National Park Service took over management of Coulee Dam National Recreation Area (renamed Lake Roosevelt National Recreation Area in 1997). In 1947, 27,500 people visited the park. The number of visitors jumped to over 260,000 the following year. By 1987, over a million people were visiting the park each year (Dietrich 1995; NPS 2015a, 2015b).

As population and industry in the Pacific Northwest expanded during the second half of the twentieth century, the demand for electricity increased. At present, the CRB is the most heavily dammed river system in the world, with 14 large dams on the Columbia River, 20 on the Snake River, and over 500 smaller power and irrigation dams in the CRB (Dietrich 1995).

5.4.11 Nuclear Weapons and Power

The dams were not the only federal projects that stimulated population migrations during the twentieth century. In 1943, "Hanford Engineer Works" was established on 670 square miles of land along the Columbia River between Richland and White Bluffs, Washington. The Hanford Site was the final site selected for the Manhattan Project, chosen based on its relative isolation, the cold water of the Columbia River (to cool the nuclear reactors), and the supply of hydroelectric power available from the Bonneville and Grand Coulee dams. Though the location was remote, it was not deserted. The U.S. Army removed over 1,500 residents from their homes and communities in order to construct the Hanford Site. Existing homes and other structures were used as living quarters during construction of the Hanford Site (Marceau et al. 2003).

By the end of the war (August 1945), the Hanford Site comprised 554 non-residential buildings devoted to plutonium production. These buildings included reactors, separation plants, laboratories, warehouses, craft shops, and electrical substations. At the peak of construction (1944), 45,000 people lived in the Hanford construction camp (within and around the evacuated town site of the same name). Employees working in the plutonium production plant settled in the nearby community of Richland (Marceau et al. 2003).

The Hanford Site continued to grow through the second half of the twentieth century, as Cold War tensions escalated. Peak production of weapons-grade plutonium at Hanford occurred between 1956 and 1965 (the height of the Cold War). The demand for plutonium fell dramatically the over the next decade. Managers of the plant searched for ways to diversify their production and boost the local economy. Emphases at the plant shifted from production to research and development programs in the late 1960s and the 1970s. By the 1980s, environmental concerns over hazardous waste at the Hanford Site led to public criticism. In 1989, the U.S. Department of Energy, the EPA, and the Washington State Department of Ecology signed the Tri-Party Agreement, under which the U.S. Department of Energy was responsible for cleaning up the Hanford Site within a 30 year time frame (Marceau et al. 2003).

5.4.12 Transportation

As is evident from the preceding sections, historic-period occupation and industry in the CRB were inextricably linked to advances in transportation from the nineteenth century through the present. The Columbia and Snake Rivers operated simultaneously as passageways and hazards to explorers, traders, missionaries, farmers, and industry workers through the region. During the first half of the nineteenth century, explorers and traders traveled on the rivers, using existing portages and trails around dangerous rapids. Routes used by the fur traders and missionaries laid the way for the Oregon Trail along the south bank of the Columbia River to The Dalles.

Emigrants rafted the river from The Dalles to Fort Vancouver and the Willamette Valley (Dietrich 1995; Schwantes 1996).

In 1836, the HBC introduced the *Beaver*, the first steam-powered vessel on the Columbia River. The steamboat era took off during the 1850s and 1860s, as Americans settled throughout the CRB, requiring transportation for themselves and their commercial exports (gold, wheat, timber). In 1860, the Oregon Steam Navigation Company (OSN) formed and would monopolize river transportation in the CRB for the next two decades. While steamboats provided transportation along the river, entrepreneurs established and operated ferry crossings to carry people and goods across the rivers. Mechanisms for powering the ferries spanned a range, including sails, horses, underwater or overhead cables, and steam or gasoline engines, depending on river conditions at the crossing and the financial status of the ferry operator. The steamboat era in the CRB came to a close in the 1950s (Harrison 2008c; Ruby and Brown 1974).

Railroads in the CBR were initially designed to facilitate transit around dangerous rapids on the Lower Columbia River. The first railroad, constructed in 1851, consisted of a portage tramway around the Cascades Rapids, in the present vicinity of Bonneville Dam. By 1862, railroad portages operated on both sides of the Cascades Rapids. Maintaining its monopoly on transportation in the CRB, the OSN constructed The Dalles & Celilo Railroad the following year. In 1875, a businessman in Walla Walla constructed the first narrow-gauge railroad to transport wheat from Walla Walla to the Columbia River (a 28-mile-long track) (Harrison 2008b; Holbrook 1990).

Prior to his arrival to the Pacific Northwest, Washington Territory's first governor Isaac Stevens was appointed as a representative for the Northern Pacific Railroad. Within that role, Stevens led surveys of five possible railroad routes through the Pacific Northwest. The outbreak of the Civil War caused delays in the selection of cross-continental railroad routes and spurred the federal government to give large land grants to railroad companies to help finance the railroads. In 1864, Congress chartered the Northern Pacific Railroad and granted the Northern Pacific 60 million acres from Lake Superior to the Pacific Ocean. The Northern Pacific line through the CRB was completed in 1883. The Northern Pacific constructed the first bridge across the Columbia River, near Pasco, Washington. Additional transcontinental lines reached the CRB between 1885 and 1909 (Harrison 2008b; Holbrook 1990; Holstine and Hobbs 2005; Meinig 1968).

Similar to the railroads, the first wagon road in the region was constructed around the portage of the Cascades (on the Oregon side) in 1856 (Bullard 1982). In 1907, the first public road bridge was constructed across the Columbia River near Wenatchee, Washington. The rise of the automobile in the early twentieth century fueled the construction of county roads and state and interstate highways, as well as a series of related bridges, in the CRB throughout the century (Holstine and Hobbs 2005).

CHAPTER 6—RESEARCH THEMES

6.1 Environmental Variability

6.1.1 Geomorphic Drivers of Landscape Change

6.1.1.1 Alluvial Forces

Post–Missoula Flood alluvial deposits represent one of the most important sediment deposits in relation to human use and settlement of the FCRPS Project Areas, as they represent chronological markers. While each dam and reservoir Project Area contains alluvial deposits (Ma et al. 2009; Schuster et al. 1997; Zientek et al. 2005), the timing and nature of their formation is variable. Much of the alluvium in the FCRPS Project Areas is found at the confluences of rivers and their tributary streams, where terraces and alluvial fans commonly form. In meandering river systems, or portions of rivers that are less confined within their floodplains, streamside terraces are often preserved as erosional forces migrate away from established landforms.

In some areas, post–Missoula Flood alluvial deposits began to accumulate during the late Pleistocene and early Holocene, shortly after the last great flood event (Chatters and Hoover 1986, 1992; Hammatt 1977; Lenz et al. 2001; Mierendorf 1983). Deposition of alluvial materials during this time was spurred by greater amounts of both alluvial and aeolian material available for erosion, transport, and deposition. For example, Mierendorf (1983) argues that three or four episodes of alluvial aggradation occurred along the Rocky Reach section of the Columbia River, sometime before 7900, around 3000, and 1400 B.P., and again after approximately 500 B.P. Chatters and Hoover (1992) identified periods of aggradation occurring approximately 9000–8000, 7000–6500, 4400–3900, and 2400–1800 B.P. in the Wells Reservoir vicinity of the Columbia River.

Huckleberry et al. (2003) discuss the presence of erosional terraces along the margins of the Columbia River near Kennewick, which formed as a result of the Columbia River downcutting through alluvium sometime between the emplacement of Missoula Flood sediments at the location and the eruption of Mount Mazama approximately 7,600 years ago. The terraces are capped by alluvium or aeolian deposits that stabilized during the mid- to late Holocene, around 2000–3000 B.P. (Huckleberry et al. 1998; Wakeley et al. 1998).

Lenz et al. (2001, 2007, 2008) have identified two periods of landscape stability and soil formation that occurred in the central Plateau region of the CRB after the last Missoula Flood events. The Bishop Geosol is thought to date between the depositions of the Mount St. Helens Set S and the Glacier Peak tephras (roughly 13,000 years ago), while the Badger Mountain Geosol formed between the eruptions of Glacial Peak and Mount Mazama (between approximately 13,000 and 7,600 years ago). These buried soils have been identified in alluvial and aeolian sediments in the central Plateau region of the CRB and can be an important datum, if present. These geosols can be contrasted with other landforms where these soils are missing as part of understanding landform development and potential. Lenz et al. (2001) argue that the early Holocene terrace sediments within which these soils formed are found in extensive tracts along the mainstem Columbia River. Along portions of the upper Snake River, alluvial terrace deposits containing archaeological sites are found overlying Pleistocene Missoula Flood deposits, but are thought to have formed during the late Holocene—much later than in other FCRPS Project Areas (Plew and Guinn 2015).

Post-glacial sea level rise also affected alluvial systems within the FCRPS study area. At the end of the Pleistocene, eustatic sea level rise was accompanied by base level rise in rivers that drain into the ocean. Base level within the Columbia River rose during the late Pleistocene and early Holocene, resulting in significant amounts of deposition within the lower stretches of the river where higher water levels resulted in greater accommodation space for sediment to be deposited (Baker et al. 2010; Leopold and Bull 1979; Schumm 1993). Although the majority of the base level-related deposition did not extend far upstream beyond Portland, Oregon (Peterson et al. 2013:1206), upstream tributaries likely experienced some increased deposition near their confluences with the rising water levels of the Columbia (Knighton 1998).

While these studies highlight periods of aggradation in the Columbia and Snake River basins, other studies found little or no alluvial build-up along regional river margins. For example, on the Chief Joseph Reach of the Columbia River, Campbell (1985) found evidence of continuous downcutting through the Holocene. The diversity of findings highlights the variability of processes and sedimentation that occurs through time and space along the length of a river system. For each FCRPS Project Area, differential rates and amounts of erosion and deposition have created complex alluvial landforms whose histories should be viewed at both local and system-wide scales.

6.1.1.2 Aeolian Forces

While loess represents a region-wide sedimentary deposit, the history of its deposition varies through time and space. Four Pleistocene-aged soil-stratigraphic units have been identified on a regional scale that correspond to periods of landscape stability between episodes of loess deposition (McDonald and Busacca 1989). The most recent soil, the Sand Hills Coulee Soil, formed in loess deposits that overlie the 13,000 year old Mount St. Helens Set S tephra, suggesting the soil formed during the late Pleistocene/early Holocene (McDonald and Busacca 1989:151). Studies in the vicinity of the Pasco Basin in south-central Washington have documented reactivation of aeolian processes that have led to dune sand deposition during the mid-Holocene (roughly 6,800 to 3,900 years ago) (Gaylord et al. 2001).

More local-scale aeolian dune creation, movement, and erosion events have likely occurred in the region throughout the late Pleistocene and early Holocene. These deposits and depositional histories need to be addressed at a local scale to determine their impact on human activities in the area (e.g., Chatters et al. 1995b), as well as their potential for burial and preservation of evidence of this human activity. If humans occupied the area between aeolian events, archaeological evidence of this occupation could be found buried beneath deep sand layers.

6.1.1.3 Mass Movements

Mass movements are a major geomorphic driver within all stretches of the Columbia River. Gravity is the driving force behind landslides, but other factors play a role in landslide susceptibility, frequency, timing, and size. The State of Washington has defined six landslide provinces (areas where landsliding has played a role in landscape geomorphology in the past and/or may in the future), which include three that overlap with the FCRPS Project Areas (Washington State 2014). These include northeastern Washington in the Okanogan Highlands portion of the Northern Rockies; the Cascade Range; and portions of the Columbia Plateau, especially along the Columbia River Gorge. The scale of mass movements in the region varies, ranging from large-scale landsliding to micro-scale soil creep (Ritter 1986).

While landslides most commonly occur in areas of high relief, such as in mountainous regions or steep river valleys (like the Columbia River Gorge), studies in the southern CRB have shown that large landslides also occur in relatively moderate- to low-relief areas. Landslides in the Cascades and Columbia Plateau have been documented at locations where modest local relief intersects contacts of weak sedimentary or volcaniclastic rock and coherent overlying cap rock (such as a younger lava flow) (Safron et al. 2011).

In northeastern Washington, landsliding along the banks of the Columbia River has been a geomorphic driver for millennia. Mass movements have modified, created, and buried river terrace sediments since incision of the river into the surrounding landscape was initiated (Jones et al. 1961). These mass movements occur as part of a normal fluvial regime along rivers where lateral movements undercut river margin deposits.

Damming the river and creation of the reservoirs resulted in more landsliding along those stretches of the reservoir. Jones et al. (1961) documented the marked uptick in landslide frequency that took place in the Pleistocene deposits that border Franklin D. Roosevelt Lake during and after the construction of the Grand Coulee Dam. Landsliding has been documented along most of the reservoir margins from both before and after filling of the reservoirs (e.g., Gatto and Doe 1983; Hansen 1989; Miklancic 1989; Othberg et al. 2002; Voight 1979) and is likely caused by the combined effects of increased saturation and erosion/undercutting of bank sediments.

One of the more well-studied areas of landsliding and its effects on the natural and cultural environment is within and upstream of the Columbia River Gorge, in the area of the Bonneville, The Dalles, and John Day Dam Project Areas. The rapids at Cascade Locks, or Cascade Rapids, were created as a result of catastrophic landslides released from Table Mountain and Greenleaf Peak, the landform that lines the northern margin of the Gorge near Cascade Locks (Palmer 1977; Pierson et al. 2014). Two large, recent landslides have been recorded as originating from the headscarp visible at Table Mountain: the Bonneville and Red Bluff landslides.

Based on radiocarbon and tree-ring dating, the Bonneville landslide is estimated to have occurred between A.D. 1416 and 1452 (Pringle 2009; Reynolds et al. 2015), with current data suggesting the event may have occurred between A.D. 1440 and 1450 (Pierson et al. 2014). Debris from this landslide, with an estimated size of 8.7 square miles, ran down the southern face of Table Mountain and extended southeast across the Columbia River, blocking its flow (O'Connor and Burns 2009). The landslide blockage created a land bridge across the river, the subject of the Native American oral tale "Bridge of the Gods" (Clark 1952; Lawrence and Lawrence 1958).

The impoundment of waters behind the landslide created what geologists call the "Lake of the Gods," which may have stretched as far as 155 miles upstream, as far as Wallula Gap (O'Connor and Burns 2009). The elevation of this lake at its highest level is estimated to have been approximately 280 to 300 feet above mean sea level. Delta deposits found perched many meters above the modern mouths of tributary streams along the margins of the Columbia River attest to the high lake levels and suggest the lake may have persisted for decades (Jim O'Connor, personal communication 2015).

Geologic evidence suggests multiple breaches of the Bonneville landslide and draining of the impounded water (O'Connor and Burns 2009). At least one of the breaches was of sufficient magnitude to deposit distinct beds of coarse-grained materials many miles downstream. At the time of the Bonneville Dam installation, postbreach water levels behind the slide were still elevated relative to prelandslide conditions, suggesting incomplete breaching of the landslide by the river (O'Connor 2004). As a result of the Bonneville landslide, the Columbia River shifted its channel approximately 1.2 miles south to run along the southern margin of the landslide toe.

A second landslide, the Red Bluff landslide, modified a portion of Table Mountain to the east of where the Bonneville landslide occurred (Randall 2012). This slide measured approximately 11.7 square miles, and, like the Bonneville landslide, is part of the Cascades landslide complex. Although the exact timing of slide initiation is not known, some research suggests the possibility that the initial slide may have occurred in the late 1600s or early 1700s, perhaps in association with a large Cascadia Subduction Zone earthquake (Thomas Pierson, personal communication 2015).

Landsliding within the Columbia River Gorge has likely affected human use and settlement of the area since the beginning of occupation of the Pacific Northwest. Analysis of LiDAR data in the western portion of the Gorge identified slide landforms dating from more than 10,000 years in age (Pierson et al. 2014). Large landslide events in the Gorge and along other rivers within the FCRPS study area would have destroyed the land and associated inhabitants along the path of the slide. However, along the margins of the mass movements or during small events, slide debris may have buried (rather than eroded and removed) evidence of previous human occupation. New landforms would have been created and existing ones modified during slides, providing continued challenges/opportunities for resource acquisition, habitation, and travel. For example, Hamilton Island, located just downstream of the Bonneville landslide, appears to have formed from reworked colluvium, likely originating from an earlier landslide event. Archaeological excavations conducted on the island revealed that stratified archaeological deposits were concentrated in abandoned channel features that were likely scoured during a catastrophic flood event, such as the breaching of the Bridge of the Gods (Dunnell and Campbell 1977).

New and altered landforms would have provided continued challenges/opportunities for resource acquisition, habitation, and travel for humans. For example, a catastrophic event, such as the Bonneville landslide, would have impeded salmon migration up the Columbia River until the blockage was breached. This would have had a major impact on people in the area who relied upon salmon as a subsistence/trade staple. On the Salmon River in Idaho, Davis (2007:256) argues that “stochastic variables, such as landslides and neotectonic behavior of local bedrock structures played a strong role in shaping the natural history of the Salmon River basin” and that information regarding these local-scale processes offer “critical information on ecological contexts and evolutionary contingency—factors that undoubtedly influenced the decisions prehistoric peoples made through time.”

6.1.1.4 Volcanism

Volcanism in the Pacific Northwest has played an active role in modifying the environmental setting of the CRB for millions of years. In addition to providing the bedrock foundation for much of the area in the form of hardened lava flows, cinder cones, and other lithified eruptive deposits, volcanoes have ejected ash and tuff (tephra)—fine-grained deposits that have settled out over the landscape as surficial sediment—into the atmosphere. These tephra deposits would have affected the natural and cultural landscape both at the time of their eruption and later as they became part of the sedimentary budget of the region. For example, thick tephra deposited closer to the source of the eruption may have affected vegetation growth and resource availability. Also, sudden, large inputs of tephra into regional riverine systems could have greatly affected river morphology and associated resources.

In areas where primary tephra deposits were buried by other sediments without erosional processes removing and/or reworking them, these deposits can serve as lithologic and chronologic stratigraphic markers to present-day researchers. Tephra deposits are one of the most widespread, intensively studied, and well-dated age markers used by scientists in the Pacific Northwest (Figure 6-1; Table 6-1). Tephra from the early Holocene eruption of Mount Mazama is perhaps the most extensively encountered deposit, primarily due to its widespread trajectory. Tephra from Mount Mazama has been found in primary contexts throughout the American West and into Canada (Sarna-Wojcicki et al. 1983). The great extent over which the tephra was distributed is likely due to both the great size of the explosive event as well as the presence of a strong wind from the west–southwest at the time of the eruption, which is thought to have occurred approximately 7,600 years ago (Bacon 1983; Hallett et al. 1997; Zdanowicz et al. 1999).

Other volcanic tephras that serve as significant correlative markers in the FCRPS region include those originating from Glacier Peak and Mount St. Helens, both in Washington State (Sarna-Wojcicki et al. 1983). Mount St. Helens has experienced multiple periods of eruptive history over the last 40,000 years, and deposits associated with these eruptions are found throughout the project area (Crandell and Mullineaux 1978; Crandell et al. 1981; Mullineaux 1996; Yamaguchi 1983; Yamaguchi and Hoblitt 1995).

Glacier Peak has been active throughout the late Quaternary, but significant tephras were produced primarily during the late Pleistocene (Porter 1978; Sarna-Wojcicki et al. 1983). The largest eruptions, which ejected approximately five times the amount of tephra as the 1980 Mount St. Helens eruption, occurred between roughly 13,400 and 13,700 years ago (Kuehn et al. 2009; Mastin and Waitt 2000). Due to its extent, the Glacier Peak tephra could play a key role in identifying late Pleistocene sites in the area. For example, Clovis projectile points were found in contact with grains of Glacier Peak tephra at the Rickey-Roberts site in Eastern Washington (Mehringer and Foit 1990), suggesting a very early age for the cache. However, because the artifacts were found overlying the tephra, the tephra provides a relative, maximum bounding date for the artifacts, not an absolute date (Davis et al. 2012).

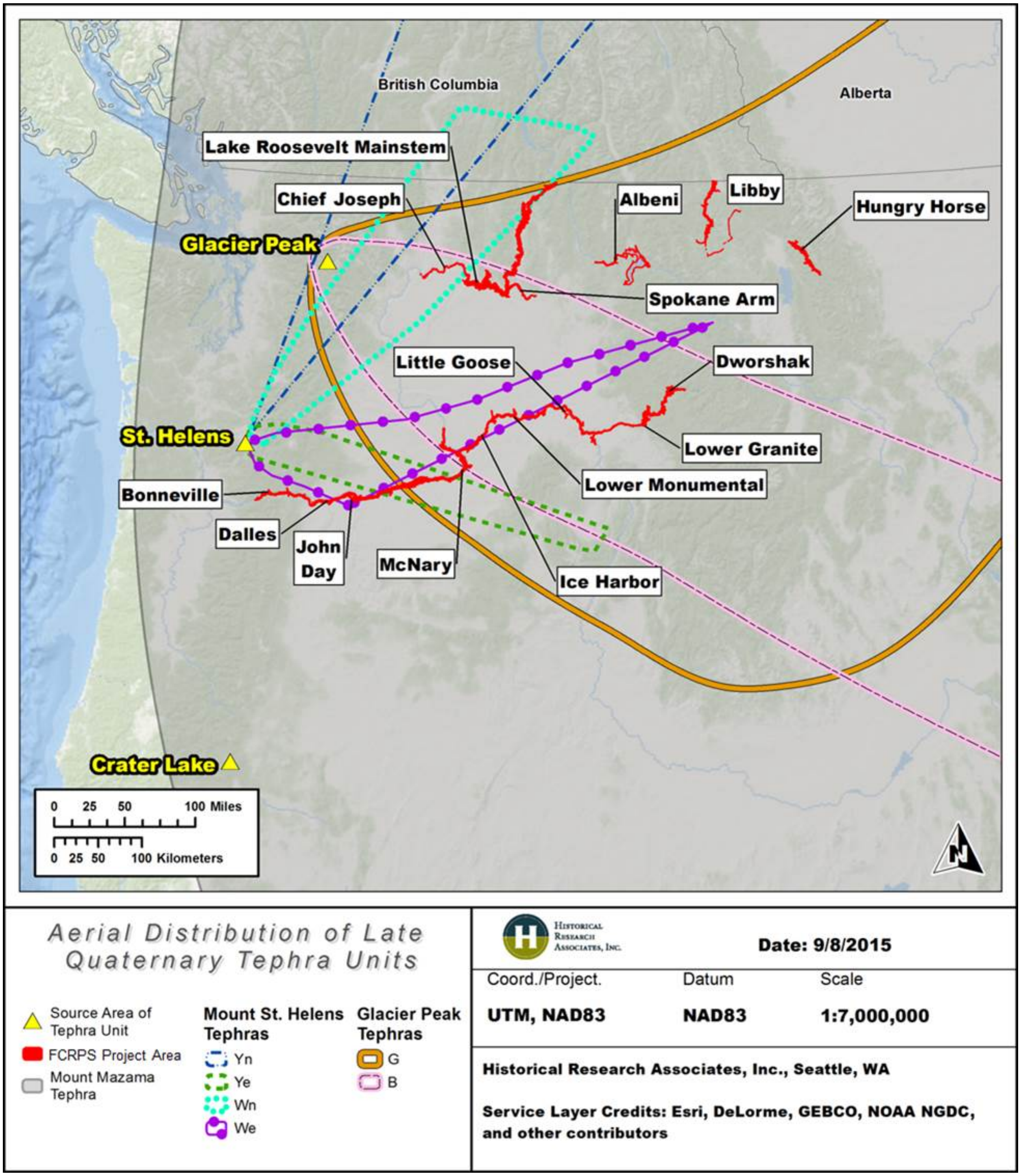


Figure 6-1. Approximate aerial distribution of late Quaternary tephra units in the FCRPS project area. Modified from Sarna-Wojcicki et al. (1983:Figure 5-1) and Kuehn et al. (2009:Figure 1).

Table 6-1. Late Quaternary Tephra Units in or near the Columbia River Basin.

Tephra	Age	Citation
Mazama O	7627 ± 150 B.P.	Zdanowicz et al. 1999
St. Helens X	~A.D. 1647	Yamaguchi and Hoblitt 1986
St. Helens Wn	A.D. 1480	Yamaguchi 1983
St. Helens We	A.D. 1482	Yamaguchi 1983
St. Helens P	between ~2500 and 3000 B.P.	Crandell et al. 1981; Mullineaux 1996
St. Helens J	between ~10,500 and 12,000 B.P	Crandell et al. 1981; Mullineaux 1996
St. Helens Y	between ~3000 and 4000 B.P.	Crandell et al. 1981; Mullineaux 1996
St. Helens K	between ~19,000 and 20,000 B.P.	Crandell et al. 1981; Mullineaux 1996
St. Helens S	between ~12,500 and 13,600 B.P.	Crandell et al. 1981; Mullineaux 1996
St. Helens B	between ~1600 and 2500 B.P.	Crandell et al. 1981; Mullineaux 1996
Glacier Peak B & G	between 13,410 and 13,710 B.P.	Kuehn et al. 2009
St. Helens 18 May 1980	A.D. 1980	

Another important product of volcanism to early peoples in the FCRPS region was fine-grained volcanic rock, particularly obsidian. Use of obsidian for the production of stone tools has occurred for millennia, and the Pacific Northwest contains some of the largest, most high-quality sources of obsidian in the world. Obsidian has been used in archaeological studies to infer past behaviors pertaining to tool manufacture, trade, and subsistence and settlement strategies. Obsidian source and hydration rind analysis has been applied to dating of archaeological resources and deposits, as well as to stratigraphic analysis of deposits. Craig Skinner has mapped obsidian source locations across the northwest (Figure 6-2), many of which have been found at archaeological sites in the FCRPS study area. Recent attempts to use trace analysis to identify sources of crystalline volcanics (also often called fine-grained volcanics [FGV], i.e., andesite, dacite, rhyolite, basalt), and CCS (chert, jasper, chalcedony, etc.) in the Pacific Northwest are also showing promise (Hicks et al. 2006; Kendall and McDonald 2015; Mierendorf and Baldwin 2015; Reimer and Hamilton 2015; Smits and Davis 2015).

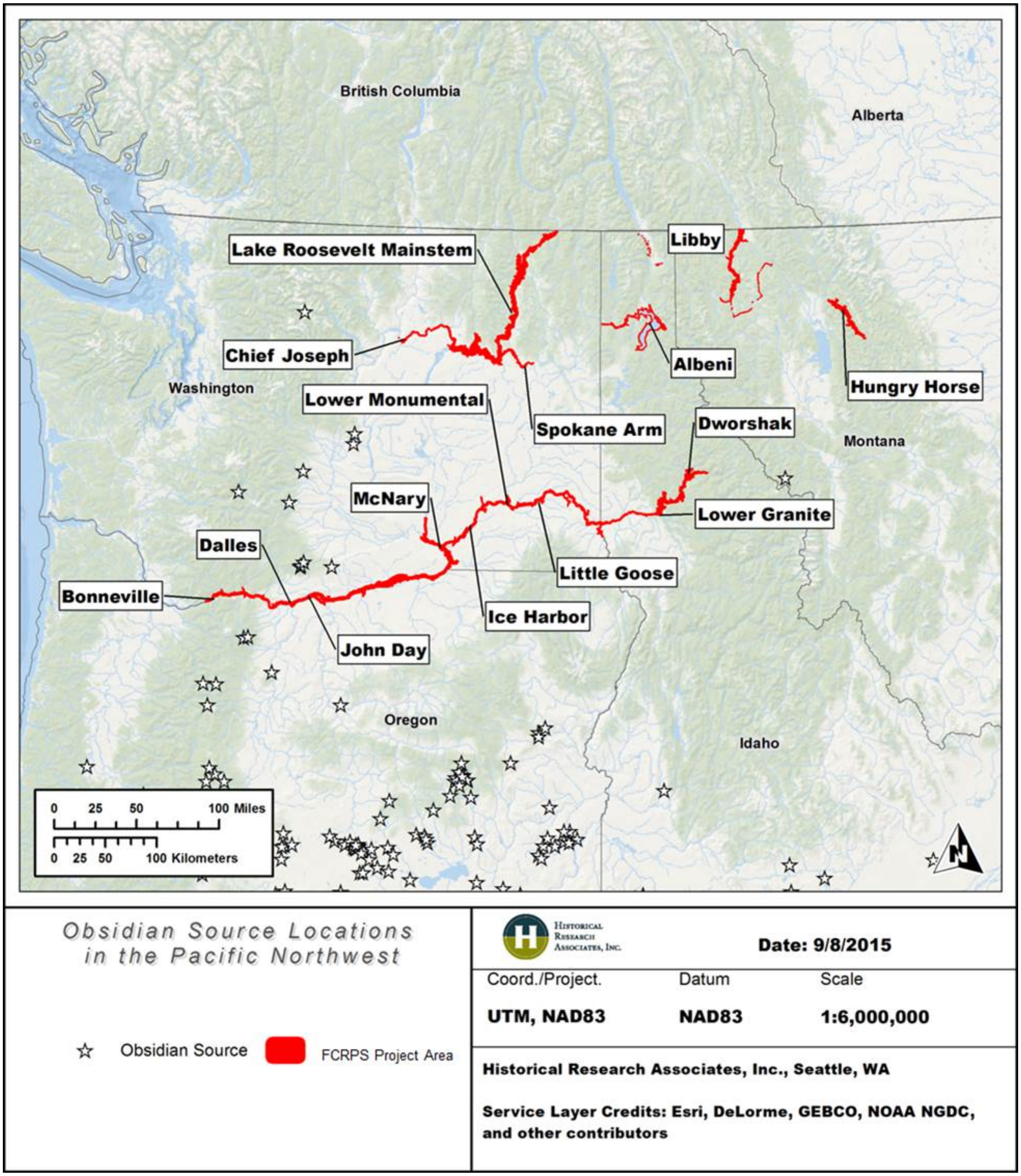


Figure 6-2. Obsidian source locations in the Pacific Northwest. Data from Northwest Obsidian Lab (http://www.obsidianlab.com/), acquired 2015.

Obsidian source and hydration studies have a wide variety of applicability. It is usually valuable to obtain obsidian source data because it is relatively inexpensive, is non-destructive, and can often support research regarding exchange and trade. One of the largest uses of trace analysis in the Northwest was for the PGT&PGE Pipeline Expansion Project, where more than 9,500 items from 141 sites in Washington, Oregon, and California were subjected to x-ray fluorescence spectrometry (Skinner 1995a). Some studies suggest, however, that certain trace elements can be altered by exposure to extreme heat from forest fires (Shackley and Dillian 2002).

Obsidian hydration as an independent dating technique is frequently problematic because many sources have too much variability in rind thicknesses to produce confident date ranges, and there is some evidence that extreme heat from forest fires can affect hydration data (Buenger 2003; Deal 2012; Loyd 2002; Loyd et al. 2002; Skinner 2002; Skinner et al. 1996). When used on specimens within discrete stratigraphic units or ash deposits, and/or in tandem with radiocarbon dates, however, hydration analysis can help to support chronological assessments (O'Neill 2008:57–59). Hydration measurements from obsidian artifacts from the same source through multiple strata within and between sites can also be effective as supporting relative temporal dating established through projectile point ranges and geoarchaeology.

Skinner (1995b) provides an excellent discussion of the pitfalls and challenges in the use of obsidian hydration studies in his discussion of the obsidian hydration analysis for the PGT&PGE Pipeline Expansion Project. Ultimately, obsidian hydration data is most useful when not only combined with other dating techniques, but also when applied to numerous specimens so that patterns can be established and outliers can be eliminated. Using data from more than 1,000 specimens at two sites near Newberry Crater, for example, Skinner (1995a:4-35; 1995b:5-25–5-26) was able to show that obsidian from two sources were confined geographically to the McKay Butte area and were only found in pre-Mazama contexts. These data, in concert with those from more than 600 specimens from nearby Newberry Crater sites, also established a new pre-Mazama obsidian (Buried Obsidian Flow) geochemically indistinguishable from Big Obsidian Flow obsidian (circa 1350 B.P.) and have allowed for a new interpretation of obsidian from several other nearby sites chemically identified as Big Obsidian Flow but found below ash from the eruption of Mount Mazama (Connolly and Byram 1999; Skinner 1995b:5-24).

In recent studies for the Oregon Department of Transportation, Connolly and Jenkins (2011:138–140) used two separate methods of establishing hydration rates at a series of sites in two separate locations on the Malheur River near the Oregon–Idaho border. The resulting data from more than 300 specimens show remarkable similarities in the frequency of certain rates and support more intensive use of the area and its local obsidian between about 3,800 and 1,500 years ago. Source diversity was much higher among the older obsidian with thicker rinds, and there was very little evidence of use of the area after about 1500 B.P. Results of this study attest to the usefulness of obsidian sourcing and hydration when applied not only to chronological questions, but also to questions of raw material procurement, trade, and settlement patterns.

6.1.1.5 Tectonics

Studies of tectonic activity in the Pacific Northwest have focused primarily on the larger and more well-known fault zones in coastal areas and near Puget Sound. Faults and folds have been documented within the FCRPS project area (Reed et al. 2005), primarily in the Canadian Rockies, Northern Rockies, Eastern Cascades, and Cascades. Large-scale deformation of bedrock deposits within the FCRPS ecoregions has occurred since original formation of the regions, but late Quaternary deformation has been more limited in scale and effect.

In the 1960s, David Sanger considered the effects of tectonic changes in river gradient and salmonid passage on trends of cultural development in the Fraser River and CRB (Sanger 1967), including temporary blockages at Drynoch on the Fraser and Bridge of the Gods on the Columbia. One major and long-standing archaeological research project in the CRB's Salmon River Basin has investigated the effects of fault movement on local environments and archaeological site formation processes and cultural development (Davis 2007). Both of these studies highlight the need for an understanding of local and regional tectonics, the interconnection of tectonics and mass movements, and their roles in landscape change as it relates to opportunities and challenges to human occupation or use of an area.

6.1.2 Paleoenvironmental Change and Resource Availability

Addressing paleoenvironmental change linked to resource availability through the archaeological record is difficult for a number of reasons, including issues of temporal and spatial compression (Bailey 2007; Lyman 2003) and inherent bias in the archaeological record as a result of human activity and postdepositional processes (Lyman 2008; Schiffer 2002; Zohar and Belmaker 2005). Additionally, availability must be separated from abundance, because the latter is nearly impossible to address through the archaeological record; instead, abundance must be viewed as a relative measure simply because of the numerous pre- and postdepositional processes that bias the record (Lyman 2008). Abundance is used throughout the discussion of subsistence below; however, its use is only to highlight relative measures unless otherwise stated.

6.1.2.1 Geomorphic Drivers and Resource Availability

Once changes in resource availability have been identified or are proposed from an archaeological data set, researchers can investigate the driving forces behind these changes. Paleoenvironmental change is often viewed simply at the macro-scale, focusing on regional shifts in climate or vegetation as the only factors driving resource availability and use. It is important to consider, however, the finer-scale mechanisms of change as well.

O'Connor (2004) discusses the effects of relatively recent geologic phenomenon on the morphology of the Columbia River and human interactions with it. O'Connor compiled information about the geologic and geomorphic setting and history of the river as noted in Native Americans oral histories and stories and the journals of early explorers of the American West, as well as historic and modern scientific studies. Based on these studies, he suggests that the salmon fisheries at The Dalles and Celilo Falls may not have been as productive prior to the Bonneville landslide as after it (O'Connor 2004:411–412). This is because after the landslide and formation of the Cascade Rapids, water levels within the river were higher upstream of Cascade Rapids due to incomplete downcutting through Bonneville slide material. He argues that prior to the Bonneville landslide, the elevation climb through The Dalles and Celilo Falls would have been approximately 120 feet, versus after the slide, when the climb measured only around 80 feet. O'Connor writes, "This higher gradient surely hindered passage, perhaps eliminating upstream salmon migration during low flow because of taller falls at the Narrows or Celilo" (O'Connor 2004:412). This hypothesis can be tested archaeologically and through oral history studies.

Studies along the Snake River and its tributaries in Idaho have found a pattern of limited fish use prior to around 1,500 to 2,000 years ago, as suggested by a paucity of older archaeological sites in river settings and limited representation of fish or fishing technologies in archaeological assemblages (Bentley 1983; Gould and Plew 1996; Plew 2008; Plew and Plager 1999). Davis (2007) and Plew and Guinn (2015) explore the possible geomorphic causes of relative fish scarcity in the pre-1500 B.P. era, linking geomorphic phenomena to changes in river system suitability for fish populations.

Plew and Guinn (2015:56) suggest that alluvial and colluvial drivers such as large floods, mudslides, debris flows, alluvial fan development, and talus slope failure could have severely altered the sediment load within the river systems. The lack of streamside terraces suitable for habitation along segments of the Snake River until the late Holocene would have limited river (and river resource) access (Plew and Guinn 2015:57). Davis (2007) argues that paleoseismic events may have changed river morphology in the Lower Salmon River in a way that increased salmon productivity. Plew and Guinn (2015:59) suggest that fire-induced erosion could lead to postfire debris flows and increased sediment load within river systems, affecting fisheries production.

Analysis of fine-scale river reaches where geomorphic processes, especially ages and patterns of depositional events, are relatively similar can provide information about the landform age and history of a site and help predict where similar landforms (and sites) may be situated simply due to the availability of the landform for occupation. However, many of those locations are inundated by the reservoirs at depths that will not be exposed for evaluation activities.

Paleoecological research has shown pronounced shifts in vegetation directly following the Mazama eruption. This shift would have had a profound effect on plant (and possibly animal) availability across much of the Plateau Culture Area.

6.1.3 Paleoecology

The steppe-like environment of the Columbia Basin was well defined prior to deglaciation in North America. Phytolith and pollen records demonstrate the presence of grasslands and shrub-steppe in the lower elevations on the Columbia Basin as early as 100,000 years ago. Since that time, the area has remained relatively open with distinct shifts in grass and shrub species and has been dotted with pockets of pine-fir or ponderosa pine-dominant forests at mid-elevation sites (Blinnikov et al. 2002).

Understanding of climate change across the Plateau was originally based on a few key palynological studies for the region (Barnosky et al. 1987; Hebda 1982; Mehringer 1985, 1996). Since 1998, when the Smithsonian *Handbook of North American Indians* for the Plateau (Walker 1998b), which has provided the primary environmental and chronological context for the entire Columbia Basin, was published, researchers have a more fine-grained understanding of climate change and climate events during the last 20,000 years. Since the mid-1990s, additional research has been completed, including charcoal histories and pollen records (Brunelle and Whitlock 2003; Davis et al. 2002; Herring and Gavin 2015; Walsh et al. 2008; Whitlock and Larsen 2001), tree-ring studies (Pederson et al. 2011), use of paleofauna as environmental indicators (Lyman 2014), and precipitation and temperature reconstructions using freshwater shellfish (Davis and Muehlenbachs 2001) and insects (Brunelle et al. 2008).

Several in-depth paleoenvironmental histories specific to the Plateau Culture Area provide a broad understanding of past climate and vegetation in the region (see Chatters 1998, 2014; Mehringer 1996). While this section focuses on the portions of the Cascades, Rockies, and Columbia Plateau that contain FCRPS Project Areas, researchers should recognize that larger continental and global climate patterns had both regional and localized effects on the vegetation, fauna, and people living throughout the FCRPS region (e.g., Bartlein et al. 1998; Mayewski et al. 2004). For the purposes of this RD, the following information summarizes paleoecological research within or adjacent to the FCRPS Project Areas to inform research questions regarding ecological change during the last 20,000 years.

The paleoecological discussion that follows is presented in chronological time periods of major ecological shifts in the Plateau region. Paleoecological change occurs at the global, continental, regional, and local scales, and the periods described are the results of datasets gathered across these varying scales of analysis.

6.1.3.1 Late Pleistocene–Early Holocene (>11,000 cal yr B.P.)

Although there currently are no archaeological sites within the FCRPS research area that date from the Late Pleistocene, archaeological evidence from elsewhere in North and South America demonstrates the presence of human populations on the landscape prior to 12,000 B.P. (see Graf et al. 2014). During the Late Glacial, conditions in the Columbia Basin were cooler than present and supported primarily bunchgrass and shrub-steppe (Chatters 2014). Due to glacial flooding and scouring related to ice-dam breaks of Glacial Lake Missoula, there are few paleoecological records in the eastern Columbia Basin containing dating prior to the early Holocene (Walker and Pellatt 2008).

Ecological records are available from farther north. Waits Lake, located in northeastern Washington approximately 21 miles east-northeast of the Grand Coulee Project Area, contains a pollen record more than 14,000 years old (Mack et al. 1978a). The environment surrounding the lake prior to the eruption of Glacier Peak (13,710–13,410 B.P.; Kuehn et al. 2009) supported an arid sagebrush steppe with few fir and spruce. At Waits Lake, *Pinus* pollen is the dominant tree type but is interpreted by Mack et al. as extralocal (1978a). As Walker and Pellat (2008:116) point out, pine trees are high pollen producers, and the pollen, due to their bisaccate morphology, can be wind carried great distances; therefore, *Pinus* is overrepresented in nearly all pollen records on the Columbia Plateau (Mehringer 1996).

Mass accumulation of loess deposits covered approximately 3,100 square miles in the eastern Columbia Basin, including those characteristic to the Palouse, occurred between 14,000 and 13,000 years ago (Blinnikov et al. 2002:80; Sweeney et al. 2005). Drier conditions and the establishments of strong westerlies contributed to development of deep loess profiles and supported steppe-like environments, as evidenced by phytoliths (Blinnikov et al. 2002).

At Carp Lake, 17 miles north of The Dalles Project Area, a 130,000-year pollen record depicts a shift from closed forest to an open cold-adapted shrub-steppe around 21,000 years ago. During the Late Pleistocene–Early Holocene transition, around 13,000 years ago, the area surrounding Carp Lake supported sagebrush-grassland environment (Whitlock and Bartlein 1997). While at Sheep Mountain Bog, in the foothills of the Rockies in northeastern Montana, an abrupt and short-lived shift from grassland to mixed conifer (spruce, fir, and white bark pine) pollen during the Younger Dryas (~11,300–10,000 calibrated years before present [cal yr B.P.]), suggests that the sudden cooling event was experienced in the Plateau Culture Area (Mehringer 1996), and the shift in environment had an effect on vegetation and animals. Archaeological evidence of changing environments and subsistence may be apparent. Fluted points are absent in archaeological deposits following the Younger Dryas, when the warmer conditions of the Early Holocene began (Newby et al. 2005).

While the Columbia Basin was a broad steppe environment before 10,500 cal yr B.P., much of the Northern and Canadian Rockies were glaciated until around 12,000 cal yr B.P. (Carrara 1986; Luckman 2000), with some glacial conditions present up until 9000 B.P. in specific areas (Clague and James 2002; Walker and Pellatt 2008). Given these conditions, most, if not all, of the Libby, Hungry Horse, Albeni Falls, and the upper portion of Grand Coulee Project Areas were still glaciated during this period (Mack et al. 1978a). The western slope of the Rockies, near Dworshak Reservoir, was also likely under glacial conditions up until 10,500 cal yr B.P. Research areas that would have been ice free and supported environments for human occupation post-12,000 B.P. include the Chief Joseph and the lower portions of Grand Coulee Project Areas, and all of the Project Areas on the Snake River and the lower Columbia.

6.1.3.2 Early Holocene (10,500–8000 cal yr B.P.)

Generally, the entire Columbia Basin was an arid steppe environment for most of the Holocene (Chatters 2014), with the exception of local and regional shifts in temperature and precipitation that led to tree-line encroachment of the steppe. Due to increased summer insolation, the climate between 10,500 and 9,500 years ago on the Columbia Basin was warmer and drier than any other time during the Holocene (Chatters 1998; Kutzbach 1987). However, winters during this period would have still been very cold. Around 10,500 cal yr B.P., glaciers had begun to recede in the northern Columbia Plateau (Ryder and Clague 1989). Areas in river bottoms and canyons, such as the Snake River, would have supported local microclimates with more ameliorated responses to temperature and precipitation change (Davis and Muehlenbachs 2001). For example, at Marmes Rockshelter in the eastern Columbia Basin, we can infer from soil chemistry and eboulis spalls that cool, wet conditions prevailed between 10,600 and 9700 cal yr B.P. (Huckleberry and Fadem 2007:21). Changes in microfauna, pollen profiles, and stable isotopes after 9,000 years ago suggest that warmer and drier summers were established across most of the eastern Columbia Basin (Davis et al. 2002; Huckleberry and Fadem 2007).

Postglacial trends in vegetation were similar across the northern Columbia Basin. As glacial ice retreated northward a cool, arid steppe environment was established. Between 10,000 and 9000 years ago, an association of *Pinus–Artemisia–Gramineae* was present at Simpsons Flats (Mack et al. 1978b), Waits Lake (Mack et al. 1978a), and across the northern Columbia Basin (Walker and Pellat 2008). Warmer conditions also led to expansion of grasslands and shifts in forest cover on the northern Columbia Plateau (Walker and Pellat 2008).

An abrupt cooling event around 8200 B.P. over the North Atlantic (Alley et al. 1997) appears to have had a regional effect on the Columbia Basin (Mehringer 1996). Cooler, moister conditions are apparent at Carp Lake around 8500 B.P. (Barnosky 1983) and at Marmes Rockshelter in the eastern Columbia Basin (Wigand and Hicks 2004).

It is likely that more archaeological deposits dating from the Early Holocene will be identified in the coming years, and therefore it is important to consider the effect changing climate and vegetation would have had on precontact populations.

6.1.3.3 The Middle Holocene (~8000–4000 B.P.)

The Middle Holocene is generally described as a period of warmer climate following the cooling of the latter part of the Early Holocene. Though generally warmer, the Middle Holocene was a time of critical shifts in climate and vegetation on the Plateau. Warmer conditions during the Altithermal (or Holocene Climatic Optimum) lasted approximately four millennia in western North America from approximately 8000 to 4000 B.P. (Mehringer 1996). Shifts in the amplification of summer and winter insolation during the early and middle Holocene caused seasonal changes in temperature and evapotranspiration, thus affecting the establishment and survival of certain vegetation communities (Bartlein et al. 1998). The warmer and drier conditions created more open, less forested conditions across most of the research areas (Miss and Hudson 1987). Climate warming also increased river water temperatures and decreased runoff affecting the availability of anadromous fish in major river systems (Chance and Chance 1982).

The eruption of Mount Mazama approximately 7,600 years ago had a profound effect on forested environments throughout the study region (Herring and Gavin 2015; Millspaugh et al. 2000). Fire frequency increased in the Cascades at Battle Ground Lake (Walsh et al. 2008) after the Mazama eruption. Walsh et al. (2008:259) believe that thick ash lenses likely killed much vegetation and created more dead fuels for larger, more severe fires. In the eastern Cascades, western Northern Rockies, and portions of the Columbia Basin, forests decline rapidly post-Mazama, and shrub-steppe and oak savannah–grasslands become the dominant vegetation (Mehringer 1996; Walsh et al. 2008).

At approximately 5000 cal yr B.P., grassland expansion on the northern Columbia Plateau was curtailed by rapid forest encroachment, suggesting a cooler climate (Walker and Pellatt 2008:16). Vegetation change and stasis during the Middle Holocene may have led to specific subsistence-based behaviors on the Columbia Basin. Certainly the blanket of Mazama tephra across much of study region would have required immediate adjustment and supports a hypothesis of a highly mobile adaptation. In the Rockies, shifts in tree-line and encroachment-meadow environments would have been noticeable to indigenous populations and may have influenced Native American management strategies of key resources (e.g., camas) to ensure plant production and predictable harvest.

6.1.3.4 Late Holocene (~ 4000 B.P.–Present)

The start of the Late Holocene was marked by an approximately 400-year period of cold and uncharacteristically wet conditions (Chatters 1998). In the northern Rockies and on the eastern edge of the Columbia Basin, climate cooling around 4,000 years ago led to increased forest cover of more mesic species of red cedar and hemlock (Barnosky 1985).

Modern climate conditions and vegetation distributions were generally established over much of western North America by about 2,500 years ago (Chatters 1998), with two anomalous events occurring during the last 1,000 years. Pollen records from Blue Lake (Smith 1982) and Carp Lake (Mack et al. 1978a, 1978b) suggest that drought conditions were present in areas of the Columbia Basin during between 2,600 and 1,600 years ago. Geomorphological and faunal evidence of decreased flooding along the Columbia River also supports the interpretation of drier, more drought-like conditions during this time (Chatters 1998:45).

Fire history reconstructions from lake sediment cores at Foy Lake in Flathead Valley of northwestern Montana suggest that the frequency of fire during the last 3,800 years is tied to climate and vegetation (fuel) change (Power et al. 2006).

Medieval Climate Anomaly (1200–700 B.P.)

Increased fire occurrence across northwestern North America after 2000 cal yr B.P. suggests that drier and warmer conditions prevailed (Hallett and Walker 2000; Power et al. 2006). Some researchers have linked this uptick in fire frequency and fire severity to sustained drought conditions in the Pacific Northwest and Great Plains during the Medieval Climate Anomaly (MCA) (1200–700 cal yr B.P.), a period of warm, dry climate across most of the northern hemisphere (Brunelle and Whitlock 2003; Walsh et al 2008; Wigand and Hicks 2004). In the Rockies, glacial retreat has been recorded during the MCA (Luckman 1994) but in other areas increased winter precipitation contributed to glacial advances (Koch and Clague 2011).

Little Ice Age (500–150 B.P.)

A rapid cooling event known as the Little Ice Age (LIA) occurred across portions of western North America between 500 and 150 cal yr B.P. (A.D. 1150–1370). During the LIA, colder, wetter conditions led to the maximum advancement of glaciers during the Late Holocene in the Canadian Rockies (Luckman 2000). Interestingly, in northwestern Montana near Hungry Horse and across the Northern Rockies in general, fire frequency increased during the colder, less lightning-prone LIA. This fire frequency pattern has been attributed to Native American burning practices rather than natural ignitions (Power et al. 2006).

One particularly important question is how the LIA affected human groups living in the study area. For example, recent tree-ring and palynological studies in the Northern Rockies have shown localized differences in snowpack, glacial advances, and vegetation responses during the LIA (Pederson et al. 2011; Whitlock et al. 2011). According to Chatters (1998), the LIA did not have a major impact on the distribution or diversity of plant communities in the Pacific Northwest. However, local differences may have greatly affected the distribution and availability of key resources for certain Plateau cultural groups, while the LIA may have had little to no effect in the CRB. It is likely that cooler conditions led to changes in the annual timing of plant harvest and availability, a situation to which Plateau people would have needed to adapt.

Although the climate during the Late Holocene looks similar to that of the modern climate, precontact people living in the FCRPS research area may have had to quickly adjust their subsistence regime and seasonal rounds to account for abrupt climatic changes such as the MCA and LIA. Archaeological site patterning and mobility, as they relate to changing environments (both plant and animal availability), should be considered when investigating Late Holocene–aged deposits. More discussion of human-environmental interactions during the LIA is needed to support Chatter's (1998) idea that the climatic event had little impact on the Columbia Basin and surrounding regions.

6.2 Tracing Temporal Dimensions/Chronology

The Smithsonian's RBS produced solid chronological frameworks for many of the subregions within the Plateau that acknowledged the greater time depth of occupation that had been recognized before. Synthetic reports resulting from that work address the region at the river-valley or catchment-area level. For example, Luther Cressman investigated and reported on The Dalles and Celilo Falls, Oregon, region (Cressman et al. 1960), with Virginia Butler and colleagues updating the analysis (e.g., Butler and Campbell 2004; Butler and O'Connor 2004). Fritz Riddell and Richard Daugherty and his students reported the early stemmed point site at Lind Coulee (Daugherty 1956, 1959) and the finds at Windust Caves (Rice 1972). Charles Nelson developed a chronological sequence in the Priest Rapids area based on excavations at the Sunset Creek 45KT28 Site (Nelson 1969). Leonhardy and Rice investigated and published an influential synthesis of the Lower Snake River (Leonhardy and Rice 1970). Sarah Campbell produced a comprehensive report of the excavation program for the Chief Joseph Dam (Campbell 1985).

These large scale projects provided a solid baseline for synthetic work in the region. However, the unintentional result of focusing on a single landscape was a proliferation of subregional sequences with particularistic and hard to remember phase names that tend to obscure larger regional patterns. For example, in Wildcat Canyon, the earliest phase is named not in a culturally or materially descriptive way, but simply after the owner of the ranch where the excavations took place (Dumond and Minor 1983).

By the completion of the federally sponsored RBS program in 1975, the federal legislation that created the contract archaeology industry was well in place. As such, further work has been conducted largely within the CRM rubric which does not include financial support for synthetic research nor public dissemination or publication of results beyond the grey literature. The data produced is often noncomparable and has been of variable quality. Furthermore, excavation standards have changed over the years, such as the size of the screen mesh used in various circumstances (i.e., 1/4 or 1/8 inch). Even when their work follows the highest professional standards of investigation and reporting, as much of it does, contract archaeologists mostly work on small-scale projects that need to be integrated into the earlier large-scale studies to contribute anthropologically meaningful insights.

Additionally, lack of peer review and external editing lends a lower threshold of reliability to the grey literature reports. Typographic errors or rushed writing in the grey literature can result in internally contradictory reports or unaccountable errors. A simple typo, for example, could change a date in the conclusion from 4500 B.P. to 5400 B.P. Washington State keeps a database of radiocarbon dates, but given variable standards of reporting over the decades, some lack information regarding whether or not they have been calibrated.

Still, a great deal of data do exist. By taking a sufficiently broad view, these data can be aggregated into coarse-grained time periods based on evolutionarily meaningful cultural markers. Critical to creating a broadly applicable sequence is not to overload it with multiple, specific correlates. This chronology proposes a set of basic terms to describe the evolutionary trajectory of the Plateau peoples. The terms are selected in order to be immediately recognizable to archaeologists. Precontact Plateau adaptations were not a sequence of fixed subsistence-settlement-political systems. Instead, they were a flexible set of adaptations applied differentially at different periods in order to address the local environmental and social challenges as they appeared (Ames 1991b). As such, the presence or absence of particular artifact classes or feature types (e.g., pithouses) is not sufficient to define an entire lifeway. The presence of one or more pithouses on a site determines only that the site dates to a period after the introduction of pithouses.

However, regardless of this, it is still temporally and anthropologically meaningful to identify pre-pithouse and post-pithouse as broad horizons in the Plateau. By way of analogy, in Peru, broad horizons are defined by ceramics and largely relate to whichever state was or was not expanding across the region (Menzel 1976). Therefore, finding a piece of Inca pottery allows the archaeological surveyor to identify the time period of the site to the Late Horizon. However, it does not indicate what the site's function was. Neither does it indicate how the site was or was not socially integrated into the Inca state. It could be that the region was a directly administered colony of the state or a politically autonomous far-flung periphery that just happened to have a piece of Inca trade ware or anywhere on a broad spectrum in between (Schrieber 1992). The fact that a horizon marker does not allow immediate definition of an entire lifeway at a particular place and time does not negate the usefulness of a horizon marker per se.

For the Plateau, the index artifacts that are most useful for defining cultural periods over time are Western stemmed points, Clovis points, Cascade points, microblade technology, side-notched points ("Cold Springs side-notched"), pithouses, corner-notched points ("Columbia corner-notched A"), camas ovens, mortar and pestles, hopper mortars, storage technologies, salmon intensification, composite fishhooks, arrow points ("Plateau side-notched," "Columbia corner-nothched B," "Columbia Stemmed A-C") , pithouse clusters, mat lodges, longhouses, and finally, a proliferation of local projectile point styles ("pinstem points," "Kamloops side notched," etc.). The presence or absence of these indicates a site's temporal location within one of the broad time periods in human evolution in the Plateau (see below). Yet, no one of these is, in and of itself, diagnostic of entire subsistence patterns or modes of social organization. Those still need to be defined and refined for each setting in which the horizon markers are found. Controversies and questions may always remain about how these relate to one another. However, by making use of a single synthetic chronology, archaeologists will at least be certain about what it is we are disagreeing.

6.2.1 Integrated Plateau Chronology

Scholars doing subregional research have generated more than a dozen competing chronological sequences for the greater Plateau region. Those that encompass the study area include sequences from the Lower Snake River (Leonhardy and Rice 1970), Lower Middle Columbia (Dumond and Minor 1983), Mid-Columbia (Galm et al. 1981), Chief Joseph Dam (Campbell 1985), Wells Reservoir (Chatters 1986), Kettle Falls (Chance and Chance 1985; Pouley 2010), Upper Columbia (Goodale et al. 2004), Middle Kootenai River (Roll 1982), Pend Oreille Lake (Miss and Hudson 1987), Canadian Plateau (Rousseau 2004), Northern Plains (Pettigrew 1981), and Lower Salmon River (Davis 2001a). Additionally, there have been several synthetic studies that, for various other purposes, have proposed Plateau-wide chronological schemes. Among the earliest of these is a broad Snake River chronology (Fryxell and Daugherty 1963), which proposed three broad periods of prehistory in addition to an ethnographic period. This basic scheme continues to be considered fundamentally sound, and some type of Early, Middle, and Late periods appear in several of the more recent synthetic works (e.g., Chatters 1986; Miss and Hudson 1987; Schalk and Cleveland 1983), albeit by different names and as a prelude to breaking these large periods into more nuanced smaller units of time (Ames 2000; Andrefsky 2004; Chatters 1995). The chronological scheme proposed in the SWRD follows this pattern and begins with three principal cultural epochs, each of which can be divided into two subperiods (Table 6-2; Figure 6-3).

Table 6-2. Integrated Plateau Chronology.

1) PaleoIndian ~14,300 to 8000 B.P.

A. Pre-Clovis - not currently found in the Plateau

B. Regional expression including Clovis, Western Stemmed (Windust, Lind Coulee, Haskett), or Folsom traditions

2) Archaic 8000 to 5000 B.P.

A. Cascade I (pre-Mazama) - variety of Cascade point types

B. Cascade II (post-Mazama) - addition of large side notched points

3) Pithouse 5000 to 400 B.P.

A. Initial Pithouse - first appearance of a pithouses with transition to corner notch point forms, pithouse clusters

i. Hiatus - A 500 year gap in the construction of pithouses sometime between 3000 and 2000 B.P.

B. Winter Village – (A.D. 1 / 2000 B.P.) Longhouses, mat lodges, arrow points most advanced expression of the Plateau "winter village" pattern, large winter villages, longhouses, seasonal rounds, trade, prestige goods, slaves, regional differentiation in subsistence and point types/ethnogenesis

4) Protohistory 400 B.P. to Present

A. Protocontact 400 B.P. (ca. A.D. 1600) to 210 B.P. (A.D. 1740) - Down-the-line transmission of diseases and trade goods and horses

B. Contact 210 B.P. to present - Euroamerican trade and settlement (Lewis and Clark to present)

It should be noted that there have been vast improvements in the calibration formulas for radiocarbon dates since the early work in the CRB. This has been particularly important for the late Pleistocene-early Holocene transition period, due to the discovery of plateaus and dips in the quantity of atmospheric C14, especially during the period from 14,700 to 11,200 cal yr B.P. (12,500 to 10,000 radiocarbon years before present [rcbp]) (Table 6-3). The result is that the radiocarbon dates (rcbp) from this period run consistently about 2000 years younger than an accurate calibrated date (B.P.) (Fiedel 2000:52). Unless otherwise noted, the B.P. dates given below refer to calibrated dates.

The PaleoIndian period (circa 14,300–9000 B.P.) encompasses the first human populations into the study area. It is associated with the Pleistocene–Holocene transition. This period is divided into a pre-Clovis period and a time period characterized by the manufacture and use of Clovis, Western Stemmed, Windust, Haskett, and (at the eastern extent of the study area) Folsom projectile points. Grouping these point types into a single period is based on chronological considerations. The level of relatedness between the technologies and the people using them can be debated (e.g., Willig and Aikens 1988; cf. Beck and Jones 2012).This period is commonly referred to as the Clovis period; however, Western Stemmed points are actually more prevalent

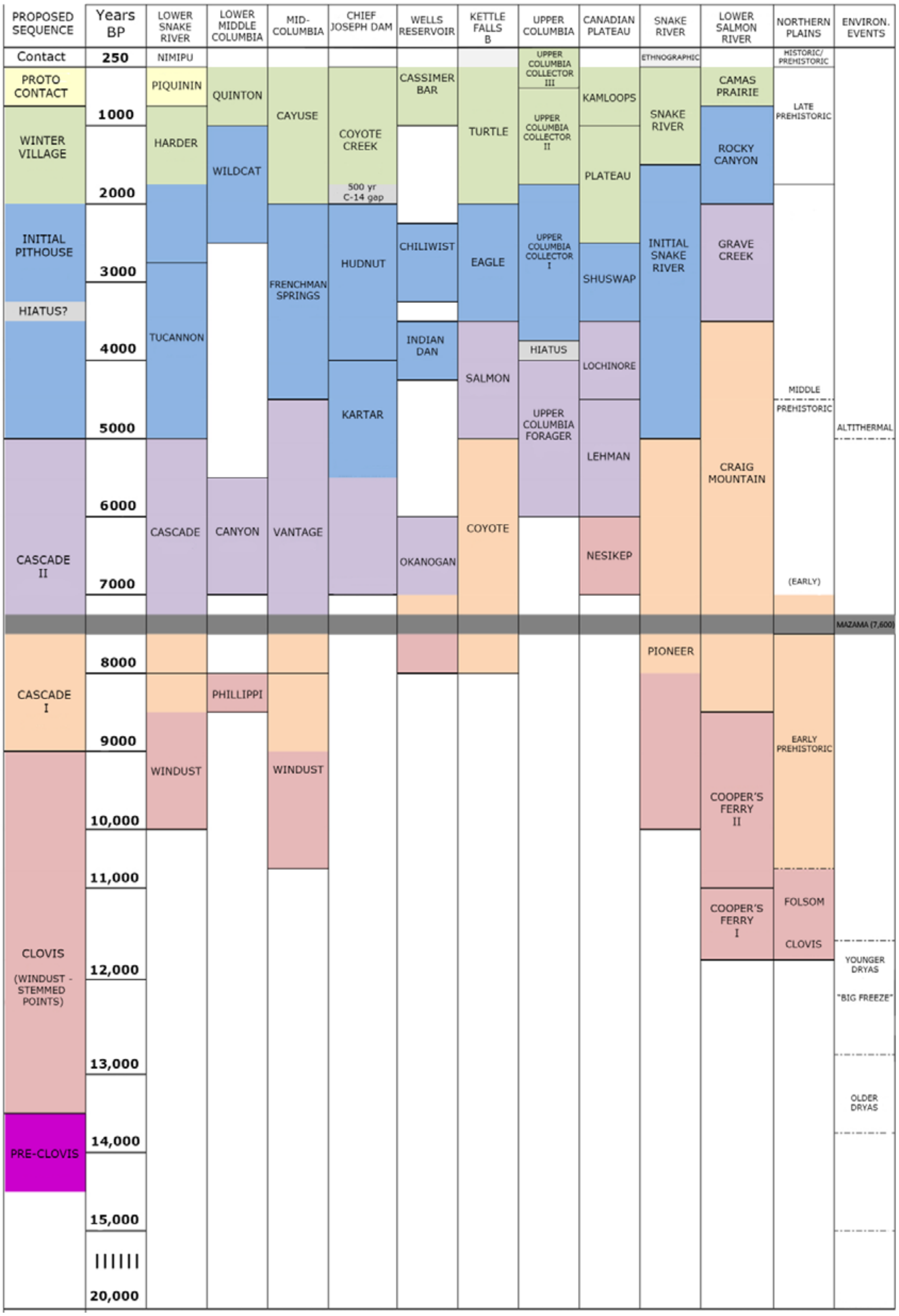


Figure 6-3. Proposed chronological sequence (divided into subperiods) in relation to local chronologies.

Table 6-3. Comparison of Uncalibrated and Calibrated Dates for Western Stemmed Point Finds in Washington, Idaho, Oregon, and Nevada (reproduced from Beck and Jones 2012: 33, Table 2.1).

Region and Site	Radiocarbon age (B.P.)	Calibrated age (B.P.)[a]	Point Type
Columbia Plateau			
Cooper's Ferry, ID	11,320 ± 80	13,159 ± 94	Lind Coulee
	11,410 ± 130	13,260 ± 147	
	10,740 ± 220	12,650 ± 221	Windust
Marmes, WA	10,810 ± 275	12,705 ± 275	Windust
	10,750 ± 90	12,677 ± 77	
Sentinel Gap, WA	10,680 ± 190	12,599 ± 200	Haskett
	10,180 ± 40	11,880 ± 92	
	10,160 ± 60	11,834 ± 134	
	10,130 ± 60	11,678 ± 143	
	10,010 ± 60	11,475 ± 151	
Buhl, ID	10,675 ± 95	12,616 ± 86	Lind Coulee?
Hatwai, ID	10,796 ± 138[b]	12,712 ± 117	Windust
(pooled mean)	11,120 ± 138[c]	12,977 ± 124	
Wildcat Canyon, OR	10,600 ± 200	12,509 ± 244	Parman
			Windust
Great Basin			
Connley Cave No. 4B, OR	11,200 ± 200	13,056 ± 191	Haskett
	10,600 ± 190	12,513 ± 229	
Smith Creek Cave, NV	11,140 ± 120	12,993 ± 110	Lake Mohave
	10,840 ± 250	12,738 ± 236	
	10,740 ± 130	12,667 ± 113	
	10,700 ± 180	12,622 ± 181	
	10,660 ± 220	12,569 ± 247	
	10,630 ± 190	12,547 ± 218	
	10,570 ± 160	12,490 ± 202	
Handprint Cave, NV	10,740 ± 70	12,670 ± 63	Lind Coulee?
Sunshine Locality, NV	10,700 ± 180	12,622 ± 181	Stem only
Bonneville Estates Rockshelter, NV	10560 ± 50	12,519 ± 61	Fragment

[a] Dates calibrated according to Fairbanks et al. (2005).
[b] Based on 5,500-year half-life.
[c] Based on 5,730-year half-life.

in the Western States, including the Plateau (Beck and Jones 2010). Beck and Jones (2010) have also suggested that there is fluted Western point that is derived from (and slightly later than) the fluted Clovis points from the Plains region.

Lanceolate (aka Cascade) points, although diagnostic of the subsequent period, also occur in these assemblages in minor percentages (Davis et al. 2014). All the formal tools are crafted with high levels of flint-knapping skill. On a continental scale, the subsistence practiced by these people is thought to be that of migratory broad spectrum foragers chasing large game (Pleistocene megafauna) while simultaneously engaging in generalized opportunistic foraging of available plant and riverine resources (Dillehay 2000). The relative importance of large game to the people of this period in the Pacific Northwest is debated (Davis et al. 2012). These were fast moving, wide-ranging populations that expanded rapidly across the Americas.

Clovis and Western Stemmed assemblages include hide-working tools. Edge-ground cobbles and cobble tools may have been used for plant processing. Also found in the assemblages are specimens representing well-developed bone and antler technology, including awls, needles, and atlatl spurs. Native people likely engaged in woodworking and plant fiber working but evidence is scant in the assemblages. Shell artifacts of adornment, specifically *Olivella* beads and musselshell pendants, have been found, for example, at Marmes Rockshelter (Hicks 2004). Archaeologists believe settlement patterns included two types of sites: lower-elevation grasslands and valleys and upland hunting camps, including rock shelters and open campsites (Bense 1972). A seasonal division may have existed between the winter shelter camp and a summer upland base camp. This is perhaps reflected in Marmes Rockshelter as a winter camp (Hicks 2004) and Lind Coulee as an upland summer camp (Irwin and Moody 1978). Habitations were surface dwellings. Social organization is thought to have been small-band egalitarian. The presence of *Olivella* shell beads may indicate coastal contact; however, these beads may have been directly collected as part of a wide seasonal or semiannual round, rather than indicating trade with coastal populations. Cremation was a common mortuary practice at sites dating to this era.

By the mid-Holocene Archaic period (8000–4000 B.P.), environmental conditions had become warm and dry. The largest of the game, the Pleistocene megafauna, had gone extinct, and Archaic period peoples appear to have been settling in to a less wide-ranging, though still highly mobile, subsistence and settlement pattern that targeted the most locally abundant resources. Environmentally, the Archaic is marked by the eruption of Mount Mazama (currently Crater Lake) circa 7,600 years ago (Zdanowicz et al. 1999). This event deposited a thick tephra lens across a majority of the Pacific Northwest, creating an identifiable chronological marker in the archaeological record. The eruption and deposition has been used as the dividing point between early and late Archaic phases (here termed Cascade I and Cascade II). The Clovis-era period point types are no longer found in the archaeological record but are replaced by laurel leaf–shaped (“lanceolate”) points. These points, including serrated varieties, were made across the Americas during the Archaic period. These are locally called Cascade points, and at least three types have been defined (see Section 6.2.2).

Cascade I–period (8000–7000 B.P.) assemblages are characterized by Cascade point types A, B, and C (lanceolate or lanceolate with some basal constriction or partial stem). Assemblages also include bifaces, a microblade technology, and levallois-like reduction of cores. Plant processing is inferred from the presence of edge-ground cobbles and other cobble implements and ground stone (Bense 1972:54; Leonhardy and Rice 1970). Bone implements persist, including awls, needles, and atlatl spurs, and the continued presence of *Olivella* shell beads indicate continued coastal contact. Notched-rock net weights are also present, as well as *bola* stones with a groove carved around the stone’s circumference.

Subsistence strategies during this period were diverse and included hunting medium and large game with an increasing emphasis over time on salmon, river mussels, and seeds. People settled in small-scale surface encampments dispersed around the confluence of rivers and tributaries. Generalized residential sites were not differentiated by specialized uses. Burials were flexed inhumations with associated grave goods, particularly beads of marine shell. Archaeologists postulate that the social organization was of a small-band, egalitarian nature. Seasonal rounds may have been wide enough to include direct access to the coast, or the marine shell may have been exchanged through familial networks.

After the Mazama ashfall, an Archaic pattern continued into the Cascade II subperiod (7000–4000 B.P.). This subperiod is distinguished by the occurrence of large side-notched (locally called Cold Springs) points in the assemblage that may have originated to the south. Otherwise, the subsistence and settlement pattern remained largely the same. Slightly more grinding and pounding implements in assemblages suggest an increase in plant processing, particularly seeds. Emphasis on larger game (deer, elk, with bison in the southeast Plateau) continued, as did an increasing use of salmon and river mussels. The numbers of bones found in assemblages seem to indicate that people were using a varying mix of resources at the local level; for example, faunal assemblages in Hatwai show include greater proportion of deer bones, while the same time period at the Chief Joseph Project indicates a greater emphasis on minnow, salmon, and marmot (Ames 2000). The social organization, coastal contacts, and preferred manner of burial remained the same as that seen in the earlier Cascade I subperiod.

The Pithouse period **(**5000–400 B.P.) begins with the Initial Pithouse subperiord (5000–2000/3000 B.P.) that is marked by the appearance of semisubterranean pithouses in the archaeological record; however, a number of other assemblage-level changes coincide with the new periodization. The first pithouse structures in the Mid-Columbia Plateau date from at least as early as 4400 or 5100 B.P. from sites like Hatwai and Alpowa (Ames 2000; Campbell 1985:481; Chatters 1995), with an extremely early example at the Paulina Lake Site dating 6000 to 7000 years ago (Ames 2000). More densely occupied pithouse settlements were present across the Plateau by 3800 B.P. (Solimano and Gilmour 2014), which indicates that settlement and subsistence strategies were moving in a more sedentary direction, although archaic adaptive strategies continued for some time despite the introduction of this residential structure type. Archaeologists hypothesize that an initial sedentary adaptation around 4000 to 4500 B.P. was associated with broad-spectrum foraging and that a collector adaptation replaced foraging sometime after 3500 B.P. (Prentiss and Kuijt 2004).

Climatic conditions during the Pithouse period became cooler, moister, and more balanced (mesic). The archaeological record indicates that Native people increasingly tailored their subsistence strategy to more intensive use of regional resources, which included large, medium, and small game; seeds; root crops; and fish. The first known roasting ovens (for meat or roots) date from as early as 4150 B.P. in the Southern Plateau but not until 2360 B.P. in the Canadian Plateau (Hayden and Cousins 2004). Settlement patterns show extensive exploitation of uplands, including the appearance nonportable site “furniture,” such as large mortars, that indicate a greater investment in specific residential locations and perhaps longer-term occupations. The upland sites are paired with smaller aggregated pithouse sites in riparian settings. Cascade points are less prominent in lithic tool assemblages, being replaced by contracting stemmed (Rabbit Island Stemmed) and corner-notched/expanding stemmed points. Overall, the quality of the manufacturing in specimens from this period is less sophisticated as more informal lithic technologies apparently came to predominate. There appears to have been a general move away from the use of basalts to cherts and petrified wood. Assemblages also contain bifaces, scrapers, burins, and drills. The appearance of hopper mortars and pestles indicates that people were incorporating new types of plant processing into their subsistence routine. An increase in numbers of net weights indicates additional emphasis on fishing. It is inferred that the use of plant fiber technologies continues along with bone, shell, and woodworking technologies. Flexed inhumation with personal burial goods remains the preferred burial practice (Ames 2000; Bense 1972; Galm et al. 1981).

Archaeologists understand the Initial Pithouse period to have been multifaceted, containing transitional, intermediate, and locally unique manifestations of the optimal forager or collector adaptation. The first indication of a winter village residential pattern occurs during this period. A variety of intermediate forms and degrees of optimal foraging, population aggregation, delayed return, and logistical organization occurred locally and over time.

A hiatus of approximately 500 years occurred between 3000 and 2000 B.P., in which it appears pithouses were not built. Some archaeologists think that people at this time returned to an archaic lifeway (Ames 2000; Chatters 1995), after which pithouse use recurred and became a central aspect of the settlement regime. This hiatus marks the break between Chatters' (1995) hypothesized "Pithouse I" and "Pithouse II" periods. Chatters described Pithouse I as the period from 5100 to 3000 B.P. characterized by dispersed pithouses but otherwise continuation of a mobile forager adaptation. After the hiatus, circa 3500 B.P., he defined the emergence of Pithouse II as entailing the use of single or small clusters of pithouses along major waterways paired with Short-term Occupation Sites at hunting, fishing, or gathering locations—in other words, the onset of the delayed-return collector adaptation. After 2000 B.P., the size of these pithouse villages increased.

The trajectory from the Initial Pithouse to the Winter Village pattern (circa 2000–400 B.P.) was not linear, and specific forms may have dropped out only to recur when environmental conditions again incentivized their use. Such intermediate forms are only identifiable at a subregional level. Existing syntheses of this time frame mark circa 3500 B.P. as the general period when subsistence and settlement strategies moved toward logistical organization strategies (Prentiss et al. 2005:57; Solimano and Gilmour 2014). Synthesizing work done in The Dalles, Solimano and Gilmour present a post-3500 B.P. chronology that shows increasing logistical organization and aggregated settlement. Prestige items became more common. Site specialization became pronounced based on an increased percentage of logistical sites. For example, 35WS5 contains a lithic workshop and approximately three quarters of the sites studied had functions unrelated to fish processing (Solimano and Gilmour 2014:139).

Prentiss et al. (2005) have put forward a broader-scale synthetic model for the post-3500 B.P. period that traces the development and spread of collector strategies. They characterize these as flexible adaptations that were responsive to climatic fluctuations. Their "Period I" is described as small (up to 10) pithouse village groups using a "classic collector" strategy based on salmon and camas roots. Their subsequent "Period II" began on the coast as a "complex collector" strategy also based on delayed return and a salmon-focused economy, but with increasing population, village density, and social inequality. These strategies commenced on the Northwest Coast circa 2500 B.P. and expanded along the waterways into the Plateau in a discontinuous fashion as climate conditions permitted (Prentiss et al. 2005:56). Prentiss et al. (2005) suggest complex collector strategies were in place by 1800 B.P., within their "Period IIb," and are first observed in the Mid-Fraser River and The Dalles subregions. Climatic instability from 1250 to 650 B.P. ("Period IIc") contributed to variation between the Canadian and Columbian Plateau. Regional elaboration in projectile (arrow) point styles occurs (e.g., Kamloops multi-notched points in the north versus pin stem points in the south). Both aggregation and abandonment of villages occurs during this period (e.g., Kuijt and Prentiss 2004).

The Winter Village period (2000–500 B.P.) is epitomized by a delayed-return, logistically organized, collector strategy as described by Ray (1936). The period was characterized by semisettled seasonal adaptation making use of aggregates pithouses in winter, intensive storage technologies, and specialized spring, summer, and fall resource-procurement locations to support relatively large populations. Winter villages along rivers with temporary camps at strategic locations characterized the settlement pattern. A demonstrable population increase occurred during this period, likely because the climate had reached stable (approximate to the mid-twentieth century) conditions. Subsistence focused on a seasonal round of available resources following a collector strategy focused on salmon (where available) and intensive camas root gathering and processing in upriver areas (e.g., Albeni Falls region) where salmon runs were not present. Diagnostic artifacts and features include aggregated pithouse villages, longhouses, and mat lodges, as well as the introduction of arrow points in various forms (i.e., small corner-notched and side-notched points, "pin stem" points, and small lanceolate points), which may indicate regional specialization and diversification amongst specific local cultures. Resource intensification occurs throughout the region, in which the most prominent local resources were utilized most heavily. Artifacts reflect this regional diversity.

Assemblages from the Winter Village period also include net weights, end scrapers, a variety of ground stone (pestles, mortars, manos, and hopper mortars), cobble tools, weaving and wood technologies, cordage, stone and bone awls, fire starters, arrow foreshafts, pipes, shamanic materials such as loon bones (Hayden 2000), shell beads, nephrite, and dentalium pendants. Social organization also became a mix of achieved and ascribed status, including some taking of slaves (Cannon 1992), and there appears to have been continued coastal interaction. People began to construct defensive earthworks after 800 B.P. in some regions (Goodale et al. 2004:40). Kent (1980) argued that there was endemic warfare in this period. Burial practices become more diverse, including flexed burials and burials associated with prominent landscape features, such as in dunes and beneath talus slopes; rock cairns and cist burials were also used (Galm et al. 1981).

Hayden and Schulting (1997) argue that the Plateau area of this period was integrated into a single interaction sphere, based on an elite ideology embodied in the circulation of a suite of prestige goods. Items archaeologists have identified as elite materials are found in burial and pithouse contexts and include dentalium shell, native copper, nephrite, steatite, obsidian, graphite, galena, and bones from dog species bred for wool and hunting. Crafted items from this period include digging-stick handles, bone or antler combs, bone tubes, L-shaped awls, gaming pieces, sculpted stone/bone/antler clubs, tubular stone pipes, ground slate pendants and effigies, serrated chipped stone pendants, flaked eccentrics, sculpted pestles, and stone sculptures. Intermontain Ware pottery is found at the extreme southeast edge of the CRB. It has been reported as far north as the Upper Selway basin of northern Idaho (Root and Ferguson 2010).

The Protohistoric period (400 B.P.–present) is here divided into a Protocontact (400–210 B.P.) and Contact (210 B.P. –present) periods. This is in recognition of the significant impact that European activities had in the region prior to actual person-to-person interaction. These Protocontact impacts included disease (which may have been introduced to the continent via contacts in Mexico) and trade goods (which could have traveled well ahead of the earliest European trappers and traders) (e.g., Ames et al. 1999). The Winter Village settlement and subsistence pattern, and associated tool kit, continued as the core adaptive pattern; however, this period saw the introduction of down-the-line trade items, including the introduction of the horse, iron, and glass. An epidemiological analysis of historic census record indicates that there were waves of epidemic diseases (Boyd 1999). The settlement pattern was the same as the Winter Village pattern with horse-grazing elements added including evidence of pasturage locations. The subsistence strategy included logistical organization along the collector pattern with a focus on salmon and delayed-return strategies, but with an increase in the prominence and social importance of raiding. Prentiss et al. (2005:98) have noted a sharp decline in camas processing at this time, possibly as a result of drier climate and overall decreasing population. Due to the increasing wealth represented by horse herds and the increased opportunity for slave taking, social inequality also increased, which can be seen in practices associated with both achieved and ascribed status. Burial practices show continuity with the Winter Village period but also included mass cremation and inhumation, possibly related to epidemic disease (Galm et al. 1981).

The Contact period (210 B.P.–present) is represented in the ethnographic record and marks a transition from Native and traditional lifeways to the adoption of agriculture, ranching, and consumer culture. A period of warfare from 1855 to 1858 marked the end of traditional settlement and subsistence patterns, and was followed by population movement to reservations. Diagnostic artifacts of this period include projectile points made of glass and other hybrid forms.

6.2.1.1 Concurrence with Subregional Chronologies

The section demonstrates how this broader chronology can be applied in each of the CRB study areas. Reaching perfect agreement between the subregional sequences and the broader chronology proposed above is hampered to some degree by differences in the underlying goals of each and the data available for each subregion. For example, the Tucannon phase of the Leonhardy and Rice (1970) sequence does not include pithouses, but the rest of the assemblage matches those of our proposed Pithouse period. The Harder phase has pithouses in small numbers at its inception, with pithouse villages emerging by the first millennium A.D. In order to mesh this with the chronology proposed here, the Harder phase is split between our Initial Pithouse and Winter Village periods (see Figure 6-3). A further distinction is made in Piqunin period assemblages, which include a variety of smaller projectile points. This corresponds to the expectations of the proposed Winter Village period. Each of these developments may be distinct in the Lower Snake River, making it a logical place to follow up research questions related to the timing of pithouses, aggregated villages, and regionally distinct artifact assemblages.

Other subregional chronologies that seem to fit the proposed chronology but do not include the appearance of pithouses as a chronological marker include Dumond and Minor's (1983) at the John Day Dam. As a matter of periodization, their report does not discuss pithouses, although many housepits were excavated. However, the other artifacts in their assemblage designations correspond to the periods proposed here.

Similarly, Campbell's (1985) periodization at Chief Joseph Dam notes the earliest appearance of pithouses (among the earliest in the Plateau), but does not use this as a phase transition marker. This is because people appear to have first used pithouses in the middle of the Kartar period, but Campbell's periodization scheme emphasizes the adaptive lifeway (in this case, foraging) rather than the index artifact approach used here. To translate into the chronology proposed here, archaeologists attribute Kartar as the time about halfway through the Cascade II period when people began constructing, and presumably living in, pithouses. As noted in the description of the Initial Pithouse period of the proposed chronology, foraging adaptation continued after pithouses appeared. The shift from foraging to collecting was discontinuous and locally contingent, and it is not surprising that different researchers have described and divided these periods differently. Campbell's (1985) Hudnut period is a more developed Initial Pithouse stage with an increase of corner-notched points appearing in assemblages dating from that time. Coyote Creek corresponds to the introduction of bow-and-arrow technology and corresponds to the Winter Village period proposed here.

The Mid-Columbia/Sunset Creek sequence of Nelson (1969) and Galm et al. (1981) closely follows that of the chronology proposed here. Frenchman Springs is our Initial Pithouse period—a "riverine settlement pattern probably consisted of small, aggregated pit house sites arranged in linear fashion along the river" (Galm et al. 1981:96) The Cayuse Phase is marked by demographic increase and the introduction of bow-and-arrow technology after A.D. 1000, corresponding to the Winter Village period.

Pouley (2010) has revised the initial sequence that Chance and Chance (1985) proposed for Kettle Falls and the Upper Columbia River subregion. The reworking was meticulous and sheds light on some stratigraphic problems in the original data. Because Pouley's revised sequence aligns more directly with nearby regional sequences and is similar to the chronology proposed here, we use it in this volume and in Figure 6-3. Discussions by Goodale et al. (2004) indicate that the post-3500 B.P. impetus toward settlement occurred somewhat independently of resource base. For example, the earliest evidence of camas roasting has been found to date from circa 4150 B.P. (Hayden and Cousins 2004). However, the correlation between house pits, intensification of camas processing, and the use of storage pits seems to have appeared after circa 3400 B.P. (Goodale et al. 2004).

Earlier chronologies underestimated the time depth of Plateau occupation (e.g., Chatters 1986; Leonhardy and Rice 1970). However, cultural developments in the Canadian Plateau and Upper Columbia do appear to have occurred slightly later than in the western and southern portions of the Plateau where the earliest finds date from the Archaic period, either Cascade I (Pouley 2010) or Cascade II (Goodale et al. 2004; Rousseau 2004:13) depending on the study location.

Similarly, the chronological sequence of the lower Salmon River (Davis 2001a, 2007) follows the basic sequence of the proposed SWRD chronology but is also later in time. There, an Initial Pithouse period, marked by the first pithouses and a shift toward salmon intensification, did not occur until circa 2000 B.P.

Chronologies devised for the Albeni Falls (Miss and Hudson 1987) and Libby Dam (Roll 1982) Project Areas only reference projectile point styles and are therefore not easily compared to the currently proposed chronology. While the early phases of Clovis or Western Stemmed and Cascade affiliates do occur in these upper Columbia River Project Areas, once local traditions begin, they follow a trajectory distinct from the Plateau pattern. These Project Areas are within a geographic zone that shows both Plateau and Plains influences. For example, the Hungry Horse Project Area is the farthest east of those in the FCRPS region and thus has the fewest similarities with the Plateau culture region. Late-period settlement here incorporated tipi rings rather than pithouses; Woodland ceramics also appear in assemblages that date from this time (Reeves 1983).

Recent syntheses in the Albeni Falls region describe Western Stemmed points after 11,500 B.P. followed by an Archaic period featuring upland settlement with Cascade and large side-notched points of local stone around 8000 B.P. Researchers then see a shift toward riverine and camas resources in the period from 6000 to 2500 B.P. After 2500 B.P., larger villages appear with exotic artifacts that include projectile point forms associated with the Plains and obsidian sourced to Oregon, Idaho, and Wyoming (USACE 2008a). Researchers in the Libby Dam–Lake Koocanusa area report some Clovis points, then an Archaic large-game-oriented occupation featuring large side-notched, eared, and concave-base (“indented”) points beginning 7,500 years ago. Subsistence shifted toward fishing and gathering in the last 3,000 years, concomitant with a settlement shift from upper terraces to river banks by 1200 B.P. (USACE 2008b).

6.2.2 Index Artifacts

The most heavily employed chronology for the region was established by Lohse (1985) during work at the Chief Joseph Project along the upper Columbia River (Figure 6-4). The chronology has since been refined (Lohse and Schou 2008) and construed into a classification key by Carter

(2010). To date, Lohse's chronology remains the standard for identification of temporally diagnostic projectile point forms in the Columbia drainage system. The regional limitations of this means that some divergence is to be expected across the CRB, particularly in the more recent periods.

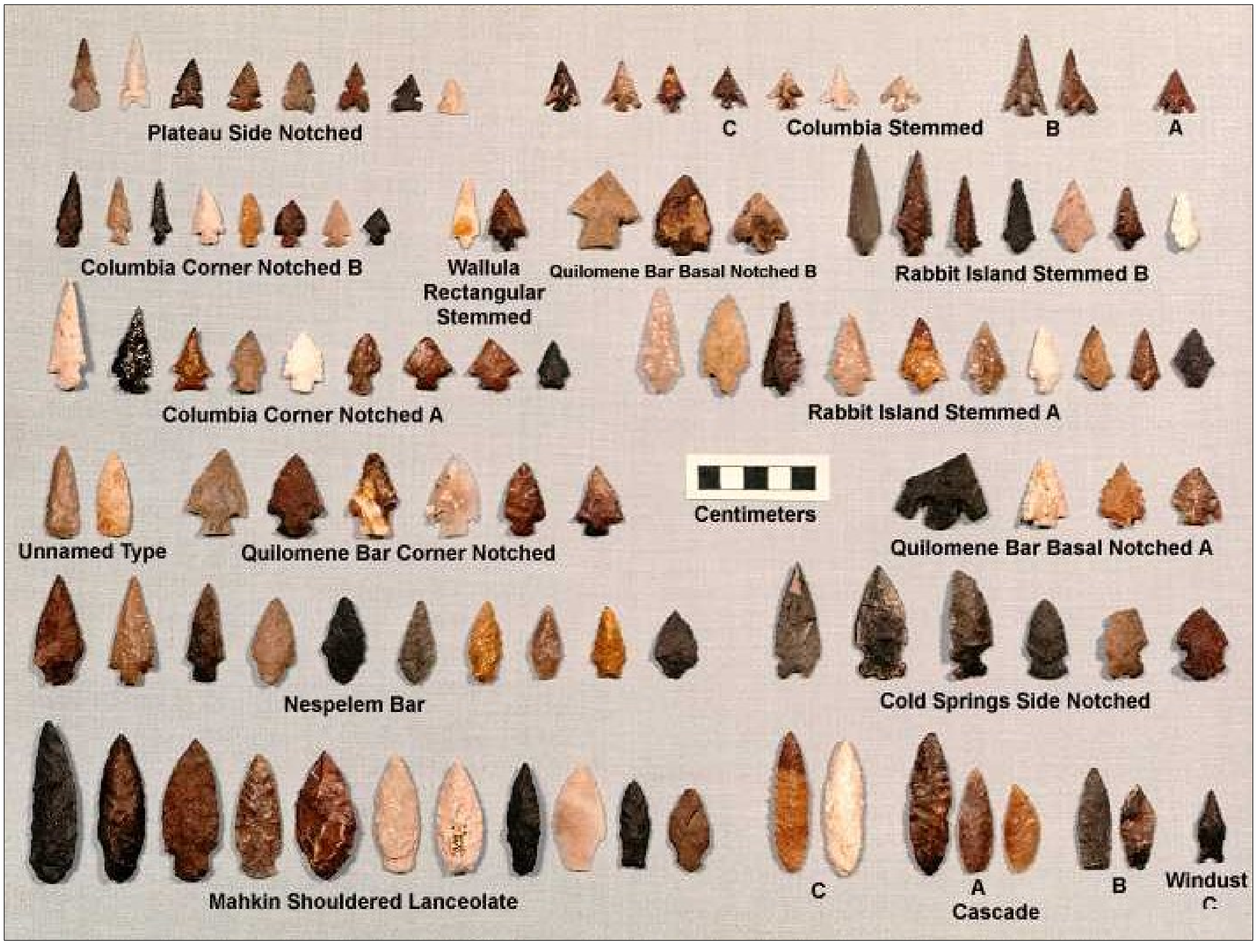


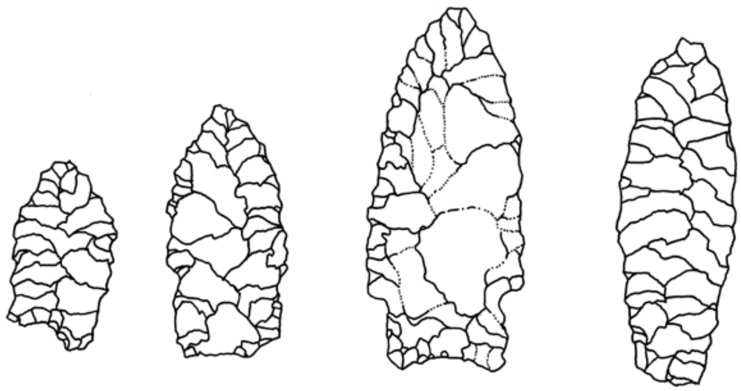
Figure 6-4. Projectile point types from central CRB (FCRPS 2013:Figure F-4).

6.2.2.1 Paleo-Indian

The traditional argument that people using Clovis technology were the earliest occupants of the North American Interior has not held up in the face of greater evidence (Graf and Schmitt 2007; Graf et al. 2014; Rhode 2012). For example, excavations at Paisley Cave, located south of the CRB in south-central Oregon, have produced cultural deposits ranging from 14,340 to 12,000 cal yr B.P. (Jenkins et al. 2011). Within the CRB, Cooper's Ferry, located along the lower Salmon River canyon of western Idaho, has deposits that date from 13,160 to 12,650 B.P. (Davis et al. 2014). Both of these occupations are associated with assemblages that contain Windust or Western Stemmed projectile points (Davis 2001a). Clovis and Western Stemmed technologies are different, particularly in the incorporation of overshot (*outrepassé*) flakes in the former tradition but not the latter (Beck and Jones 2012). Their inclusion in the same broad period here should not negate potentially important distinctions that can be made between the two traditions.

Early dates ofor the use of Marmes Rockshelter come in at 12,700 B.P. (Hicks 2004). At the Manis Site located west of the CRB in the Puget Sound area of Washington, a projectile point made of mastodon bone embedded in a rib of a single disarticulated mastodon. The Manis Site radiocarbon dates from 13,800 cal yr B.P. (Waters et al. 2011).

Western Stemmed (Windust, Lind Coulee, Haskett) - 13,000–8500 B.P.

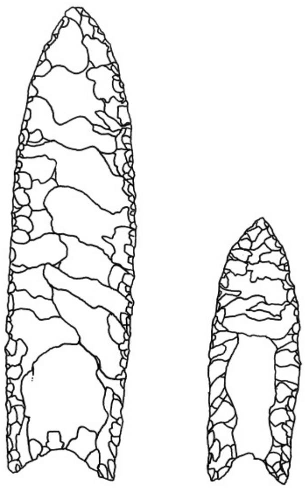


These large-stemmed and shouldered lanceolate forms generally have a relatively short blade, straight to contracting stems, and straight or slightly concave basal margins. The base elements, stem and base margins, exhibit grinding. The flaking patterns are variable and can be random to patterned. Collateral and transverse flaking (collateral flake scars that cross the midline) is common. Lohse (1995) and Lohse and Schou (2008) describe three variants: Windust A is a shouldered lanceolate with a straight base margin. Windust B is a shouldered lanceolate with a concave base. Windust C has a markedly concave base (deeply notched). Many Windust points are biconvex in cross section and fairly robust.

Western Stemmed occupations begin circa 13,000 B.P. with the Lind Coulee occupation and Cooper's Ferry Idaho and Haskett points found at Connley Cave No. 4B in Oregon (Beck and Jones 2012:33). Early Windust dates from the Hatwai site in Idaho are 12,710 cal yr B.P. (Beck and Jones 2012). Leonhardy and Rice (1970) and Rice (1972) dated Windust projectile points from 12,000 to 8000 B.P. Excavations at Marmes Rockshelter (Sheppard 1984) provided radiocarbon dates with a range from 12,700 to 7500 B.P. Lohse (1995) suggested a range of pre-10,000 to 7000 B.P. for the Windust C variant based on his work at Rufus Woods Lake. Dumond and Minor (1983) supplied radiocarbon dates from Wildcat Canyon and suggested 10,600 to 8000 rcbp (12,500 cal yr B.P.) for Windust on the Lower Columbia River. Lohse and Schou (2008) suggested a temporal range from 13,000 to 9000 B.P. The earliest dateable evidence of precontact populations along the Snake River Plain is the Buhl Burial Site, located east of Twin Falls, Idaho. This burial has an accelerator mass spectrometry (AMS) date of 12,616 + 86 B.P.

(Green et al. 1998:440). Artifacts associated with this burial include a large Western Stemmed (Windust) tranchet- or chisel-tipped biface (Green et al. 1998:449).

Clovis - 13,350–12,870 B.P. (Traditional Dates)/ 13,125–12,925 B.P. (Stafford and Waters 2007)

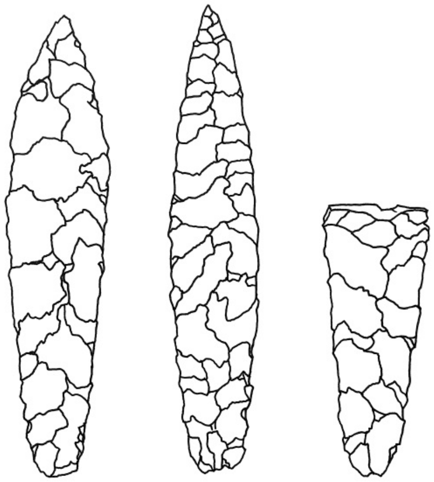


Archaeologists long held the Clovis adaptation as the oldest undisputed Paleo-Indian tradition. It is not common in the Pacific Northwest, where the Western Stemmed tradition instead predominates. Clovis points date earlier in the Plains, ranging back to circa 13,600 B.P., while they have been dated only tentatively to 12,800 B.P. in the far western United States (Beck and Jones 2012:26–27). Clovis points are described as large lanceolate-shaped points with parallel or slightly convex margins and a concave base. Clovis points were fluted by removing one or more long flakes from the base on face of the point. The flutes typically run a third of the length of the tool. In most cases, the basal element is heavily ground. Flaking characteristics indicated that the makers were using a well-controlled percussion technology with parallel to oblique patterns and a controlled overshot flaking technique to thin the points. Clovis points can range from 24 millimeters to 150 millimeters in length, with the typical point being in the 50 to 74 millimeter range (Lohse 1995).

Clovis points and Clovis-related lithics are often recovered from cache sites (Huckell and Kilby 2014); the Simon Cache near Fairfield, Idaho, and the East Wenatchee Site are nearest to the FCRPS Projects (Lohse and Schou 2008; Santarone 2014).

The radiocarbon record has traditionally dated Clovis occupation from approximately 13,350–12,870 B.P. (Frison 1991; Holmer 2002; Lohse 1995; Plew 2008). Stafford and Waters (2007), realizing that radiocarbon dates for Clovis occupation had been generated over the course of 40 years using changing technology, redated many of the early Clovis sites. Stafford and Waters resampled bone, seed, and charcoal from known Clovis sites; and when samples were not available, they culled dates that were obvious outliers. The project resulted in a date range of 13,125–12,925 B.P. from 43 radiocarbon dates, both placing Clovis later in time and indicating that it endured only about 400 years.

Haskett - 12,000–9000 B.P.

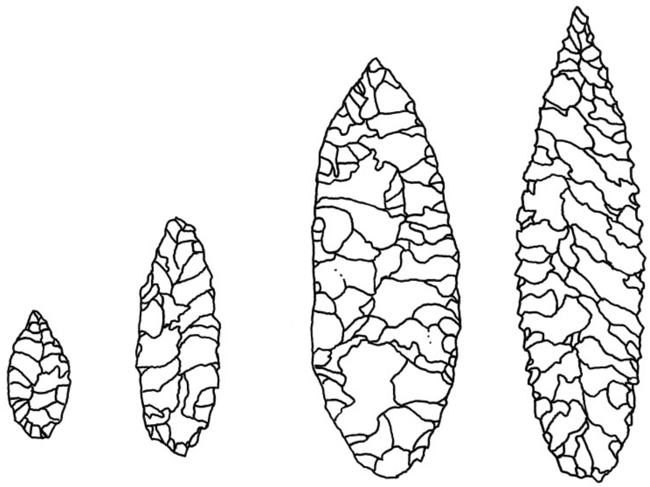


Hasketts are large, thick lanceolate points with long tapering stems and wide blade tips. They are collaterally flaked and exhibit broad flake scars. In cross section, they are thick; some are triangular, suggesting that they were manufactured on blades struck from a blade core. The margins of Hasketts are heavily ground from the convex base element to nearly the full length of the blade. Butler (1965) initially identified two Haskett types: Type I is broad and thick near the tip, accounting for nearly a third of the artifact length. Type II is heavier, longer, and narrower and does not have the wide-bladed tip.

The temporal span of Haskett points are known by dated finds in Eastern Washington and Oregon. Haskett points at the large residential camp at Sentinel Gap in Washington (45KT1362) are associated with radiocarbon dates ranging from 11,475 to 12,599 B.P. (Galm and Gough 2000, 2007). The Connley Cave No. 4B Site in Oregon had Haskett points associated with radiocarbon dates of 12,513 and 13, 056 B.P. (Beck and Jones 2012; Bedwell 1973).

6.2.2.2 Archaic

Cascade - 8000–4000 B.P.



Cascade series includes three variants, and exhibit fine pressure flaking and distinctive retouched basal margins (Lohse 1995). Notably, Cascade points are relatively thick in relation to their length. These are fairly robust points, but note variant B below. Flaking patterns are variable and sometimes mixed on individual artifacts. Collateral and transverse flaking is common, but many flake patterns are random. Serrated margins have been recorded on all variants but are common on the Cascade C variant. Cross sections are usually biconvex or planoconvex, but frequently, the cross sections are trapezoidal and occasionally diamond cross sections occur.

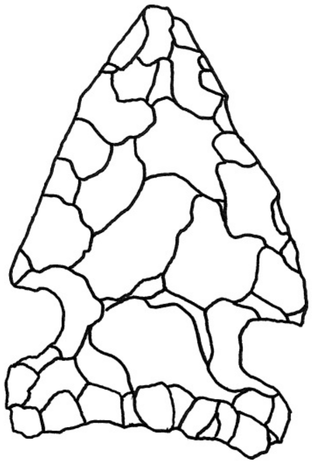
Cascade A is a broad, thick lanceolate with a rounded or convex base.

Cascade B is a slender lanceolate with a slightly concave base. Morphologically, it is closest to Windust C. Typically, these are thin and delicate-looking points and not a frequent occurrence.

Cascade C is the classic Cascade point defined by Butler (1961, 1965). This variant is a small slender lanceolate with serrated margins and contracting base margins. Frequently, the cross sections are biconvex or planoconvex, but there are greater instances of trapezoidal or diamond cross sections than with the other type variants.

Temporal distribution is from 8000 to 5000 B.P. (Lohse and Schou 2008). Lohse (1995) suggested a date range of 8000 to 4000 B.P. for Cascade A and C, and a range of 8500 to 6500 B.P. for the Cascade B variant.

Cold Springs Side-Notch - 7000–4000 B.P.



Cold Springs Side-notch points are large triangular points with horizontal notches, generally making the base element as wide as the maximum blade width of the artifact. The base is straight to concave, and the lateral margins tend to be convex. Flaking patterns are mixed and can be collateral, oblique, and random. Along the Snake River in Idaho, these are called Northern Side-notch; in the Northern Rocky Mountains, they are called Bitterroot Side-notch. In the Columbia Basin, these are commonly found with Cascade type variants. Cross sections are predominantly biconvex, but specimens with planoconvex and trapezoidal cross sections are not uncommon.

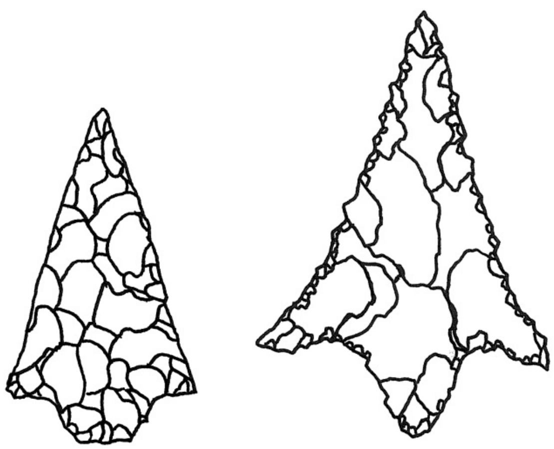
The date range of Cold Springs Side-notch points is from 7000 to 4000 B.P. (Lohse 1995; Lohse and Schou 2008) in the upper Columbia River and from 6000 to 4000 B.P. along the Snake River Plain; Northern Side-notch and Bitterroot Side-notch date from 7500 to 4500 B.P. (Holmer 2002).

6.2.2.3 Pithouse

Columbia Corner-notch Type A - 4000–2500 B.P.

Columbia Corner-notched Type A points are large triangular forms with straight to slightly convex lateral blade margins (Lohse 1995). These points are deeply notched in the corners, producing thick expanding stems and downward projecting shoulders or barbs. Flaking patterns are variable, but tend to be regularly patterned; parallel oblique flaking is not uncommon. In cross section, these points tend to be thick and biconvex. This type is contemporaneous with Rabbit Island Stemmed, but Lohse (1995) indicated that the two forms do not overlap in their spatial range. This pattern needs further investigation as the Spokane Tribe has found both of these points along the Spokane Arm of the Grand Coulee Dam Project Area. Columbia Corner-notched points are more representative of southern Columbia Plateau, and Rabbit Island Stemmed points are more common on the central and northern Columbia Plateau over the same temporal range, between 5000 and 2000 B.P. (Lohse 1995; Lohse and Schou 2008). Along the Snake River Plain and farther north in Montana, these are referred to as Elko Corner-notch and Pelican Lake, and Holmer (2002) gives a date range of 7500 to 1200 B.P.

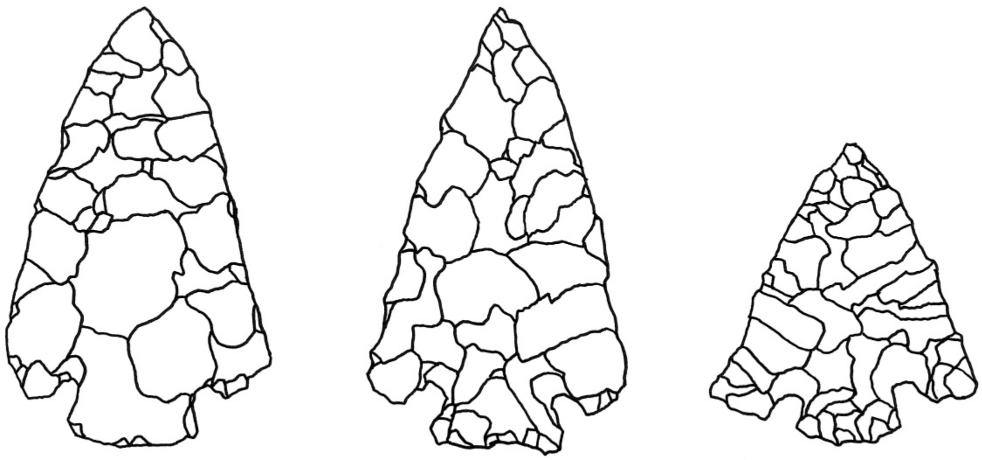
Rabbit Island Stemmed A and B - 4000–2000 B.P.



The A variant is an attractively made, elongated thin triangular form with square shoulders and well-defined base element that employs a straight to contracting stem. Cross sections are predominantly biconvex. Serrated lateral margins are common. Temporal distributions overlap with the Columbia Corner-notched A type and the Nespelem Bar. Lohse (1995) and Lohse and Schou (2008) have indicated a temporal distribution from 4000 to 2000 B.P.

The B Variant is a smaller, more delicate version of the Rabbit Island Stemmed A point type. Lohse (1985) indicated that it consistently occurs in later contexts than Rabbit Island Stemmed Type A. This small triangular point with square shoulders is sometimes straight but often possesses slightly incurvate (concave) lateral margins. The base element incorporates a sharply contracting stem. As with type A, blade margins often are serrated. Flaking patterns are typically random, with biconvex cross sections. Lohse (1995) and Lohse and Schou (2008) give a temporal distribution from 3000–1500 B.P.

Quilomene Bar - 3000–2000 B.P.



Lohse (1985) defined three Quilomene Bar variants: Quilomene Bar Corner-notched, Quilomene Bar Basal-notch A, and Quilomene Bar Basal-notch B. Within the eastern portion of the Columbia drainage system, along the Snake River, and farther north in Montana, these would be late series Elko Corner-notch and Pelican Lake, as with the Columbia Corner-notch. Quilomene Bar projectile points are thought to have come into use after the Columbia Corner-notched and Rabbit Island Stemmed A types, circa 3000 B.P. Nelson (1969) suggested that these forms continued in use well past 2000 B.P., with the latest examples having the notches placed in the base element rather than the corners.

Morphologically, the Quilomene Bar Corner-notched projectile points resemble the Columbia Corner-notched A type, but are far larger and heavier. They are big, robust points, with straight to slightly convex lateral blade margins and deep, broad notches in the proximal corners. The corners removed creates a prominently expanding thick stem. Flaking patterns are variable, but tend toward regular or patterned. Margins are not serrated, and cross sections are typically biconvex, but planoconvex and trapezoidal cross sections are not uncommon. Lohse (1995) and Lohse and Schou (2008) give a temporal distribution from 3000 to 2000 B.P.

Quilomene Bar Basal-notched A are thick and heavy points with slightly convex to straight blade margins. The base is notched, leaving squared barbs or tangs above the expanding stem that defines the basal element. Flake scars are variable but tend to be patterned. Bioconvex cross sections are typical. Lohse and Schou (2008) give a temporal distribution from 2000 to 1500 B.P.

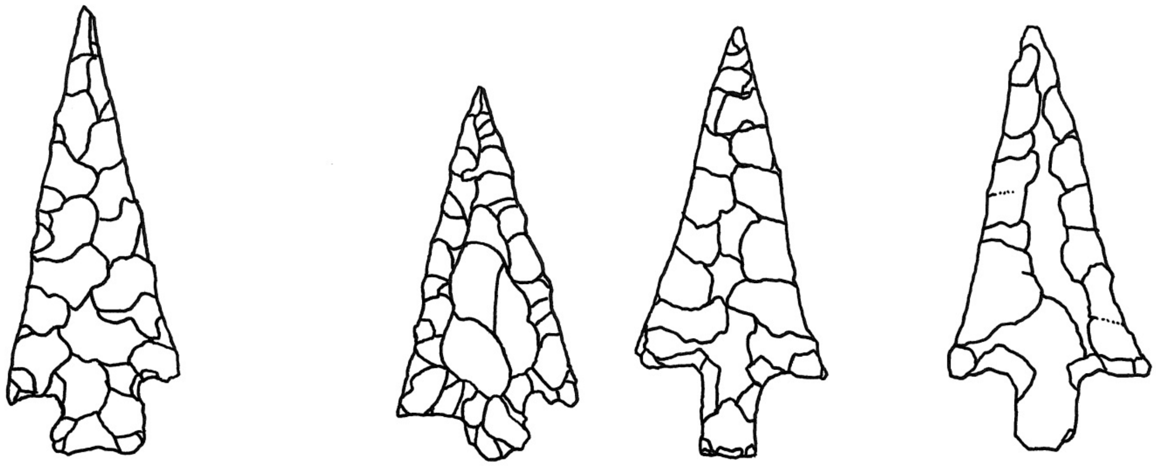
Quilomene Bar Basal-notched B is equivalent to Quilomene Bar Basal-notched A, although notably smaller in overall size. The barbs are less square and shouldered, and resemble corner removed, stemmed points. Lohse (1995) indicated that while Quilomene Bar Basal-notched B appears to be a distinctive form, specimens could be normal production variants of the A type. From a manufacturing point of view, if the pressure tool used to notch the projectile point twists in the process, the corner will break away and produce the B variant instead of the A. Flaking patterns tend to be random, although uniform patterned flaking occurs. Cross sections are predominantly biconvex. Lohse and Schou (2008) give a temporal span from 2500 to 1500 B.P.

6.2.2.4 Winter Village

Columbia Corner-notched B - 2000–150 B.P

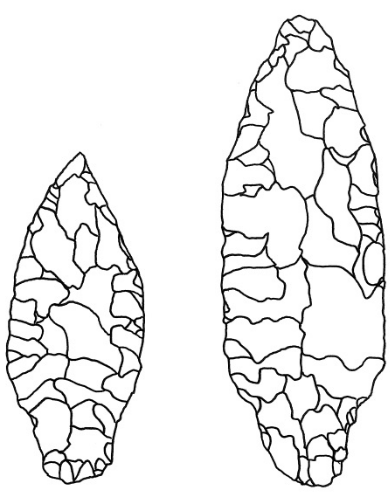
Columbia Corner-notched B variants are smaller versions of the Columbia Corner-notched A form. Outline and surface treatment are similar to the A variant (Lohse 1995). They are a small triangular point with margins that are straight to slightly convex; rarely are the margins serrated. Deep notches placed in the corner produce expanding stems, and the base element is straight to slightly convex. Flaking patterns are generally regular or patterned, with a cross section that can be biconvex to planoconvex. Lohse and Schou (2008) combined these with the A series as generalized Columbia Corner-notched form. These points are compatible morphologically and temporally with Elko Corner-notch and Pelican Lake found along the Snake River Plain and farther north in Montana. This may indicate regional connections or simply a functional pan-regional style. Lohse (1995) and Lohse and Schou (2008) give a temporal distribution from 2000 to 150 B.P.

Wallula Rectangular Stemmed - 2000–150 B.P.



Wallula Rectangular Stemmed points are small, thin triangular forms with straight margins, with a straight to convex base (Lohse 1995). Notches are placed in the corner, producing a contracting to straight stem. Flaking patterns are variable from random to patterned, with typically biconvex cross sections. The Wallula Rectangular Stemmed type is common on the lower region of the Columbia River drainage, but occurs in limited numbers as far north as Kettle Falls. These appear to be contemporaneous with Eastgate–Rose Spring points found in the easternmost regions of the Columbia drainage (including the Snake River Plain) and the Great Basin. Lohse (1995) suggested that the temporal range is from 2000 to 150 B.P.

Columbia Stemmed - 2000–150 B.P.



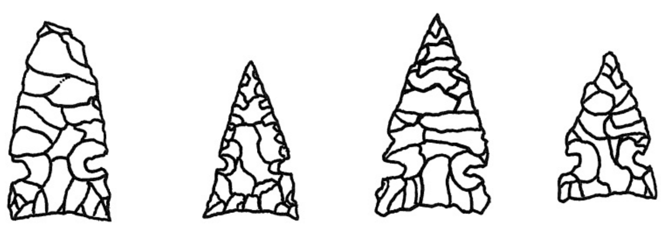
Columbia Stemmed A type points are delicate, elongated triangular forms with small expanding stems produced by placing the notch low in the corner of the basal element and removing the corner. The removal of the corner produces a downward projecting barb (Lohse 1995).

Typically, these are long narrow points with straight to slightly concave lateral margins. Square barbs do occur but are not as pronounced as the Quilomene Bar series. Flaking patterns are mixed, from random patterning to uniform parallel or parallel oblique. Cross sections are biconvex and regular. Columbia Stemmed A are more frequently identified in the lower Columbia River drainage, but have been found as far north as Kettle Falls. Columbia Stemmed series in general appear to be contemporaneous with Eastgate–Rose Spring corner notch and corner removed points found in the eastern most regions of the Columbia drainage (including the Snake River Plain and northern Rocky Mountains).

Columbia Stemmed B points are similar to the Type A variant. The basal notches are more open and lack squared barbs. The lateral margins tend to be slightly concave. The suggested date range is the same as Columbia Stemmed Type A (Lohse 1995).

Columbia Stemmed C variants are similar to both Types A and B. These are small triangular forms with distinctive basal notches and barbs. They are smaller and shorter than the A and B variants, and tend to have broader basal notches that produce an expanding stem and barbs that expand outward. Lateral margins are variable but tend straight to convex. Flaking patterns are also variable; often parallel patterned and parallel oblique occur, but many are randomly patterned. Cross sections are typically biconvex, although planoconvex is also common. Type C variants appear to occur slightly later in the archaeological record than do Type A or B points. The suggested date range is from 1500 to 150 B.P. (Lohse 1995).

Plateau Side-Notch - 1500–150 B.P.



The Plateau Side-notch is a small side-notched triangular point type unrelated to the larger Cold Springs Side-notched type (Lohse 1995). The side notches are placed low on the margins, close to the proximal end. The base element tends to be straight but can be concave to convex, and sometimes a third notch is placed in the center of the basal margin creating a tri-notch arrangement. Basal lateral margins can be straight to expanding but never contracting. Lateral margins are typically straight, but slightly convex and serrated examples occur. Cross sections are almost always biconvex, but planoconvex also occur.

This projectile point type has a wide distribution across all of western and central North America and is referred to variously as small side-notched, Columbia Side-notched, Plateau Side-notched, Desert Side-notched, Plains Side-notch, Plains Tri-notched, and Cahokia Point. Temporal distribution is given as from 1500 to 150 B.P.

Bliss and Avonlea Forms

In the Idaho portions of the CRB, there are additionally found Bliss and Avonlea points. Bliss points are a small ovoid contracting stem point with an elliptical cross section. It is weakly shouldered with a long contracting stem and flat to rounded base (Green 1993). Avonlea points are more common in the woodland region, but are described as a thin small to medium side notched point with an elliptical to flattened cross section. It has low and shallow parallel notches and an expanding stem with a concave base (University of Minnesota 2015).

6.3 Economies and Resources

Peoples' interaction with the environment in which they live leaves evidence that can be found and analyzed to lead to suppositions about activities that may not leave visible evidence. Subsistence and settlement are closely intertwined, and research into one often reveals information about the other. A principal point of research in the CRB is the timing of the emergence of a semisedentary lifeway after approximately 3500 or 4000 B.P. and the evidence of the degree that this lifeway differed from the mobile foraging lifeway through time. Variation in both subsistence and settlement has been documented across the CRB through time and was still evident in the ethnographic period, accompanied by a great deal of variability in social organization and levels of social complexity. Toward the eastern margin of the Plateau, bordering the Plains, hunter-gatherers were mobile and organized in flexible bands. On the western edge of the plains and along the Columbia River, populations were denser, and winter villages comprised a social stratified and ranked society exerting territorial control over hunting and fishing grounds. These people were likely in contact with the tribes of the Pacific Coast, and many of the features and measures of complexity are parallel to that found among coastal peoples (Prentiss and Kuijt 2004). This section reviews evidence of subsistence and settlement present in the archaeological record.

6.3.1 Subsistence Resources

6.3.1.1 Food Resources

Due to space constraints, discussion of subsistence in a document of this nature must rely heavily on synthetic works. Butler and Campbell (2004) provide the most detailed and thorough review of faunal data available within the FCRPS study area. Although their selection of data sets for analysis is more rigorous than other studies (e.g., Chatters 1989, 1995), the exclusion of other reviews narrows the scope of our discussion. The text below provides views of subsistence from a number of different geographic areas on the Plateau.

The faunal record, should be viewed with some consideration given to temporal and geographic scale as well as taphonomy and limitation inherent in archaeological data. The reader is referred to Grayson (1984), Lyman (1994), Klein and Cruz-Uribe (1984), Behrensmeyer and Hill (1980), and Lyman (2009b) for an in depth consideration of taphonomy and issues relating to the nature of archaeological data.

Davis (2007) points out that large scale environmental factors cannot be used to explain local variation in archaeological patterning for a number of reasons (e.g., differential preservation of faunal remains, changes in seasonality and climate over millennia, or incomplete material record of subsistence and storage practices).

General Trends

Archaeologists have generally characterized Pacific Northwest subsistence, both coastal and interior, as a system almost completely reliant and built on anadromous salmonids but supplemented by other terrestrial and aquatic resources (Ames 1994; Ames and Maschner 1999; Butler and Campbell 2004; Chatters 1995; Prentiss et al. 2005). Although salmonids were important, they were, perhaps less reliable as a food source than early investigators (e.g., Luther Cressman) thought (Schalk 1977). Our knowledge of the trajectory of subsistence regimes across the region rests on just a few sites that date from the late Pleistocene and early Holocene, like Marmes Rockshelter (Hicks 2004), Cooper’s Ferry (Davis 2001b), and Hatwai (Ames et al. 1981). As such, evidence from these sites is necessarily buttressed by archaeological data from elsewhere in the western United States (see below).

Early Subsistence Regimes

Hunter-gatherer populations in North America during the Late Pleistocene/Early Holocene likely practiced some sort of generalized foraging. Long-held hypotheses of narrow-niche focused “PaleoIndian” big game hunters (e.g., Martin 1967) have generally been overturned by data from numerous sites. For example, isotopic data from human remains at On Your Knees Cave in Alaska indicates that early North American diets included marine resources (Dixon et al. 1997). A recent find in central Alaska documents salmon bones in an 11,500 B.P. hearth (Bhanoo 2015). Similar evidence comes from Southern California, where Erlandson et al. (2011) have reported exploitation of marine environments in the Channel Islands. Waters et al. (2011) and others have shown that humans did exploit megafauna, but that large game animals played a less prominent role in subsistence patterns than was previously thought (Grayson and Meltzer 2002, 2003). To date, archaeological sites with evidence of megafauna exploitation have not been found in the Plateau.

Early to mid-Holocene archaeological sites are more common than late Pleistocene sites in the Pacific Northwest, generally, and on the Plateau, specifically. Some of the best subsistence data available for this period on the Plateau comes from the Snake River Plain (see below).

Northern Plateau

Prentiss et al. (2005) discussed five periods of cultural change on the Canadian and Columbia Plateaus, focusing on the evolution of social complexity and the development of increasingly complex collector-like land-use systems.

Period I is characterized as a formative collector period with the appearance of settlements indicating logistical organization. Storage features occur at sites on the Canadian Plateau with evidence of a broad resource base focused on salmon, various medium to large mammals, and freshwater mussels. Prentiss et al. (2005) argued for increased resource specialization on the Columbia Plateau during this period with an economy focused on salmon, ungulates, and freshwater mussels (see also Chatters 1995). In essence, the basic structure of a salmon- and large terrestrial game–based economy did not dramatically change through time. Storage, particularly for salmon, did appear, however, to have grown in importance and become more widespread. Storage of salmon is often inferred through body part representation (e.g., few head parts compared to vertebrae); however, this most likely does not present a full picture of the extent of storage and may overestimate its importance in some situations.

Prentiss et al. (2005) have contended that the pattern of “salmon intensification” noted in Period I continued in Periods IIa and IIb. Storage features, indicating delayed consumption of resources (probably salmon), become increasingly large and geographically more widely distributed. The increased emphasis on salmonids may result from what Chatters (1994) asserts is a decline in bison populations during this general period.

Social complexity during Period IIc is thought to be signaled in part by differential representation of older, larger salmon compared to smaller, younger salmon in two contemporary assemblages (Prentiss et al. 2005). In short, larger, older salmon are suggested to indicate high status access to optimal fishing locations. Berry (2000) applied Cannon’s speciation method to faunal remains from a few house pits and suggested that a diverse salmon fishery must have existed at Keatley Creek, including sockeye, chum, and pink salmon. Later DNA analysis of many of these vertebrae revealed no chum or pink salmon and presented a picture of a fishery restricted to sockeye, Chinook, and coho (Speller et al. 2005). Contradictory species identification does not necessarily undermine the status/size access argument, but it does likely modify our understandings of seasonality and species/status linkages.

Data presented by Butler and Campbell (2004) indicate that killing and using bison, as well as other medium and large mammals, specifically artiodactyls (ungulates with an even number of toes), increased across the Plateau. They noted an increase in artiodactyl remains relative to the remains of other mammals. In fact, their data supports this trend throughout the Holocene. While not used specifically to address questions of foraging efficiency, Butler and Campbell's (2004) artiodactyl index data do appear to suggest that Holocene hunters and gatherers on the Plateau became increasingly efficient in their use of terrestrial resources. This same basic trend carries through Prentiss et al.'s (2005) Period IIb on the Canadian Plateau.

Central Plateau

Butler and Campbell's (2004) subsistence data appears to indicate an increase in salmon abundance on the Plateau through the Holocene. This trend is somewhat skewed by three early sites (Bernard Creek, Marmes Floodplain, and Kirkwood Bar) from the Snake River with low relative salmon abundance. Exclusion of these data sets and consideration of only sites on the main stem of the Columbia changes the trend and makes increasing "salmon intensification" less apparent. The main-stem assemblages have high abundances of salmon through time. The separation of these data sets may also indicate that resident fish like catostomids were more important in non-main-stem areas of the Plateau. As evidence in the Plateau assemblages Butler and Campbell considered indicates, the abundance of artiodactyls and toed ungulates increased through time; however, early data sets are generally small and not ideal for quantitative analysis. Of 15 post-4000-B.P. assemblage artiodactyl indices (residences and camps), only one is less than 0.8[6], suggesting very high abundances of large game in the region. By proxy, high artiodactyl indices suggest highly efficient terrestrial foraging strategies that do not appear to change greatly through time, although these interpretations should be scrutinized regarding taphonomic processes.

Changes in taxonomic richness are often linked to intensification of resources; in short, as one resource becomes more important, other resources become relatively less important and may drop out of diets altogether. Richness is not sensitive to changes in relative abundance; thus, rare taxa are represented as equally as taxa that are abundant (see Nagaoka 2001 for a detailed consideration of this point). Interestingly, analysis of data provided by Butler and Campbell (2004) demonstrates no trend in taxonomic richness through time at sites on the Columbia Plateau (including The Dalles Road Cut site) (Figure 6-5).

[6] Abundance indices produce values from 0 to 1, effectively a ratio of "animal remains of interest" to all other animal remains found. These indices are calculated using the following formula: (∑ "animal remains of interest"/ (∑ "animal remains of interest" + ∑ "other mammals")). The higher the number, the more the remains of the "animal remains of interest" dominate an assemblage.

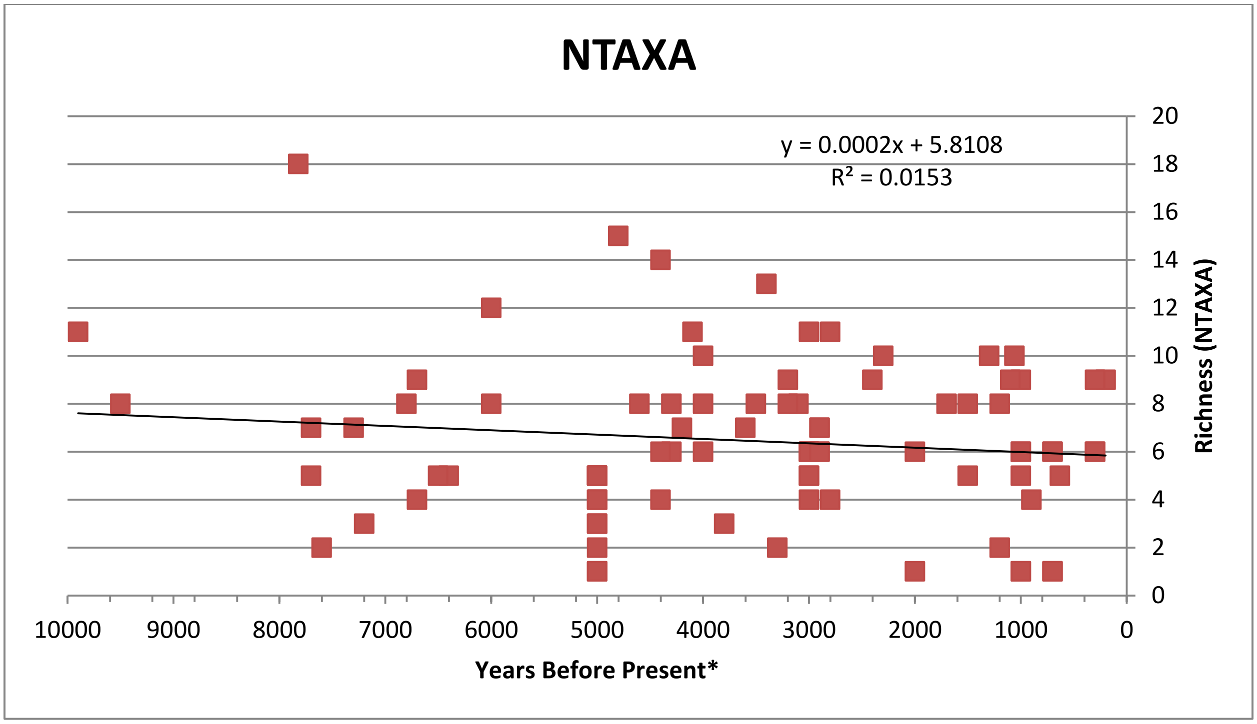


Figure 6-5. Taxonomic richness through time of all Northern Plateau data presented in Butler and Campbell 2004 (note: *indicates "Ages B.P." from Butler and Campbell 2004).

These datasets are drawn from different types of sites and something akin to Thomas and Mayer's (1983) monitoring perspective concept should be taken into account. Taken individually, sites only reflect a portion of patterned activity and do not represent a complete picture of resource use or other behaviors.

Figure 6-6 illustrates the taxa Butler and Campbell (2004) identified at the Wells Reservoir and Chief Joseph Dam archaeological projects. Assemblages are shown in 1,000-year categories to assess changes in relative taxonomic abundance through time. Family-level data reported by Butler and Campbell (2004:376–381) for fish and mammals are collapsed into broader categories so patterning is more easily observed. The newly generated categories include: invertebrates, small mammals, medium mammals, large mammals (nonartiodactyl), artiodactyls, birds, reptiles/amphibians, and fish. Table 6-4 includes the data HRA used to generate Figure 6-6.

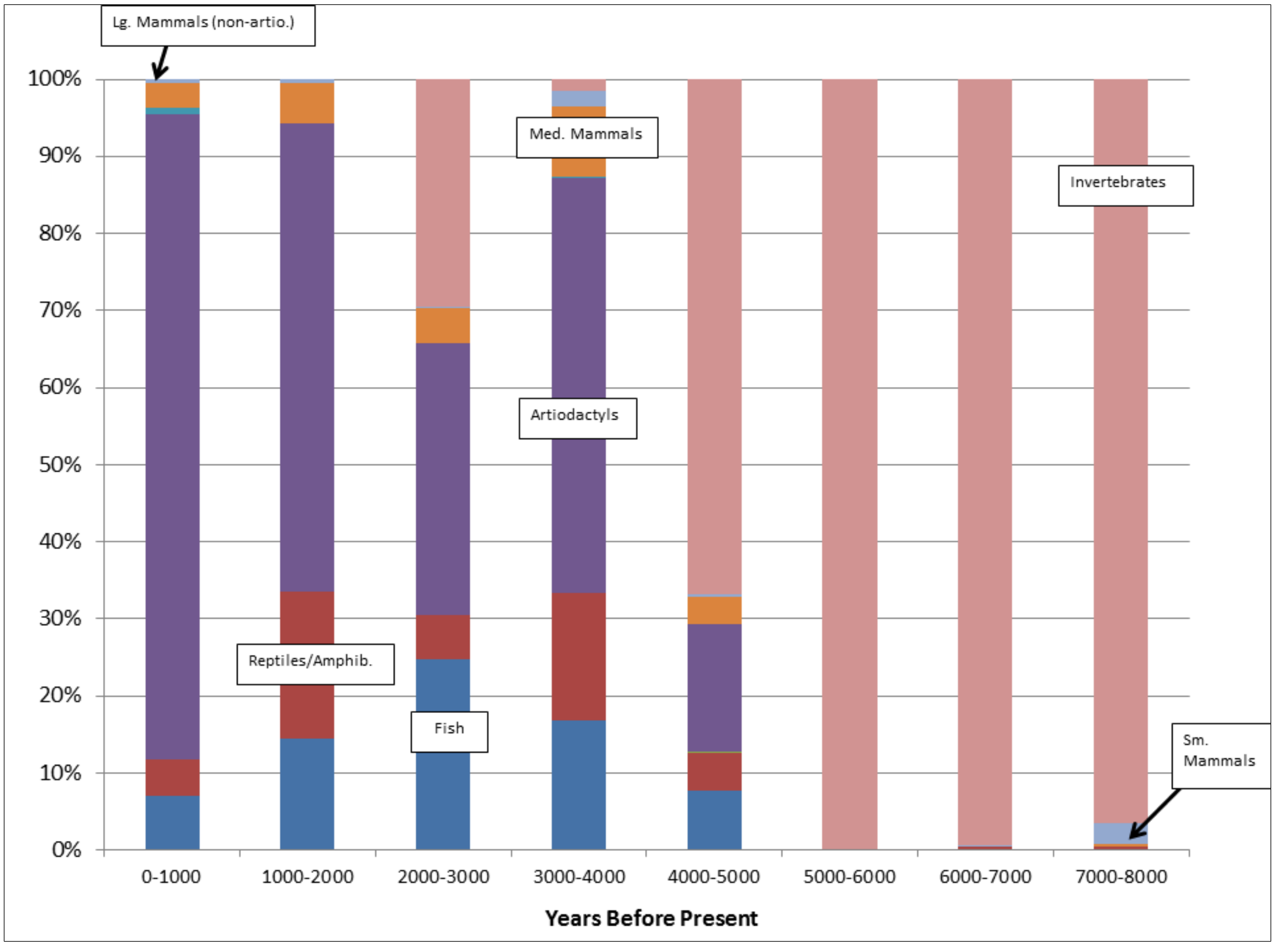


Figure 6-6. Percentage of fauna at the Wells Reservoir and Chief Joseph Dam archaeological sites through time (Butler and Campbell 2004).

Table 6-4. Relative Abundance (%) of Collapsed Taxa Categories (after Butler and Campbell 2004).

	Calendar Years Before Present							
Taxon	**0–1000**	**1000–2000**	**2000–3000**	**3000–4000**	**4000–5000**	**5000–6000**	**6000–7000**	**7000–8000**
Fish	7.06	14.47	24.75	16.83	7.78	.01	.19	.21
Reptilia/Amphibia	4.68	19.09	5.81	16.53	4.91	---	.23	.19
Birds	---	---	---	---	---	---	---	---
Artiodactyls	83.68	60.76	35.26	53.78	16.64	.01	.05	.06
Large Mammals (nonartiodactyl)	.83	---	.02	.21	.03	---	---	---
Medium Mammals	3.24	5.20	4.46	9.06	3.38	.02	.05	.42
Small Mammals	.52	.47	.20	2.06	.41	.01	.13	2.64
Invertebrates	---	---	29.50	1.53	66.81	99.96	99.35	96.47

Freshwater bivalves dominate early assemblages, making up between 66 and 96 percent of the identified specimens from sites dating from between about 4000 and 8000 cal yr B.P. (see Figure 6-6). Taxonomic richness is low to moderate (see Figure 6-5). Invertebrate faunas become relatively less abundant in assemblages that date from the later Holocene (after about 4000 B.P.). By the middle Holocene, assembled remains of fish and artiodactyls dramatically increase in relative abundance and specimens to medium mammals; reptiles and amphibians increase as well. This period began a general trend of increasing exploitation of artiodactyls, although their representation decreases in assemblages dating from between 2000 and 3000 B.P., which likely corresponded to a rebound in the relative abundance of invertebrate fauna. Artiodactyl remains dominate identified specimens during the latest time period (0–1000 B.P.). The relative proportion of fish remains peaks in assemblages dating from this period as well. The relative abundance of specimens from reptiles and amphibians varies through time in the middle to late Holocene, reaching a high of 19 percent of identified faunal remains between 1000 and 2000 B.P. Medium mammals are relatively consistently represented through time after between 4000 and 5000 years ago. A small percentage of nonartiodactyl large mammals remains from the post-1000 B.P. time period include bear and horse remains. Specimens from this category are relatively rare through time in the assemblages included here.

The pre-4000 B.P. assemblages, which are dominated by invertebrates, were likely affected by postdepositional destruction of bone, making the dominance of invertebrate faunas more apparent than real. Additionally, freshwater musselshell is more easily identified to taxonomic family than are vertebrate remains. Because of presumed taphonomic bias, consideration of faunal data from here on will focus most heavily on post-4000 B.P. assemblages.

It is useful to think of the fauna included in Butler and Campbell's (2004) data set as comprising foraging data for two basic patches: aquatic and terrestrial. In general, artiodactyls, birds (those identified here), and medium and small mammals represent fauna that spend the majority if not all of their time on land and are most commonly taken through terrestrial hunting. Since reptiles and amphibians are collapsed into a single category, specimens from this category could represent terrestrial or aquatic patch exploitation. Fish and invertebrates (those identified here) represent exploitation of an aquatic patch. Figure 6-7 presents relative faunal abundance for the last 4,000 years aggregated into these patches.

Resources from the terrestrial patch dominate assemblages from the Wells and Chief Joseph Dam projects (Figure 6-7). Specimens assigned to the aquatic patch represent less than a quarter of the relative resource mix reported for assemblages dating from between 3000 and 4000 B.P. This pattern changes dramatically for newer assemblages, in which fish and invertebrate remains compose more than 50 percent of identified specimens. This increase in relative abundance is in part the result of a proportional increase in fish remains but mainly due to a dramatic increase in invertebrate remains from two archaeological sites, 45OK74 and 45DO189. After 2000 B.P., the relative importance of the aquatic patch appears to wane, and specimens associated with terrestrial patch exploitation account for nearly 90 percent of faunal remains after about 1000 B.P. Remains of cervids and pronghorn account for the majority of the terrestrial faunal assemblage from 0 to 1000 B.P. Salmonids are found in many of the assemblages after 1000 B.P., but they are proportionally rare compared to terrestrial specimens.

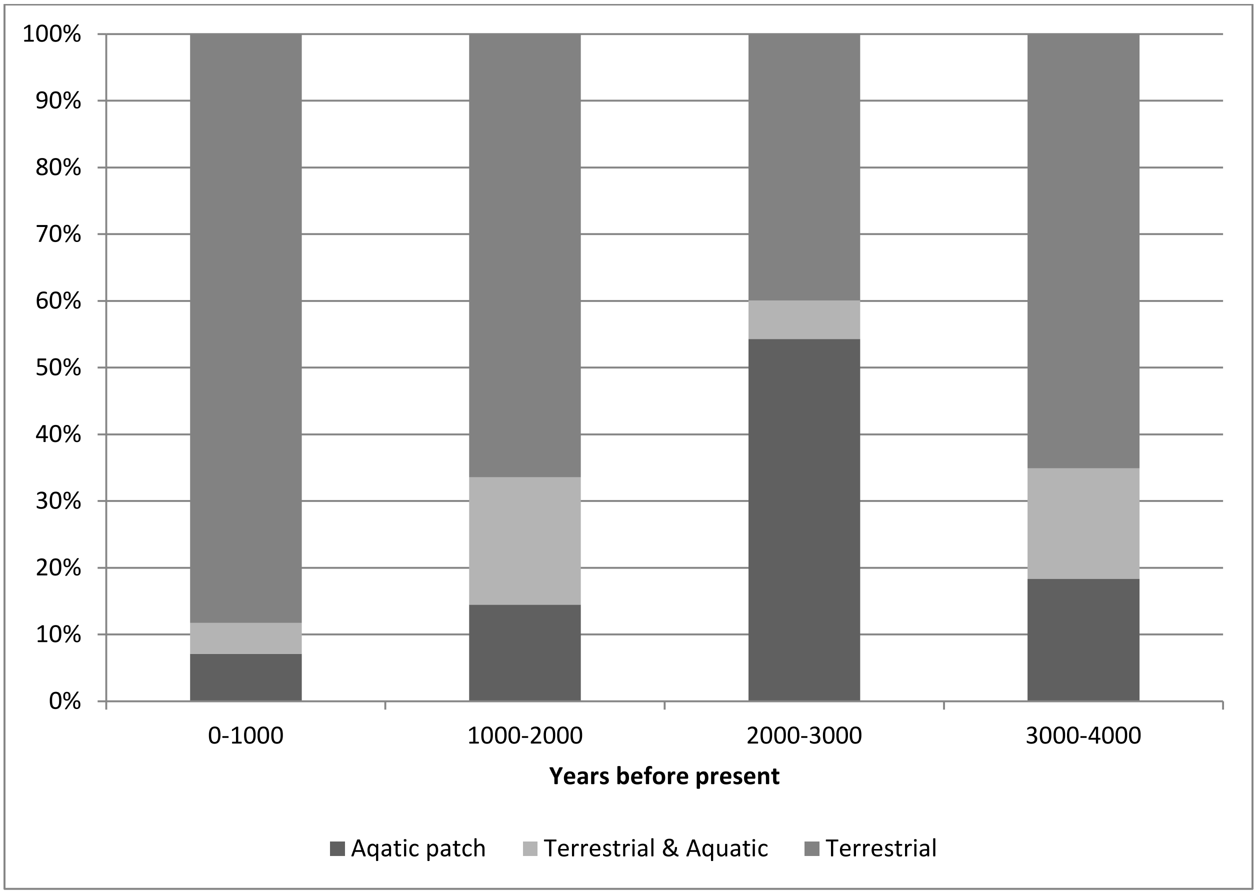


Figure 6-7. Patch exploitation based on identified taxa presented by Butler and Campbell (2004:376–381).

Snake River System

The Marmes Site rockshelter and floodplain deposits provide perhaps the longest continuous view of the regional subsistence regime; however, the site should be considered as part of a larger system that changed through time (Hicks 2004). Bernard Creek Rockshelter's similar age makes this site a useful point of reference for the earliest settlement in the region (Knudson 1980; Randolph and Dahlstrom 1977). Early on, when Marmes was part of what is hypothesized to have been the mobile forager land-use system, the resource base was relatively diverse and included fish, shellfish, and large and medium terrestrial fauna. During later occupations, an increase in small mammal use coupled with a decrease in large mammal use indicates a shift from large to small game and the broadening of the foraging spectrum due to the changes in mobility or because the large game were harder to acquire. Archaeologists use the observed decrease in freshwater shellfish remains as support for logistical organization, because these animals are thought to be used locally and rarely transported.

Manning's (2011) recent analysis of fish remains from the Hetrick Site on the Snake River plain sheds light on the use of this resource base through time in the area. The site was occupied through the Holocene and provides a unique site from which to view non-main-stem fishing practices. Nonsalmonid fish remains dominate cultural components at the site, which dates from approximately 10,000 B.P. Middle Holocene fish remains from this site are rare; Manning only identified 37 specimens to taxonomic class, but these are split evenly between nonsalmonid and salmonid remains. Finally, the late Holocene component at this site also yielded few fish remains, but these are generally evenly distributed between salmonid and nonsalmonid taxa. Smaller fish (determined through statistical analysis of vertebral dimensions) dominate the salmonid assemblages, which are more likely resident trout and not anadromous salmon. Data from Kirkwood Bar and other Snake River sites show similar trends (Butler and Campbell 2004).

Farther inland, especially well off the main stem of the Columbia (e.g., Snake River), anadromous salmonids may not have been a particularly attractive resources from a purely optimal foraging theory (OFT) perspective. Plew (1990) has demonstrated that after making long-distance migrations, salmon are depleted of nutrients, making local, somewhat smaller fish more attractive. Unpredictable runs coupled with decreased nutritive value and low numbers because of downstream exploitation (Schalk 1977) may have made anadromous salmon less valuable in the upper portions of the study area (Manning 2011). This seems in contract to the pattern of the largest villages being based around salmon fisheries and an emphasis on the fishing or types of fish as names of Spokan bands. In addition, oral history and historical records describe large numbers of salmon being harvested as a prize resource at such places as Kettle Falls. But Davis (2001a) extended Butler and Schalk's (1986) logic to suggest that prior to about 2000 B.P., the Lower Salmon River (a tributary to the Snake River) was not ideal for substantial anadromous salmonid production.

Lower Columbia

Recently, Solimano and Gilmour (2014) have attempted to address what they see as a substantial data gap in the synthesis of archaeological data for the Lower Columbia region, specifically the archaeological record in and around The Dalles. Using coarse time units (pre- and post-3500 B.P.), their analysis shows that pre-3500 B.P. assemblages generally have low taxonomic richness, indicating a narrow diet breadth (with the exception of Site 35WS8). The post-3500 B.P. assemblages they studied, however, have much greater taxonomic richness, indicating a broader diet breadth. Salmon did play a role in the pre-3500 B.P. economy as early as 9000 B.P., as evidenced by assemblages recovered from Site 35WS8 (Butler 1990; Butler and O'Connor 2004).

Subsistence practices in the Lower Columbia region appear to indicate an intensification of low-ranked resources that correlated with a decrease in higher-ranked taxa during the late Holocene and prior to European contact in the region (Butler 2000). Butler (2000) suggested that the importance of small fish increased in the region as a result of population increase. Salmon may not have played the paramount role in late-Holocene precontact subsistence that was noted ethnohistorically in this area. They were likely still an important resource at the time, but Butler (2000) has suggested that they grew in importance as result of a decline in predation pressure brought on by a reduction in Native populations in the region resulting from European contact.

Biogeography

Understanding the modern and historic range of animals is important for archaeological inquiry. Modern and historic-period biogeography varies in large part because of large-scale modifications humans have made to their environment (e.g., dam construction [see Dauble 2001]). Beyond this, the introduction of nonnative taxa has impacted native faunal communities in numerous ways (see discussion of fish taxa in Lower Columbia region below). Faunal communities had been affected by Native Americans prior to the arrival of Euroamerican populations; historic-period abundance and biogeography only provide a point in time for comparison of the modern situation of animals and should not be taken as a "baseline" for restoration or conservation purposes.

Reviewing historical records, explorers' journals, and ethnographic literature to generate biogeographic data is a common practice in wildlife management (Sodhi and Ehrlich 2010). Some weaknesses exists in this method, however. First, these sources were generated, sometimes by unreliable sources, with varying levels of skill in taxonomic identification. Second, even if the authors correctly identified taxa, they most commonly refer to them by common names, which may have been used to refer to numerous other taxa. Finally, assertions of absence of taxa may be linked to season of observation. Despite these biases, historical information is invaluable for documenting biogeography. Archaeological data can be used to provide another line of evidence regarding precontact biogeography (Lyman and Cannon 2004).

Archaeological Data and Biogeography

Archaeological data provides useful evidence somewhat independent of historic-period observations and with a longer temporal perspective than historic-period accounts (Lyman and Cannon 2004). Newsome et al. (2007) demonstrated the utility of archaeological data in establishing the possible presence of northern fur seal rookeries in the North Pacific. Rookeries in this area were not documented historically, but by using archaeological data and geochemistry, the investigators were able to demonstrate that rookeries must have existed where they had not been observed by historic-period hunters. In a similar vein, Butler et al. (2010) used archaeological fish remains to demonstrate the likelihood that anadromous salmonids once migrated into the upper reaches of the Klamath Basin, at least as far as Bly, prior to the construction of the Copco 1 dam and perhaps as long ago as 5000 B.P.

Because of the nature of archaeological deposits, faunal remains from archaeological settings can and should only be used to inform biogeography at a nominal scale to provide either presence/absence data or relative abundance (Grayson 1984); using these data to address questions of absolute abundance is not appropriate.

Mammals

Wisdom et al. (2000) analyzed the biogeography of 91 individual terrestrial animal taxa, which include 12 Linnaean families. Their analysis included over 145 million acres in the interior Columbia Basin and used observed changes in habitat to estimate abundance. In short, nearly all habitats have been reduced, likely leading to reductions in breeding populations of terrestrial mammals across the region. This analysis was coarse grained but can be used as a baseline against which to compare relative abundances as well as presence/absence of native fauna in the archaeological record.

R. Lee Lyman has written extensively on the Holocene history of numerous mammalian taxa from eastern Washington. His derives his data from various archaeological deposits across the region. Lyman's (2010) examination of *Cervus elaphus* remains from Marmes Rockshelter demonstrated that early Holocene elk may have been substantially larger than those documented historically in the region. His research has also demonstrated precontact biogeography of the noble marten (*Martes americana nobilis)* (Lyman 2011), bighorn sheep (*Ovis canadensis*) (Lyman 2010), pronghorn (*Antilocapra americana*) (Lyman 2007), and bison (*Bison* sp.) (Lyman and Bassett 2004). His studies have shed new light on issues of precontact ranges. For example, debate on the native status and abundance of bighorn sheep (*Ovis canadensis*) in eastern Washington has been ongoing since the early twentieth century (Lyman 2009a). These animals were found in only small numbers around the turn of the twentieth century. However, review of archaeological assemblages spanning approximately 10,000 years in the region suggests bighorn were relatively abundant in the region throughout much of the Holocene.

Much information about ungulate use and their importance in precontact diets is available through archaeological collections, because evidence of ungulates endure in site deposits and in ethnohistorical accounts. Examination of the oral literature of the peoples of the CRB provides evidence of subbasin variation in economic focus; in peripheral watersheds with highly unreliable salmon runs or demonstrable migration barriers (e.g., Similkameen Falls), the oral literature of resident populations typically recount a variant of the "Coyote Brings Salmon" narrative. This narrative is told across the Plateau with the relevant plot point being that the ancestral communities of these watersheds would not give treasure (usually a wife) to Coyote for his gift of salmon in their waters and as punishment, Coyote constructed impediments to salmon migration into these watersheds. In the version of the story recounted in the communities of the Similkameen, the punishment is shrugged off because mountain sheep was sufficient to their needs (Lyons 2013). The subsistence ramifications of this narrative mark the geographic limits of salmon and imply a contrast in the economic focus among Plateau groups that should be visible in their subsistence technologies.

Precontact aquatic mammal data is scarce for the Columbia Plateau; however, Lyman et al. (2002) have addressed harbor seal (*Phoca vitulina*) abundance in the region. Their study demonstrated that harbor seals were probably taken from the Columbia River near Celilo Falls as early as 10,000 B.P. and were certainly present in the system after about 1000 B.P.

Fish

Precontact fisheries of the Columbia Plateau have not received consistent treatment and have not been synthesized outside of Butler and Campbell (2004). Studies like Manning (2011) provide an excellent opportunity to gain detailed insight into non-main-stem fish biogeography, but these efforts are relatively sparse given the size of the region. Salmonid restoration and conservation efforts are very important on the Columbia Plateau, yet archaeological data has not been used to its full potential to address these issues.

Determining species of salmon and trout found in archaeological deposits has been a pursuit that has received a tremendous amount of attention in the last three decades. Members of the *Oncorhynchus* genus are morphologically very similar and can only be distinguished through a handful of skeletal elements and otoliths (Gorshkov et al. 1980). Vertebrae are the most commonly recovered skeletal element attributed to salmonids (Pacific salmon and trout). These elements are morphologically very similar, and visually indistinguishable (but see Gobalet et al. 2004). Species identification has significant implications for conservation biology (e.g., Stevenson 2011) as well as understanding season of site use and social inequality (e.g., Speller et al. 2005).

Early efforts to identify the species of archaeological salmon specimens employed radiographic methods developed by Cannon (1988). In short, Cannon’s working hypothesis was that apparent growth visible on vertebrae when exposed to X-rays could be used to establish age at spawning and by extension species. This method has been widely applied in Pacific Northwest archaeology (see also Orchard and Szpak 2011). Hofkamp (2015) has recently demonstrated that this method of species and age determination is invalid. He exposed vertebral specimens of known age and species from modern salmon to X-rays and applied Cannon’s method of species determination.

Hofkamp's results showed that the method does not accurately identify age, and by extension species, because radio opaque rings counted by Cannon do not actually correlate with age.

Huber et al. (2011) developed a morphometric method of salmon species identification that relies on statistical analysis of the relationship between two dimensions of individual vertebrae. The method was created using a large collection of modern specimens and was able to discriminate between species and species groups with a high degree of certainty. Recently, Moss et al. (2014) demonstrated through ancient DNA (aDNA) analysis and application of the Huber et al. (2011) method that the morphometric method is not applicable in all scenarios.

Pioneering aDNA work by Butler and Bowers (1998) and refinement of techniques by Yang et al. (2004) has thus far been the only method of accurate species identification. Genetic species identification targets mitochondrial DNA and is highly subject to contamination (Yang and Watt 2005). Speller et al. (2005) applied techniques developed by Yang to identify salmon species associated with "high status" structures at Keatley Creek. Their study overturned Berry's (2000) species identifications (see discussion above). The single greatest drawback to this technique has been that it is a destructive technique and unless specimens are large enough to split, application of new technology and confirmation through other means is not possible.

Genetic analysis may also be used in conjunction with geochemical analysis to determine species and life history of salmon (e.g., Robinson et al. 2009); however, Butler et al. (2010) noted difficulty with techniques applied by Robinson. A strontium/calcium (Sr/Ca) analysis study reported by Butler et al. (2010) showed evidence of resident and anadromous life histories; however, unpublished data on strontium ratios of those specimens suggests a high degree of diagenesis, which has had an unquantifiable effect on Sr/Ca data. Miller et al. (2010) have demonstrated the validity of Sr/Ca data for life-history determination in archaeological otolith specimens. Geochemical analysis of otoliths to address questions of life history is well established in modern fisheries literature (Campana 1999; Kalish 1990; Zimmerman 2005) and otoliths do not appear to be subject to diagenesis (i.e., changes in chemical composition) like bone (Miller et al. 2011).

Butler and Schalk (1983) compiled data on historic presence of various anadromous salmonid taxa in the Upper CRB. According to explorers' journals and fisheries studies, Chinook, sockeye, steelhead, and coho probably all migrated through and spawned in the Upper Columbia. Pink salmon are also said to have made it into the area, but this claim is more suspect.

Butler (2004) reviewed data from the lower Columbia River that pertains directly to native fish biogeography. Lewis and Clark recorded a number of native fish using common names, some of which are no longer in general use (e.g., "red charr," which is thought to refer to sockeye). Although the Lewis and Clark expedition made it into the lower Columbia River region during a period when not many anadromous salmonids were running, they appear to have observed fish identified by Butler as *O. kisutch*, *O. mykiss*, and/or *O. keta*. Additionally, they saw specimens of *Acipenser* sp. (sturgeon), *Thaleichthys pacificus* (eulachon), Pleuronectidae (flounder), and *Raja* or *Bathyraja* spp. (skates). Archaeological evidence of the fishery in this region suggests that Native Americans used a more diverse fishery in the region, including cyprinids (minnows), cottids (sculpins), catostomids (sucker fish) and Gasterosteidae (three-spined stickleback), among other fish. Some of the fish in the Native American fishery are very small, and the Corps of Discovery members documenting what they saw may not have deemed these fish as suitable food.

Table 6-5 presents a generalized Gantt chart for many of the subsistence fish of the region that return to predictable fisheries; the table notes the periods when they are most numerous.

Table 6-5. Spawning Windows of Culturally Utilized Fisheries for the Columbia Basin.

	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Chum												
Chinook												
Steelhead[a]												
Steelhead[b]												
Sockeye												
Bull trout												
Westslope cutthroat trout												
Mountain whitefish												
Sucker												
White sturgeon												

a = summer run, b = winter run

The fisheries of some species listed above tended to be localized in the late precontact period. Furthermore, bull trout habitat overlaps with the eastern range of salmon habitat, which stunts the bull trout, making it less desirable economically and therefore underutilized in those waters. However, in those watersheds where salmon are absent or small in number, bull trout mature to considerable size and weight. Winter-run steelhead and westslope cutthroat trout are mutually exclusive categories and cannot co-occur within the same subbasin as they hybridize; westslope cutthroat tend to occupy waters that are isolated from anadromous populations by naturally occurring hydrologic barriers. Understanding these nuances is necessary for developing lists of culturally utilized resources in a given area. Archaeological recovery of otoliths has particular utility; not only can species and age class identification be determined but also identification of the natal waters with which the run was associated (see Miller et al. 2011).

The introduction of nonnative fish to the region beginning in the late nineteenth century has dramatically affected native fish populations (Butler 2004). Invasive species are often able to out-compete native species. This over competition, in addition to multiple introductions for sport fishing and other purposes, has drastically changed the fish fauna in the region in the last two hundred years.

Shellfish

Freshwater mussels have been part of precontact diets on the Plateau for over 8,000 years (Lyman 1984). Lyman's (1980) review of freshwater mussels from 13 Plateau archaeological sites, coupled with data from Marmes Rockshelter (Ford 2004), provides a useful basis for establishing precontact biogeography of these animals. Commonly, it is assumed that both *Gonidea* sp. and *Margaritifera* spp. represent local harvest and, as such, changing taxonomic frequencies may indicate shifts in paleoenvironment, but these taxa may also co-occur in neighboring stretches of river (see Section 4.3.4). For example, a noted decrease in *Gonidea angulata* and a concomitant increase in *Margaritifera falcata* in Lyman's Columbia Basin sites, suggests increased runoff and faster-moving streams. Research on shell from the Lower Salmon River has been used successfully to reconstruct past precipitation regimes (Davis and Muehlenbachs 2001). Chatters et al. (1995a) used interpretations of shellfish morphology in concert with other paleoclimatic data to anticipate the effects of climatic change on salmonid populations in the CRB (but see Black et al. 2010).

Studies of modern populations by the CTUIR (e.g., Brim Box et al. 2006) and individuals such as Allan Smith (Nedeau et al. 2005) have begun to document the current biogeography of freshwater bivalves.

Plants

A number of economically important food, medicinal, and technological plants occur within the FCRPS Project Areas. Where anadromous fish could be anticipated in quantity, they represented a reasonably secure element of a subsistence economy. The same was true of ungulates but with a higher degree of risk. However, the various native geophytes of the region provided the highest degree of food security and, along with other plant foodstuffs, represented a high fraction of foods consumed on an annualized basis in many parts of the CRB. Unlike terrestrial fauna, plant resources generally reoccur in the same location from year to year, but their productivity may be affected by short-trend weather conditions, disease, browsing pressure, or wildfire.

Archaeological evidence of Plateau people gathering and processing various plants for food dates to around 6,000 years ago. Archaeologists have not resolved if this represented delayed food consumption and storage, which may have begun during the mid-Holocene (Davis 2007; Schalk and Cleveland 1983). Processing of geophytes, like camas, through slow cooking was necessary to convert indigestible long-chained carbohydrates into edible short-chained sugars, which also extended their storage duration (Thoms 1989). A number of economically important subsistence plants occur within the FCRPS Project Areas.

The list of plants provided here is by no means exhaustive. Rather, the following descriptions focus on plant resources that made significant contributions to diet, and/or have been found in archaeological deposits in the region (Lepofsky and Peacock 2004; Peacock 2008; Stenholm 1985; Thoms 1989), and thus are likely to be encountered archaeologically in the FCRPS Project Areas.

Bitterroot (*Lewisia rediviva*) is a perennial herbaceous plant primarily found in xeric climates across a wide elevational range from 60 to 3,000 meters. Bitterroot grows in open woodlands and sagebrush shrublands with pine, oak, or juniper in many soil and lithic facies types, such as shale, sand, clay, granite, serpentine, or talus. It has a wide geographic distribution in the western United States and Canada and was an important food plant for Plateau Tribes. The roots are prepared by removing the bark and boiling, steaming, or pit roasting them, after which they are eaten fresh or dried (NRCS 2015a). Because digging the roots destroys the entire plant, intensive harvest of this species could deplete a specific resource patch if not done after the seed was off. Alternatively, Catherine Dickson reports that bitterroot will regenerate from fragments left in the ground, which is one reason for the contemporary cultural practice of returning the peelings to the site from which they were dug (personal communication, August 12, 2015). In some modern American Indian communities where this plant is uncommon, it is consumed as a delicacy, rather than a staple, and is featured with other traditional foods at annual ceremonial gatherings (Lyons 1999–2011).

A variety of *Lomatium* species were used by Native American tribes in western North America and made a significant contribution to their diet (Turner 2014b). Over 10 species of edible *Lomatium* (including biscuitroots, desert parsley, and Indian celery) are found growing in the dry, geographically scattered lithosols of the CRB (Hunn and French 1981). According to Turner (2014b:188), the Okanagan and people of the Interior Plateau selectively harvested female plants of desert parsley (*L. macrocarpum*) for their roots. The tuberous taproots of Gray's lomatium (*L. grayi*) were eaten by people of the southern Plateau (Turner and Davis 1993), while the foliage of biscuitroot (*Lomatium* spp.), a common name used to describe various *Lomatium* species, was dried and used as a spice in Okanogan cooking (Turner et al. 1980). The Flathead consumed the spring roots of biscuitroots as a staple (Blankinship 1905). The root can be eaten raw or cooked, and its flavor profile changes with both seasonality of harvest and method of preparation.

Wapato (*Sagittaria latifolia*), also commonly and historically called duck potato or water potato, is a rhizomatous perennial broadleaf emergent. Vegetative production peaks in July, but by mid-fall the emergent plant parts annually die back to the root crown. Prior to the annual die back, nutrients and carbohydrates are translocated to subterranean tubers (NRCS 2015b). Its optimal habitat is perennial waters approximately 1 foot deep. This plant was used as a food by the Thompson, Klamath, Coeur d'Alene (Chalfant 1974; Turner et al. 1980), and maybe Kalispel (Smith 1936–1938). Among the Thompson, the root was cooked or dried; if dried, it was later reconstituted and mixed with fish in soups.

Camas (*Camassia quamash*) was and continues to be an important traditional food for indigenous people of western North America. Like the other listed geophytes mentioned above, it was prized for its nutritious bulb. The bulbs were usually dug after flowering, in summer, although some peoples dug them in spring. Among the Nez Perce, for example, harvesting the bulbs traditionally took weeks or months. Within that community, each family group "owned" a camas patch, which was passed down as an inheritance. Bulbs were dug with a pointed digging stick and smaller bulbs were replanted. Controlled burning was used to maintain an open prairie-like habitat for optimum camas production with areas being harvested only every few years. As with bitterroot, harvesting the camas bulb effectively kills the plant, thus too much harvest pressure on it would deplete a resource patch; Nez Perce oral history recounts postbloom harvest, weeding, field burning to arrest forest encroachment, and bulb size selection to assure both continued and optimal productivity (Lyons 2013).

Thoms (1989) calculated that the average size of a camas patch needed to feed a five-person family was 6.67 acres. However, large and abundantly moist wetland habitats (e.g., Calispell Valley) allowed for higher rates of recovery with reduced travel times. Due to agricultural conversion of valley bottoms and the wide and historical practice of open grazing, the ubiquity of camas has been drastically reduced. Restoration of camas prairies and access to camas bulbs are priorities of many Native American communities associated with the FCRPS study area, as there are myriad traditionally associated subsistence and medicinal plants with this species.

Plateau people traveled great distances to harvest camas. It may have been cultivated beyond its native range in the ethnographic period (Turner and Efrat 1982; Turner and Kuhnlein 1983). As late as the 1960s, this bulb constituted an important element of Nez Perce traditional modes of exchange, trade, and gifting relationships (Harbinger 1964).

Arrowleaf balsamroot (*Balsamorihza sagittata*), a member of the sunflower family (Asteracea), is a forb that served various purposes for Plateau people. Balsamroot grows on dry, relatively exposed sagebrush-steppe soils and in open conifer forest across eastern Washington, northern Idaho, and western Montana (Franklin and Dyrness 1988). Young plants were harvested for their roots, which were baked or steamed in earth ovens (Peacock 1998). The flowers and seeds were also eaten or made into flour (Turner 2014a:270) and charred remains have been recovered from archaeological deposits in the FCRPS area (Campbell 1985).

Berry fruits are the most numerous of the edible plant types found on the Plateau. A variety of berries were eaten by Plateau tribes and including currant, serviceberry, highbush cranberries, soapberries, gooseberries, kinnikinnick, and elderberries (Hunn et al. 1998:530). Several species of *Vaccinium* (huckleberry) grow throughout the FCRPS Project Areas and were gathered from both low and high elevation environments. The timing of harvest of these many species of berries figured heavily into the seasonal round of some Plateau groups and usually consisted of forays into the foothills and mountains for several weeks in the fall (Hunn et al. 1998). The seeds of huckleberry, wild strawberry, and serviceberry, among others, have been recovered from archaeological deposits throughout the Pacific Northwest (Hicks 1995; Hicks and Morgenstein 1994; Hicks et al. 2006; Turner 2014a:274) and within FCRPS Project Areas (Stenholm 1985).

In addition to berries, various wild grains from the *Chenopodium* family were used by Plateau people, although there is some debate as to their importance in the diet. The seeds of charred goosefoot (*C. fremontii*) seeds were recovered from archaeological deposits ranging from 3300 to 600 B.P. in the Chief Joseph area (Stenholm 1985:438) and large quantities have been identified at Keatley Creek (Lepofsky 2004). However, Turner (2014a:306) notes that it is not clear if archaeological deposits represent consumption or are just a natural signal since chenopod seeds are plentiful in some Plateau environments. Identification of chenopodium processing through groundstone pollen washes may help clarify the dietary role of this species.

Western (beaked) hazelnut (*Corylus cornuta*) grows in moist forested environments and along some riparian areas throughout the Plateau. According to Hunn et al. (1998:530) "[h]azelnuts were the only species of nut available" in the Plateau Culture Area and were utilized wherever they occurred." Ethnographically, hazelnuts were commonly used by people of the northern Plateau (Turner 2014a:275). The hard outer shell of the hazelnut preserves well in archaeological deposits, and the nuts have been recovered from hearth features in the Chief Joseph Project Area.

Garry oak (*Quercus garryana*) acorns were found in the eastern Cascades and along the Columbia River and were an important dietary staple of people living near these areas (Hunn et al. 1998; Turner 2014a). Acorns were collected and leached of their tannins in pits and then processed into meal. The site of Sunken Village, on the lower Columbia River, arguably provides the best example of large scale acorn processing in the region (Croes et al. 2009) and while such features have not been identified within the FCRPS Project Areas it is possible that macrobotanical remains of acorns may be encounted in archaeological deposits near the Bonneville, the Dalles, and McNary Project Areas. Like camas meadows, oak stands benefit from low intensity, understory fires (Agee 1993), and fire was used by various tribes throughout western North America to intensify production of acorns (Stewart 2002).

Although not common within the FCRPS Project Areas, whitebark pine (*Pinus albicaulis*) seeds were dried and eaten by Plateau tribes (Hunn et al. 1998) and were of particular importance to people of the Interior Plateau (Turner 2014a:307). In some cases, the seeds were roasted and therefore may be preserved in hearths and have the potential to be present in archaeological deposits.

Medicinal Plants

Plants used for medicine and ritual practices by Plateau tribes are numerous. Hunn et al. (1998:534) note “[t]he Thompson alone used at least 200 species of plants in medicinal preparations,… Nearly 120 species of medicinal plants have been recorded for Sahptin-speaking peoples.” Many species used as food and for other parts of the plant were also considered to have healing properties. For example, tea made from kinnikinnick leaves was used as blood tonic by the Okanagan (Turner 2014a:420). In addition to annual and perineal plants, both deciduous and evergreen trees provided a variety of materials used for healing (Hunn et al. 1998; Turner 2014a). Pollen, seeds, leaves and other macrobotanical remains of medicinal plants may be preserved in archaeological deposits within the CRB.

Birds

As with precontact fisheries of the Columbia Plateau, archaeologists have paid little attention to birds (but see Hicks 2004). Avifauna recovered from the Marmes Site include passerine taxa like the bluebird (*Sialia* sp.) and the flycatcher (*Empidonax* sp.), Anseriformes like the common goldeneye duck (*Bucephala clangula*), and Charadriiformes like Cassin’s aucklet (*Ptychoramphus aleuticus*) (Hicks 2004). A swan bone with signs of butchering was found in one of the earliest occupation layers of the Marmes Floodplain (Hicks 2004:391). Moss and Erlandson (2013) have commented on the long history of importance of wetland resources including birds in an area that encompasses portions of the CRB.

Results of faunal analyses including birds have not been synthesized, with the exception of Butler and Campbell’s (2004) study. Given the depletion of sagebrush environments across the Plateau and their importance to many bird species (Rich et al. 2005), future studies should address precontact biogeography. Bird bones are commonly reported when they are interpreted as personal adornment (i.e., beads). Such bird bone beads were recorded during the Chief Joseph Dam project (Campbell 1984) and at the McNary Reservoir (Shiner 1954). Farther down the Columbia River, Pettigrew (1981) identified a stone club in the shape of a bird, bird bone beads, a whistle made from bird bone and the presence of many bird bones in context suggesting their consumption. The presence of such objects from archaeological contexts further reinforces the cultural importance of these animals.

Wisdom et al. (2000) and Campbell (1997) provide detailed information on modern biogeography as well as some historical data.

Hunn (1990) and other authors indicate that avifauna were an important component, not only of subsistence, but they figured prominently in technology and cosmology as well. Raptor feathers are said to have been used to make an "arrow's flight true" (Hunn 1990:146). Hunn (1996) notes that of 76 recorded Sahaptian place names that include reference to animals, 17 of those relate directly to birds and only 12 relate to fish, which are commonly thought to be an important cultural symbol.

6.3.1.2 Technological Resources

Technological resources included everything drawn from nature that was not eaten. Given that hunter-gatherers survive in large part on their knowledge of the environment in which they lived, this list is long. However, a great proportion of elements interpreted (or described in oral history, ethnography, and early historical accounts) for technological use were organic and nondurable in archaeological deposits. Lithics (including unmodified rocks), rock-based features (cairns, alignments, pits), and soil-based features (hearths, ovens, house depressions, storage pits), along with crafted wood and fiber textiles, comprise much of the record of precontact technology. Most subsistence activities used a number of items in conjunction, which are referred to as tool kits.

Projectile points are the most frequently studied type of artifact in the Plateau. This is likely because they preserve under most conditions, are easily recognizable as artifacts, and have temporally diagnostic characteristics. However, this emphasis is misleading, and may inaccurately reinforce an image of prehistoric populations as primarily engaged in hunting. Instead, daily life among precontact people of the Plateau required a multitude of tools. Other lithic implements included a range of groundstone types, including mortars, pestles, hopper mortars, edge-ground cobbles, and bowls. Plant-fiber textiles and cordage were critical to homebuilding, snares, food processing, and storage (Collier et al.1942:98–101; Swanson et al. 1964:Figure 40). As part of the cultural "technology," a number of artistic items were shaped from stone and bone, including figurines and sculptural representations. The stone sculptures depict human faces and anthropomorphic dieties (Seaman 1967:182–187; Strong 1959:109, 114, 118). Carved stone and bone figurines also portray human and animal subjects (Strong 1959:123, 125)

Another common lithic artifact, recovered largely by looters, is the sculptural stone or wooden mortar or bowl (Seaman 1967:188; Strong 1959:177, 178). These depict animals and mythical beings' faces (Strong 1959:116, 119). Similarly, carved and polished stone mauls sometimes included sculptural elements (Strong 1959:170). Woodworking tools in addition to mauls included antler, wood, stone, and bone wedges (Strong 1959:168), and stone and wood adzes (Collier et al.1942:163; Strong 1959:173, 174). Digging tools ranged from informal basalt slabs to more finely crafted dig bars with carved antler handles (Collier et al.1942:83, 85, 147; Strong 1959:180–181). Fishing technology entailed shaped and polished bone spear points and hooks

(Strong 1959:198). Polished bone needles, awls, and multi-use points have been recovered (Collier et al. 1942:149).

Items of personal adornment included beads and rings that were shaped, carved, drilled, and polished out of stone, bone, or shell (Collier et al. 1942:107, 155–157; Strong 1959:128–131, 196). A wide variety of tobacco-smoking pipes and incense-burners ("cloud blowers") were shaped and carved out of stone (Collier et al. 1942:161; Seaman 1967:202–204; Strong 1959:133, 135–138). Gaming pieces were carved out of bone and on slate tablets (Strong 1959:201, 203).

The emphasis here placed on weapons technology reflects the nature of the existing literature, and the temporally diagnostic properties of projectile points. Plateau people used three basic weapons systems: the lance or spear, atlatl, and bow and arrow. Clibs and club-heads made of stone or whale bone were also used in combat (Seaman 1967:188; Strong 1959:142–147, 184). The lance as a thrusting spear or as a javelin is traditionally considered the first available projectile-point delivery system for hunter-gatherers within the CRB. However, there is little to no hard evidence to support this model other than shifts in assemblages from large lanceolate to smaller notched forms of projectile points. Large lanceolate points such as large Clovis and Haskett forms would be unsuitable for any delivery other than a spear or javelin. Smaller variants of Clovis and Windust forms would be suitable for use within an atlatl-dart system. The atlatl and thrusting spear may have been used side-by-side during the late Pleistocene. In fact, during the late precontact, the Wahmuza Lanceolate was utilized as a thrusting spear alongside bow-and-arrow technology (Woods 1987). The spear could have been maintained to perform the *coup de grâce* on wounded animals as a means by which to conserve arrow points.

The atlatl-dart system entered the archaeological record around 8000 to 7000 B.P. The earliest recovered atlatl in the western states was found in Nevada. Excavations at Nicolarson Cave (NVWA197) yielded an atlatl dating from 7980 ± 610 cal yr B.P. (Hester 1974) while an atlatl spur was found in Windust-associated level at the Marmes Rockshelter (Leonhardy and Rice 1970; Lohse and Sprague 1998:22). Rousseau (1993) suggested that atlatls were in use as early as 10,500 to 9000 B.P. in south-central British Columbia based on bone artifacts resembling atlatl spurs or hooks. Archaeologists generally accept that the atlatl was the primary weapon system Native people used throughout the Archaic and into the late period. Carved stone atlatl weights, sometimes depicting animal faces, are also found (Strong 1959:165).

While most researchers accept a much later date for the introduction of bow-and-arrow technology, Ames et al.'s (2010) metric analyses of projectile point data from the Plateau and western Great Basin suggests that bow-and-arrow technology may have been present on the Plateau as early as 8500 B.P. and widespread in the region by 4400 B.P. However, this early date is not universally accepted (Erlandson et al. 2014; Hildebrandt and King 2012). Instead, most scholars accept that the introduction of the bow and arrow, as indicated by distinctive small corner-notched and then side-notched projectile points, at the beginning of the Late Precontact period at 2000 B.P. or later (Andrefsky 2004; Chatters 2009; Holmer 2002). Chatters (2009) speculates that bow-and-arrow technology reached the Arctic from northeast Siberia approximately 5,000 years ago, as part of the Arctic Small Tool Tradition, but did not cross into temperate North America until 2,000 years ago. Chatters also pointed out that once the new technology was introduced, it spread across the continent in less than 800 years. Most chronologies indicate that small corner-notched forms were the earliest of arrow points, with side-notched points being reintroduced later (see Holmer 2002; Lohse 1995). This is a curious phenomenon, as side-notch points were the first forms of early darts, but were exclusively replaced by corner-notch and basal-notch types later. Based on ethnohistorical information and experimental breakage patterns, Falkner (2003) suggested intended function as the primary motivation between choosing side-notch over corner-notching. Falkner interpreted corner-notching as a hunting technology and side-notching as intended for warfare.

The tool kits and activities associated with large game predation in the CRB have been difficult to identify in wooded uplands and are better represented regionally within the channeled scablands. However, while more identifiable, assemblages resulting from hunting in one environment may not be the same as those from hunting elsewhere. In these cases, the setting should be investigated along with the lithic assemblage, as landscape elements may have influenced a successful hunt for elk versus big horn sheep. For example, Palouse Canyon, a tributary off the lower Snake River, includes numerous rock alignments, pits interpreted as hunting blinds and for storage, that take advantage of box canyons, cliffs and mesas, talus slopes, and rockshelters, to hunt various mammals, sometimes *en masse*. Many of the rock alignments appear situated to direct animals in certain directions; for example, deer tend to run uphill when chased, so only low rock walls are needed to prevent them from escaping a game drive by running downhill). One example of the way natural and constructed features were used together includes a location in Palouse Canyon where boulders and the tail end of a rock slide form a “corral” at the end of a narrow canyon. Around the natural corral feature are a number of talus pits (i.e., hunting blinds). The area appears to form the end point of a game drive that used rock alignments placed at potential diversions over a half mile leading up to the corral to keep animals directed into the canyon. Broken projectile points were found at the base of boulders on the opposite side of the corral from the talus pits (presumably “missed shots”). Adjacent to the “corral” is a small rockshelter with a storage pit that contained remains of an elk haunch (Hicks 1995, 1996).

Game drives look different archaeologically in different environments and for different prey species. Box canyons would have been useful for mass harvest of antelope in sparsely vegetated environments. Ridgelines and swales could have been used as well, with the addition of a few people and rock features emulating people. Once Plateau people had the horse, they could run down or herd ungulates, but this occurred prior to the horse as well. Hicks (1996:58) interpreted a high-density elk bone-processing site near the base of Palouse Falls as the result of an elk jump harvest from the adjacent cliff top; the site dates from nearly 500 B.P.

As noted above, bow-and-arrow technology was the dominant projectile delivery technology used for hunting prior to the introduction of guns to the Plateau. Artifacts include projectile points of various morphologies and lithologies, hammer stones, cores, antler/bone pressure flakers, blanks or preforms, and debitage. Excluding the less portable elements of this tool kit, most was probably carried as a hunter's personal gear to be ready for repair of equipment and/or rearming while on a hunt. Game taken distant from the central base camp would be field dressed, smoked/cured, and then cached for later transport home. Pits in talus slopes and rockshelters in the central basin may have been used as temporary storage facilities. It is assumed that storage facilities in wooded uplands are more difficult for archaeologists to identify and so they may be underrepresented in the record (Lyons 2013).

Hunting by-products (e.g., bone refuse) and meat-processing residue from both immediate eating and delayed consumption (storage) archaeologically represents both seasonal fluctuations of game capture and the dietary breadth of a community. Additionally, specialized game-hunting camps, such as those associated with extinct forms of Columbia bison, have been used to establish the biogeographic histories of harvested game (Lyman 2004). Additional specialized sites (or activity areas within larger sites) have been identified and related to bone greasing and marrow extraction, pointing to the fact that traditional diets, particularly those focused upon terrestrial resources, were lipid deficient (Herbel et al. 2012).

Fishing-related technologies (both catching and processing) largely comprise cordage and wooden elements from structural elements of weirs; harpoon shafts; and lines, nets, and racks for storage and access. Despite the limitations of preservation of organic materials, good fishing locations can retain durable remnants that can give hints of tasks that used items that are no longer in the record. In such locations, for example, archaeologists interpret a bilaterally notched tabular cobble as a weight for either a fishing net or a hook-and-line fishery. Similarly, if a weir was operated at the location, then one might infer that a medial girdled cobble stone with heavy bipolar pecking was likely used as a maul to drive in stakes and other structural elements (Lyons 2013). Given the weight of such objects, and the expectation of its user that they would return the next season, these types of artifacts would likely not have been carried from site to site (Binford 1978b).

In addition to materials related to fish harvesting, elements representing fish processing should also be present archaeologically at fish-related sites. Most fish are readily split and cleaned with a knife. Regionally, the tabular knife or scraper, expediently knapped from various local and tool stones with parallel cleavage such as tabular quartzite, shale or schist, is a common tool for this task (Roulette et al. 2000). For an anadromous fishery where salmon is highly fatty, the worked edges of such tools tend to quickly encrust with fats and dull, thus ongoing resharpening of blades resulted in large amounts of retouch flake debitage. Curing a catch for later consumption may have included cooking but more likely air drying and/or smoke drying.

The tools used for root crop-harvest and -processing activities also include technological items that do not preserve. Native people typically gathered the once ubiquitous and still highly prized camas bulb after June (if seasonal floodwaters had receded in some locations) and as late as August once the plant had gone off-bloom and its energy stores were returning into the bulb (Lyons 1999–2011; Smith 2000). Among the Kalispel, women of a residential group would begin the day's task of digging bulbs from a selected field in the early to mid-morning. The bulb was extracted from the sod with a fire-hardened hawthorn stick that had a natural curve and was pointed at its tip. This tool had a cross handle at the top made of wood or antler; an archaeological example has been recovered from the Sunset Creek Site (45KT28) (Nelson 1969). Metal digging tools in the same shape as precontact wood examples have also been recovered and continue to be used today, indicating that new materials were adapted to traditional practices. The yield for the day was carried back to camp in a sack tied at the top and hauled on a person's back with the aid of a head strap. Camas harvesting continued daily until sufficient stores were collected for a family's annual sustenance as well as to support the various scheduled and unscheduled feasting obligations that would occur.

Owing to the Calispell Valley Archaeological Project and subsequent nearby investigations, the general metric and morphological archaeological signatures of subsistence activity surrounding camas include near complete basal elements of earth ovens (Andrefsky et al. 2000; Gough 1997; Herbel and Hicks 2008; Herbel et al. 2010, 2012; Sanders 1992; Walker 2004; Willis 2012) and disarticulated ovens (Herbel and Greiser 2008). Smith (2000:7.09) provided a thorough description of the construction and mechanics of an earth oven feature. In the neighboring Colville Valley, Radford (2008) has examined the density and morphology of the FMR, radiocarbon signatures, and presence/absence of macrobotanical samples within an earth oven, as well as its phytolith content to examine potential resource broadening at approximately 2000 B.P.

Textiles

A variety of plant resources were used in the construction of technological resources. Key plant groups include sedges, grasses, sagebrush, cattails, and tule, along with willow and cedar that were used throughout the FCRPS Project Areas in the construction of cordage, matting, baskets, and clothing. Perishable materials are not as well represented in the archaeological record for the Plateau, but some major finds at Palouse Canyon and Squirt Cave (Endacott 1992) demonstrate the use of various plant resources to construct baskets, cordage, and mats (Hicks and Morgenstein 1994).

Matting used to cover the floor of living spaces, storage pits, and for other domestic activities was commonly used across the Plateau and was constructed from a variety of plant resources including tule, sedges, and grasses. Tule mats were used to cover wood frames for both conical lodges and larger, oblong lodges (Kennedy and Bouchard 1998). Archaeologically, tule mat fragments were identified in the construction of storage pit features at both McGregor and Porcupine Caves in Palouse Canyon, along with a variety of other, smaller mat fragments made of locally available crested wheatgrass, cattails, sedges, and bunch grasses. Woven tule and grass mats may have been used as liners and covers in storage pits after their use life within residential sites had been exhausted, while bunches of locally available grasses, interpreted as armfuls, were also used for these purposes (Hicks 1995).

Baskets served a variety of purposes for Plateau people including food preparation, food and water collection and storage, and ceremonial use. In some river systems, such as at Kettle Falls, J-shaped baskets were also employed in the capture of salmon and other fish (Chance and Chance 1982). Basketry styles and construction techniques varied across the CRB and were an indicator of not only social identity but also personal identity of the basket maker. The making of baskets was a time consuming and difficult process; a skill that was highly respected and valued. While the majority of basket makers were women, both boys and girls learned basket making skills. Materials were gathered and prepared during the summer and fall and the majorityof baskets were constructed during the winter (Schlick 1994). Because styles, techniques, and the use of plant materials for making baskets varied among Plateau groups, the identification of preserved basketry allows for a more in depth look into precontact life as well as investigations into intra- and inter-regional contact (Hicks 1995).

Archaeologically, there are very few examples of basketry from *in situ* site deposits from the Plateau. At Squirt Cave in eastern Washington, a total of 23 basketry fragments was recovered (Endacott 1992). One small fragment of basketry was recovered from excavations at Porcupine Cave in Palouse Canyon, while some fragments of material that may represent baskety weft techniques were identified in nearby McGregor Cave (Hicks 1995; Hicks and Morgenstein 1994).

6.3.2 Settlement and Habitation Systems

There remain a great number of questions regarding the lifeways, strategies, and group choices that lead to the formation of the archaeological sites of the precontact period. Unlike the settled agricultural and industrial economy that was transplanted onto the continent during the historic period, archaeological sites of the precontact era run a gamut from hunter-gatherer to semisettled lifeways, and comprise a record of cultural evolution that spans the Holocene. As such, the goals of a site typology are different for precontact sites than for historic sites. As the setting and context of historic sites is well known, it is sufficient to list them according to which of a set of categories of known functions they fulfilled. For precontact sites, the function and role must often be deduced from its place within the larger settlement system. Therefore, precontact site typologies are often derived from a theoretical framework regarding hunter-gatherer mobility and settlement strategies. Organizing precontact sites in this manner allows them to be categorized (useful for the purposes of the SWRD for comparing sites within and between Project Areas), and, at the same time, used to test the validity of the underlying theoretical construct.

In the CRB, the theoretical framework that is most commonly applied was popularized by Binford (1980, 1990) and expanded upon by Wiessner (1982), Woodburn (1980), and Bettinger (1999). As more fully discussed in Section 5.3, it consists of a mobility-based model of hunter-gatherer site usage that ranges along a continuum from foragers to collectors, based on measures such as length of occupation, resource intensification, and levels of storage (or delayed return). This continuum broadly charts a discontinuous evolutionary trajectory from mobile hunter-gatherers to the semisedentary, logistically organized populations that were present during the ethnographic or late precontact periods. The forager-collector model predicts the existence of particular site types and site-type patterns based on the mobility system thought to be in use at a given time.

6.3.2.1 Site Types

Archaeologists generally agree that the forager and collector mobility categories can be useful in identifying variability within and between a range of site types and settlement strategies seen among hunter-gatherer occupations in the Plateau (Ames 1991a, 1994; Chatters 1995; Habu and Fitzhugh 2002; Prentiss et al. 2005). These categories are not viewed as a dichotomy but instead occur as a continuum of possible intermediate forms. On the high-mobility end of the spectrum, foragers are characterized as having made many seasonal residential moves between resource patches and having practiced a broad-spectrum diet that did not take advantage of storage. At the opposite end of the spectrum, collectors practiced reduced residential mobility by establishing residential camps from which they made targeted forays to acquire specific resources. Therefore, the primary distinction to be made between these two systems was the existence of a central permanent or semipermanent residential site.

Salo (1985) defined archaeological correlates of the forager-collector model in the CRB as part of the subregional archaeological study conducted at the Chief Joseph Dam Project (Campbell 1985). The Chief Joseph site typology was explicitly designed to test implications of the forager-collector model and produced three principal types. The typology offered here (Table 6-6) is adapted from that work with additions made by Morgan as part of the comprehensive subregional study at Priest Rapids (Bruce et al. 2001:5.3; Morgan 2001). It follows Binford's (1967) site types that have been used to distinguish forager versus collector strategies. However here is added a category to distinguish Ritual sites.

Table 6-6. Site Types (adapted from Salo 1985 and Morgan 2001).

Type Number	Type Name	Minimal Defining Contents
1	Residential / Central Base	House pit(s), house floor(s), or post holes (evidence of a structure) + one other kind of feature, i.e., rock midden, shell midden, dense lithic scatter, groundstone
2	Short-Term Occupation (formerly Field Camp)	At least one hearth with associated artifacts
3	Location (Resource Procurement, Processing, or Storage)	Variable, includes butchering sites, quarry sites, discrete lithic scatters, caches
4	Ritual	Burials, also petroglyphs, pictographs, cairns, culturally modified trees with dendoglyphs
5	Miscellaneous (Misc.)	Rock alignments, trails, stripped bark trees

Type 1 sites are distinguished as Residential based on the presence of a structure (or remnant structural element) plus a second feature indicative of more sustained use. Type 2 sites correspond to more temporary Short-term Occupation Site locations where some domestic (hearth) activities took place. Type 3 sites are Locations where specific resource-related and spatially discrete activities took place. Type 4 sites encompass burials and sites of a Ritual or spiritual/artistic character. Finally, Type 5 is a miscellaneous category for rock alignments or other phenomenon that has more utilitarian than ritual uses. For management purposes, if a site falls into more than one category and a database only permits recording a single site type, it is recommended that it be listed as the more substantial type. For example, if a Location is also a Short-term Occupation Site, it can be recorded as a Type 2 site.

Rockshelters and caves are important landscape features in the Plateau where archaeological sites are often found. Rockshelters were used for multiple purposes. They can be seasonal and/or long duration residences.They may be burial locations. Sometimes they include rock art, or are shelters that have been utilized for storage. As such they are not given a separate type here, but are landforms that are recorded based upon their primary function.

The function of sites within a settlement system and subsistence strategy is identified by the types of artifacts and features found onsite. The sorts of features typically found within the CRB and making up the bulk of the archaeological record include shell middens, burned rock middens, talus pits, culturally modified trees (CMTs), fish weirs, and a variety of house and storage pit and fire features. Some of these are discussed below. Except where otherwise noted, the following descriptions follow those of Sammons-Lohse (1985).

House Pits

House pits can be identified by the presence of three elements: floors, walls/rim, and fill. On the Interior Plateau, they range from less than 4 meters to over 20 meters in diameter, with an average in the CRB of 7–10 meters from rim edge to rim edge. Aggregated data from across the northern Plateau (Canada) shows that there is a great deal of intra-site variability in housepit size. This is interpreted as a measure of hierarchy and inequality within the site (Hayden 1997:51). Their depth varies greatly depending on erosion and deposition conditions, ranging from a few tens of centimeters to as much as a few meters. They tend to be circular or curvilinear in shape, but may occasionally be rectangular or subrectangular. The subrectangular shape often appears so due to the presence of side entrances, side rooms, or storage rooms built into the original underground structure, which after collapse and subsequent fill and erosion, may distort the original shape and/or dimensions. Floors are generally hard-packed soil or clay and are distinguished from roof fill by the presence of fire pits and stains, postholes, raised benches, storage pits, and artifacts *in situ*. Shallower house pits have gently sloped angles from the center to the outer rim in contrast to deeper pits, which obviously will exhibit steeper, more vertical walls. Local soils and other geomorphological factors and site age will all affect the final condition of the walls. Rims generally consist of backfill either from the original digging-out process or subsequent “cleaning” of the interior living surface. Re-occupation can create multiple floors. The identification of sequential floor stratigraphy may be complicated by redigging and cleaning out prior to re-use. Rim deposits are often jumbled sediments of dugout floor, roof material, fire-pit detritus and FMR, animal bones and shell, and lithic debitage and artifacts built up around the outer perimeter of the pithouse roof. Fill often consists of collapsed roof materials (mainly wood and other organics such as timber from wood poles, beams, or mats), both old and new sods, and locally accreted layers of sediments.

Fire Features

Fire features include fire pits, hearths, and ovens (for example, for roasting camas). Fire pits can be located either within pithouses or outside of them as independent features. Both interior fire pits and exterior fire pits are defined by their internal contents (burnt wood, charcoal, FMR, and burnt organic materials). Fire pit feature sediments are distinct from surrounding sediments by an outer boundary, although charcoal can stain surrounding sediments. Fire pits are usually distinguishable from other types of pits based on their content, and also by a burnt and/or discolored transition (oxidation from heating) between the pit depression and the surrounding sediments.

Pits

Sammons-Lohse (1985) identified three primary types of pits: interior pits, exterior pits, and postholes. Interior pits are those located on the living floors of pithouses. Exterior pits are those not located within pithouses. Interior pits were often used as storage spaces beneath living floors, sometimes lined with stones, bark, or other material to deter pests or spoilage. Exterior pits may have served a range of similar functions to internal pits. A common type of pit (internal and external) found in the CRB is the roasting pit, which can range in diameter from about 1 to 3 square meters. They are usually no more than a meter or so deep and are often lined with FMR. These pits may have been used to cook or smoke any number of foods but are generally associated with root roasting. Storage pits occur within residential sites and in the Location site type (3) category where they make up the sole or main function of a site, such as in rockshelters, caves, or on talus slopes. Interior and exterior pits are often backfilled with trash from surrounding living floors, including hearth refuse, FMR, and organic materials ranging from plant remains to bones to excrement. Postholes may be located inside or outside of house pits and range in size depending on the posts placed within them. All pits may be shallow or deep depending on their original function. Posthole depressions tend to be cylindrical in cross section and relatively deep in comparison to their width.

Exterior Occupation Surfaces

Sammons-Lohse (1985:466) described exterior occupation surfaces (EOS) as possessing "definable boundaries and regularly distributed contents setting them apart from debris scatters" with "evidence of *in situ* activity remains." This category includes "activity areas" and "living surfaces" and is meant to be a generalized descriptor for areas outside a dwelling where activities commonly took place.

Living floors are those areas that show distinctive patterns of domestic use (similar to occupation floors in pithouses described above), but lack evidence of a structure or dwelling space. These generally include ground spaces that have been matted down by continued use, often exhibiting evidence of daily living activities, such as lithic debitage scatters or concentrations, processed/fragmentary bones, hearths, site furniture, and so on.

Artifact Scatters/Concentrations

Artifact distributions fall into four categories based on material type: bone concentrations, FMR concentrations, shell concentrations, and mixed artifact concentrations. The key difference between a scatter and a concentration is the density of materials "relative to the surrounding matrix" (Sammons-Lohse 1985:474).

Stains

Stains are distinctively discolored patches of a surface. Stains may be caused by a number of activities, including animal butchery (which may discolor surfaces depending on their exposure to blood, fatty tissue, or other bodily constituents); fish processing (surfaces may become stained or oily from exposure to blood, scale mucus, or oil); and heat alteration (smoke, soot, oxidation, and charcoal staining) in and around hearth and fire-pit features. Activities such as hide preparation can introduce tannins into surrounding sediments, altering their color and texture, or can cause greasy residues that may stain surfaces (Binford 1967).

Miscellaneous

Rock art, ritual cairns, and burials are features that comprise Site Type 4 as described below.

Functional Site Types

Salo and others have discussed the features that appear in the archaeological record of the Interior Plateau in the context of "functionally useful categories" to aid in the determination of site types (Bruce et al. 2001; Campbell 1985; Salo 1985:193). Table 6-6 above and further discussion below provides a breakdown of the generalized Site Types (1, 2, 3, 4, and 5), the number of associated features, and examples of features that make up each type. Although the above feature descriptions are not exhaustive, they may be useful for identifying both site types and site functions. Keeping these site types general should aid researchers in comparing and contrasting assemblages and their settings within and between FCRPS Project Areas.

Site Type 1: Residential Base

Residential Bases include evidence of a dwelling(s) plus at least one other onsite feature. Residence or dwelling evidence can include any of the following: aboveground structures or posthole configurations that appear to outline or otherwise designate a living area; house pit depression (these often occur in groups); circular stone configurations such as a tipi ring; or a rockshelter (although rockshelters are also used for other purposes than residences). The additional feature(s) could, theoretically, be anything from a hearth, a scatter of lithic debitage, or another dwelling, among many other possible features.

Residential sites are also likely to contain multiple features that indicate a longer use life of the locality. Such features might include stratification (indicative of sustained or repeated use), multiple hearths, midden deposits, and/or workshop areas, some at purposeful distance from the residences (e.g., sweat lodge, menstrual huts, bone grease extraction features). Residential Base sites are also most likely to have what Binford (1978a:329) referred to as "site furniture," defined as those material objects not easily moved from place to place. These include examples such as rock and/or earthen benches, piled stone windbreaks, heavy tools, and large and/or heavy stone mortars or bowls, which may be placed over domestic tool kits during an extended absence.

Lithic debitage may include cores and exhausted cores, primary, secondary, and tertiary flakes and shatter, core-reduction flakes, thinning flakes, retouch and resharpening flakes, all of various sizes and conditions depending on the types of tools being manufactured, period of manufacture, and materials being worked. Residential Base sites also tend to have the most debris and organic midden deposits. Middens may include animal bones in various states of completeness, fracture, or decomposition in addition to broken artifacts and other discarded refuse. Mammal bones, especially those of larger animals, often show signs of processing for bone marrow. In the case of both lithic debitage and midden materials, residential sites tend to have a more uniform distribution of materials over a much larger space than seen at the other site types, with concentrations of various materials often present in functionally separated activity areas, though this is not always the case.

Residential Base sites in the CRB are often located adjacent to water sources and near large waterways such as the Columbia River. As such, midden deposits are likely to contain the remains of freshwater shellfish and fish as well as both terrestrial and aquatic mammals. When the majority of activity areas are primarily confined within the footprint of a mat lodge, a typical interpretation is that such an encampment was seasonally used during winter months. Artifact densities are typically high, as is the “richness” or degree of functional variability in assemblages at these sites.

While collectors’ Residential Bases are thought of as permanent or semipermanent sites, that does not mean that they did not shift locations. Avoiding overharvesting of resources may have required shifting the central base around somewhat, particularly in response to depletion of local fuel resources and/or managing the cumulative effects of human sanitation needs. Even in fuel-rich environments, the daily need of wood for cooking, heating, and maintaining structures for a village would soon outstrip local sources. Over time, short movements of the residential base created an archaeological signature of long and narrow residential encampment sites with multiple “nested” functionally specific work areas; examples include Hornby Creek (10-BR-14) and LeClerc Creek (45FS2075) (Herbel et al. 2010; Willis 2012). Moving a residential site would have been easier to do with mat lodges than house pits, so the extent of the “drift” in Residential Base sites along a river shoreline may be greater in latest prehistory. In areas with less available fuel, such as within the central Basin, winter encampments should be more fixed since driftwood was harvested and cached during the year. CCT oral history mentions place names and important locations for a fuel supply. The narrow draw p'əp'n'ásaʔxn was a source for firewood that could be dragged down by horses to villages along the river (George 2011:17–25).

This is not always the case, however, as there also may be several villages close together that appear to form one contiguous habitation site, but are separate sites. For example, there are a cluster of named places on the Snake River (Lake Sacajawea) between Levey Park and just upstream from Dalton Lake. These named places include villages, camping area, fishing stations, and gathering/processing areas. These places presented the general appearance of a continuous settlement extending for about a mile along both sides of the river and on the numerous islands, creating a metropolitan center. Each of these villages, despite their proximity, was independent of the other villages in local affairs and each had its own separate name (Finley 2008:23).

Site Type 2: Short-term Occupation Site

Short-term Occupation Sites are defined by the presence of a hearth and are thought to represent nonpermanent domestic camps or living spaces. Type 2 sites are those locales used for short-term, seasonal procurement of a specialized resource(s) at a distance from a residential site. We might reasonably expect Short-term Occupation Sites to be paired with Type 3: Location sites, which are associated with the location of a seasonal or fixed resource, for example tool stone sources (Binford 1980:10). Although they do not commonly exhibit permanent dwellings, this is not to preclude the possibility that such sites might have stratified occupation sequences. However, the sequences are likely to be of a different type than residential bases. They are more likely to be separated by seasonal or longer hiatuses, which will create a sequence that is easier to separate into distinct components, but perhaps not to have spatially distinct activity areas (Campbell 1985, personal communication 2015). On the contrary, within the CRB, such sites were often revisited as part of a seasonal round or transhumant cycle. Additionally, Short-term Occupation Sites may be re-used over the course of time for different tasks that correspond to shifts in the subsistence regime and/or surrounding environment. For example, Site 45DO285 in the Chief Joseph reservoir area changed from a bison processing to fish processing camp in the Pithouse to Winter Village periods, respectively (Campbell 1985:512–513). Each occupation is likely to exhibit evidence of resource-directed or target-specific activities often in conjunction with short-term use per activity.

Short-term Occupation Sites generally exhibit a limited variety and variation of artifacts and features as they tend, by their definition, to be resource oriented. Artifacts may be complete, broken, and sometimes unfinished; although “unfinished” tools at Short-term Occupation Sites may often have been expedient tools made for a specific task at hand and never intended to be refined. Research conducted by Chatters (1987:368) suggests that, contrary to expectations, special-use sites may have greater tool diversity than residential sites. Further research is needed to confirm this hypothesis

Short-term Occupation Sites can show evidence of short-term high-intensity activity, or simply be short-term loci of domestic activities, such as cooking, sleeping, tool preparation, and repair.

Damaged projectile points associated with hunting camps often exhibit hinged bend-break fractures running perpendicular to the length of the tool resulting from impact stress caused when hitting a target, or bend-hinge fractures that often result when a point strikes something hard like bone or the ground.

Generally speaking, the sizes and conditions of lithic debitage will depend on the types of tools being utilized/manufactured, the period of use, and the material being used. The majority of lithic debitage will often consist of very small retouch and resharpening flakes as tools (particularly tool edges) were necessarily maintained during activities that generally caused a fair amount of wear such as animal butchery. Short-term Occupation Sites represent shorter duration occupation and potentially smaller numbers of people so would be expected to have less accumulated refuse/debris than residential camps and rarely possess midden deposits. However, depending on the logistical activities being accomplished at the site, this may not be the case. For instance, Short-term Occupation Sites in support of mass-kill sites (which would be listed as a Type 3 location) such as game drives and bison jumps often resulted in extreme amounts of debitage and midden, as processing large amounts of carcasses could quickly exhaust many tools and resulted in thick bone beds of both whole and fragmentary processed bones. This process involves crushing and splitting of the bone and results in spiral fractures on fresh (green) long bones. In the case of both lithic debitage and midden materials, Short-term Occupation Sites tend to have a concentrated distribution of materials within a more limited area than seen at the other site types as activities are often centered around a particular task or set of tasks for a shorter duration. Large, heavy artifacts like mortars, manos and hammerstones, and other ground-stone tools are often cached at Short-term Occupation Sites, as their bulk tends to make them difficult to transport. The cached tool types vary depending on the camp's target resource (e.g., well-formed root processing artifacts used to create cakes that are carried away for delayed consumption).

Short-term Occupation Sites activities often targeted specific resources and/or activities, and assemblages associated with those activities will make up the bulk of archaeological materials observed. Recognizing, however, that Short-term Occupation Sites may have been used for various purposes over time, or to exploit different resources at different times under variable ecological niches, means that we must expect some variability in these sites and carefully consider the possibility during identification and evaluation.

Site Type 3: Location

Location sites are diverse and relate to human exploitation of economically or culturally valuable resources in a given locality. This broad category includes kill and butchering sites, quarry sites, discrete lithic scatters, wood-collecting sites, berry-collecting patches, and caches, among others. They can be large areas of an anthropogenic landscape that provided a particular resource utilized by many people (e.g., a camas prairie) or discrete locations used repeatedly by a single person (e.g., a fishing hole or hunting blind). Locations may have served a social or ritual function, such as vision-quest locations (see Caldwell and Carlson 1954; Connolly et al. 1997:427). Features such as piled-rock blinds, fish traps/weirs, game-drive fences (including rock alignments, which are also found in the Miscellaneous site type 5 category), discrete lithic scatters, and quarry sites are all possible archaeological remnants of Locations/Stations. Binford (1980:10) pointed out that although these sites may sometimes be minimally visible on the ground, their association with Short-term Occupation Sites (Type 2 sites) may well produce considerable "off-site" archaeological remains if long periods of land use are involved. This site type includes animal kill and butchery locations not associated with communal or mass-capture strategies.

Location sites tend to exhibit functionally limited archaeological materials. At locations associated with hunting, such as hunting blinds and kill locations, artifacts tend to be isolated finds, possibly discarded or even dropped accidentally but not directly associated with a particular activity occurring at the site. Lithic debitage tends to be low density and consist mainly of relatively small tertiary retouch/resharpening flakes. Kill locations may also have some faunal remains. These tend to be bones from low-utility parts that may be left behind due to transport concerns or other decision-making strategies and tend to show little or no alteration (e.g., not split or broken to extract marrow).

Quarry-sites are marked by assemblages consisting almost entirely of a single material type (i.e., the toolstone being quarried on site) and dominated by primary & secondary flakes, cores, and shatter; tool preforms or "blanks" are presumed to have been carried away. There tend to be minor (less than 5 percent) amounts of lithic debitage or other material types present. Additionally, lithic raw-material acquisition sites may contain hammerstones.

Plant (e.g., camas) processing commonly occurred at a Short-term Occupation Sites but Native people also processed plants at harvest locations and carried the resources to the Short-term Occupation Sites. In the case of the latter, as noted above, the material assemblage will be largely one-dimensional, reflecting the processing activities and little else; the oven features described above are expected, together with milling equipment in the forms of pestles, anvils, and/or hopper-mortar bases representing the preparation of loaves or cakes. Different plant types can have different archaeological tool kit associations, but this has not been well-demonstrated archaeologically in the CRB.

Storage sites are often Locations when activities are functionally narrow. But they can exhibit various other activities depending on how much resource processing is conducted there and what equipment or materials are used to construct the storage feature (Hicks 1995, 1996; Hicks and Morgenstein 1994). Rockshelters can exhibit surface storage-pit features but have been used as

Short-term Occupation Sites over their history of use (Hicks 2004). In addition, rockshelter storage sites offer temporary shelter for users, both during the activities related to placing items in storage and while on resource forays in the vicinity.

Site Type 4: Ritual

This type corresponds to Morgan's (2001) "Ritual" site category. Rock art, petroglyphs, pictographs, stacked-rock cairns, CMTs, and burials comprise the majority of this category. This category distinguishes culturally significant site types from those represented by more common functionality, but as a result can be difficult to identify archaeologically. Pei-Lin Yu (1997) provided an insightful example of such a location surface when she described a communal space at the edge of a Pumé village that served as an important area for villagers to congregate, particularly to dance. She contended that this activity area would otherwise appear archaeologically sterile, but for a bounded area of hard-packed earth and a conspicuous void of materials within a discretely outlined space surrounded by a periphery of features and detritus. Rock cairns can be ceremonial in nature (e.g., burial or prayer markers) or simply location markers (Type 5) that may not be discernible to archaeologists.

Site Type 5: Miscellaneous

Rock art of the Columbia Plateau "shows a remarkable homogeneity of form and function combined with a basic simplicity of style" (Keyser 1992:121). Petroglyphs are more common in older sites, but pictographs are more susceptible to fading through time. Hunting scenes, vision quest compositions, and horsemen are stylistically the same throughout the region, and the images do not change dramatically through time (Figure 6-8), with notable similarities between images hundreds of miles apart (Keyser 1992:121, 123). The exceptions are two distinct styles that occur in the Columbia River gorge in protohistory, the Yakima polychrome and the Long Narrows styles, which show an increasing stylization of the human form that culminates in the portrayal of humans and spirit beings as complex mask designs. These styles are thought to have been influenced by Northwest Art traditions (Keyser 1992:16–17).

Miscellaneous sites include rock alignments, trails, or other non-ritual material that cannot be readily placed in to the other categories. If the activities that occurred there are narrow, these sites will exhibit a limited archaeological assemblage. Faunal remains may also be associated with Miscellaneous sites but, as with lithics, will not be distributed in the same fashion as remains would be in other contexts. For instance, animal remains may be more likely to be intact at a Miscellaneous site associated with offerings or repeated ritual use, or remains may comprise only certain elements, such as antlered deer skulls, bison skulls, or other animal parts associated with ritual contexts. As Miscellaneous sites are by nature somewhat subjective in their identification, care must be taken in assessing the materials and debitage associated with them.

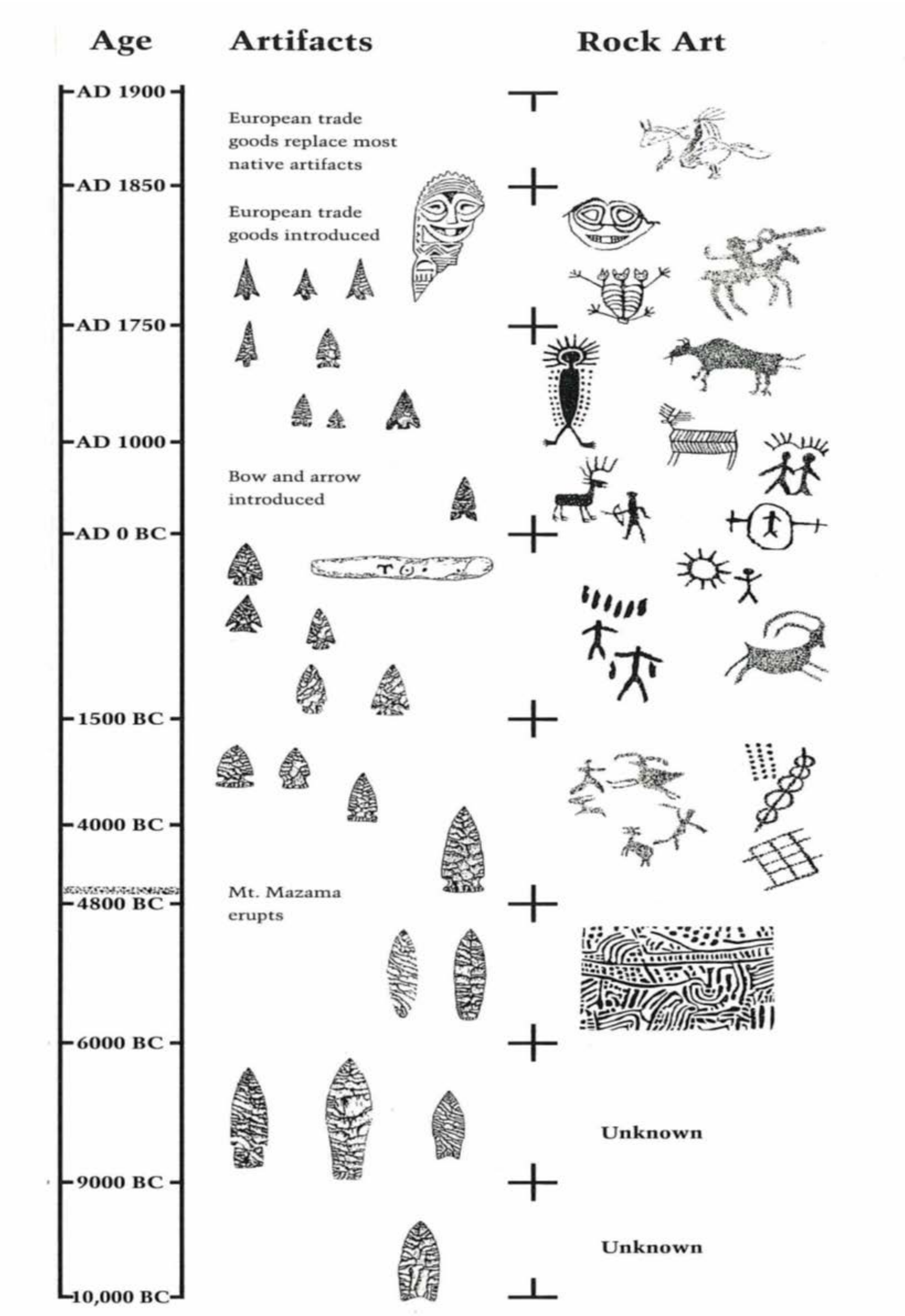


Figure 6-8. Rock Art Motifs with Associated Project Point Styles Through Time (adapted from Keyser 1992:Figure 2).

6.3.2.2 Settlement Patterns by Temporal Phase/Period

Following the cultural chronology presented in Section 6.2.1, this section attempts to correlate expected site types and archaeological assemblages with culturally meaningful temporal periods. A number of phenomena related to mobility and settlement patterns, resource acquisition strategies, technological adaptations, and broad sociocultural practices predominant in each temporal context, and from place to place in geographic and environmental contexts as well.

Phase/Period: PaleoIndian A: Pre-Clovis (Pre-13,500 B.P.)

There are no positively dated sites from this period yet recorded in the Plateau. Based on finds in other regions of North America, people during this period were highly mobile hunter-gatherers, assumedly having a wide diet breadth that consisted of terrestrial mammals of all sizes, various fowl, and edible plants. Anticipated site types during this period should be limited to Types 2, 3, and 4. Features are likely to include: charcoal stains and/or minimally stratified hearth features; lithic debitage; lithic flake scatters; lithic artifacts including bi- and unifacial flake tools, various forms of unifacial scrapers, utilized flakes, and cobble tools; burnt, calcined, fragmentary, and complete animal bones from a variety of regional terrestrial species including extinct genera such as *Proboscidea* (e.g., *Mammuthus columbi*, *Mammut americanus*), giant ground sloth (e.g., *Megalonyx jeffersonii*), horse (*Equid* spp.), bison (*Bison antiquus*), and camelids (*Camelops* spp.). Rock art dating from this period has not been documented in the Interior Plateau and positively identifying and dating rock formations from this period is difficult.

Phase/Period: PaleoIndian B: Clovis (13,500–9000 B.P.)

Indigenous people during this period—also referred to as the "Large Game Hunting Tradition"—were highly mobile hunter-gatherers, having a wide diet breadth that consisted of terrestrial mammals of all sizes (although hunting strategies seem to be aimed at larger animals whenever possible), various waterfowl, shellfish, and edible plants.

Site types during this period should be limited to Types 2, 3, 4, and 5, although it must be noted that people had previously utilized features of the natural landscape as at least semipermanent habitation spaces, as at the Marmes Rockshelter and other rockshelters.

Features are likely to include: charcoal stains and/or minimally stratified hearth features; lithic debitage; lithic flake scatters; lithic artifacts, including relatively large stemmed- and shouldered-biface lanceolate points (Western-Stemmed type), relatively large basally fluted bifacial lanceolate points (Clovis type), relatively large and thick tapered-stem lanceolate points (Haskett type), relatively large unifacial scrapers, ovoid knives, and crescents, as well as utilized flakes, all on a variety of materials but most commonly cryptocrystalline quartzites, thinly stratified middens consisting of burnt, calcined, fragmentary, and complete animal bones from a variety of regional terrestrial and avian species, including extinct genera presented above, and potentially highly concentrated bone beds from mass kills, particularly from sites on the northwestern plains. Rock art dating from this period has not been documented in the Interior Plateau and positively identifying and dating rock formations from this period is difficult. However, pecked-stone petroglyphs have been documented in Idaho along the northern boundary of the Great Basin that are potentially as old as 9400 B.P. at Wave Rock at the Tom's Spring Site (Merrell and Dorn 2009). Human remains from this period are occasionally discovered but identifiable burial contexts have not been documented. For example, the Buhl Woman in Idaho was recovered from a quarry and has been radiocarbon dated to 10,675 ± 95 B.P. (Green et al. 1998). Osteological studies suggest she was a young adult and possibly buried with grave offerings including unused an obsidian biface and bone needle (Slayman 1998).

Phase/Period: Archaic: Cascade I: Pre-Mazama (9000–7600 B.P.)

Plateau people during this period continued to be highly mobile hunter-gatherers, practicing frequent residential movements across the landscape and leaving little evidence of dwelling structures. Evidence suggests that they had a wide diet breadth consisting of terrestrial mammals of all sizes, birds (particularly various waterfowl), and a wide array of edible plants (Butler 1965). Along the Pacific Coast during this time, the first strong evidence for marine-based diets emerges (Dixon et al. 1997). Butler (1961, 1965) originally described the period between 9000 and 5000 B.P. in areas adjacent to much of the southern Plateau as that of the Old Cordilleran Culture Complex, characterized by relatively large projectile/spear "Cascade" points, and a subsistence strategy that focused on "species of artiodactyla, such as deer, elk, antelope and sheep; snaring, or trapping of birds; collecting and processing of such root crops as camas and kouse . . . fishing; and the collecting of mussels and snails" (Butler 1965:1127). He also suggested that the appearance of edge-ground cobbles at this time directly associate the period with an increase in processing root crops.

Some important pre-Mazama age sites in the Plateau include Alpowa sites 45AS78 and 45AS82, Ash Cave 45WW61, Bernard Creek Rockshelter 10IH483, Granite Point 45WT41, Marmes Rockshelter 45FR50, Thorn Thicket 45WT36, Tucannon 45CO1, Votaw 45FR36, Weis Rockshelter 10IH66, and Wexpusnime 45FA61 (Peregrine and Ember 2003).

Site types during this period should be again limited to Types 2, 3, 4, and 5. Features are likely to include: charcoal stains and/or minimally stratified hearth features; lithic debitage; lithic flake scatters; lithic artifacts including: relatively large and thick tapered-stem lanceolate points (Haskett type), mid-sized, broad and robust lanceolates with convex or tapered bases (Cascade types), other leaf-shaped lanceolate points, triangular side-notched points, microblades and microblade cores, various scrapers and piercers; edge-ground and pecked cobbles, cobble spall tools, ground stone such as mortars, pestles, and hammerstones; concentrations and/or scatters of FMR; middens consisting largely of burnt, calcined, fragmentary, and complete animal bones from a variety of extant regional terrestrial, avian, and lacustrine species, as well as the possibility of highly concentrated bone beds from mass kills; and organic remains of edible geophytes, roots, and seeds. Rock art dating from this period has been documented in the Interior Plateau although positively identifying and dating rock formations from this period is difficult. At least one "shield motif" petroglyph has been documented adjacent to the CRB in Idaho along the northern boundary of the Great Basin dating from a range within this period at the Indian Writing Waterhole site (Merrell and Dorn 2009). Human remains from this period are occasionally discovered but positively identifiable burial (interment) contexts have not been documented during this early period within the CRB. An exception is Kennewick Man, found eroded from an interred location, which has been radiocarbon dated to between 8400 and 8690 cal yr B.P. (Owsley et al. 2014:379; Stafford 2014).

Phase/Period: Archaic: Cascade II: Post-Mazama (7600–4000 B.P.)

Indigenous populations of the Interior Plateau at this time remained highly mobile hunter-gatherers that utilized a broad-spectrum of plant and animal resources. Toward the end of this phase and into the subsequent "Plateau" phases that followed, hunter-gatherers throughout the region began to develop strategies that involved remaining in particular areas for longer periods of time than they had previously. The construction of semipermanent dwellings emerged in the late Archaic period. The earliest documented structure in the Plateau is from the Paulina Lake site, associated with a hearth dated between 10, 040 and 9680 B.P. (Ames 2000:42).

Site types during this period should most commonly consist of Types 2, 3, 4, and 5, although sporadic dwelling features of Type 1 define the close of this phase. Features are likely to include charcoal stains; stratified hearth features; stacked rock cairns; variously configured posthole arrangements; scattered and concentrated lithic debitage; lithic flake scatters and concentrations; lithic artifacts including similar technologies as evident in "Archaic: Cascade I" with the later addition of corner-notched points and notched-cobbles; ground stone such as mortars, pestles, and hammerstones; concentrations and/or scatters of FMR; middens consisting largely of burnt, calcined, fragmentary, and complete animal bones from a variety of extant regional terrestrial, avian, lacustrine species, and fish (particularly, but not limited to *Osteicthyes* genera—salmonids); highly concentrated bone beds from mass kills (usually *Bison* spp.), particularly at sites on the northwestern plains; and organic remains of edible geophytes, roots, and seeds. Rock art dating from this period is not uncommon and has been documented throughout the Interior Plateau. At least one petroglyph series of concentric circles has been documented at the Tom's Spring site dating from at least 5700 B.P. (Merrell and Dorn 2009).

Human remains from this period are occasionally discovered and burial contexts, such as the Western Idaho Archaic Burial Complex, have been well documented (Pavesic 1985). Adjacent to the CRB in southwestern Idaho, an excellent example of burial practices at this time comes from the Braden Burial Site (10WN117), at which the remains of at least four men, two women, and four children were recovered with a variety of grave goods along with evidence for at least two cremations (Meatte 1990:49). Grave goods associated with the burials included: "191 obsidian blanks, six large Northern Side-notched (Bitterroot) projectile points, six "turkey-tail" burial blades, four oval bifaces, two "turkey-tail" scrapers, one drill, two bone awls, three abraders, one smooth basalt pebble, one obsidian core, three *Olivella* beads, two musselshell fragments, one antler tine fragment, one beaver incisor, and one flake" (Meatte 1990:49, paraphrasing Butler 1980:122–123).

Phase/Period: Pithouse: Initial Pithouse (4000–2000/3000 B.P.)

Between 4,000 and 5,000 years ago, new developments in mobility strategies and habitation practices emerged in the Interior Plateau. During this time, foragers in the southeastern Columbia–Snake River area began settling into relatively small semisubterranean pithouses (across the region, house pit sizes vary dramatically through time, with early houses at Slocan Narrows being as large as 22 meters in diameter, but generally speaking pithouses emerged as relatively small, single-family-sized structures and got larger over time) (Sammons-Lohse 1985). Pithouses during the earliest phase of this period tended to be small (4–6.5 meters in diameter), likely representing single-family dwellings, and rarely occurred in aggregations of more than two houses (Chatters 1986). Evidence suggests that people settling into this semisedentary lifeway utilized pithouse dwellings in both summer and winter seasonal extremes (Chatters 1987:356). These early settlers practiced a broad-spectrum diet that included terrestrial, avian, and marine resources, including salmon and freshwater mollusks. The ability to maintain settlement for a greater part of the year suggests that the locality of both single and small congregations of pithouses (concentrations of houses on a village scale emerged later) must have been centered at loci of diverse and abundant food resources such as riverine/forest ecotones. Chatters (1989, 1995) suggested that the shift toward sedentism between 4300 and 3700 B.P. (his Pithouse I episode) was an adaptation to dramatic climatic cooling and increased precipitation that altered biotic regimes in the region, making year-round foraging possible in a relatively constricted foraging area. The period 3300 to 2600 B.P. (his Pithouse II episode) differed from previous periods: evidence shows that storage features appeared and proliferated rapidly throughout the area starting around 3800 B.P., along with increased use of both roots and salmon (Chatters 1995:349; Goodale et al. 2004:44).

All five site types are present in the archaeological record during this period. Features are likely to include house pit depressions (circular, ovoid, and rounded-rectangular in shape, usually no deeper than 1–2 meters in a crater-like depression, often with a low sloping rim around the perimeter); storage-pit depressions; roasting-pit depressions (some stone-lined); charcoal stains; stratified hearth features; stacked-rock configurations; variously organized posthole arrangements; scattered and concentrated lithic debitage; and lithic flake scatters and concentrations. Features also include concentrations and/or scatters of FMR, storage pits, and middens consisting largely of burnt, calcined, fragmentary, and complete animal bones from a variety of extant regional terrestrial, avian, lacustrine species, and fish (particularly, but not limited salmonids); highly concentrated bone beds from mass kills (usually *Bison* spp.), particularly at sites on the northwestern plains; and organic remains of edible geophytes, roots, and seeds.

Lithic technology is similar to the "Archaic" Phases with projectile point sizes decreasing dramatically through this period and they appear in an array of forms (i.e., side-notched, corner-notched, tri-notched, and stemmed forms with convex, concave, and straight bases), all on a variety of materials from fine-grained basalts/dacite to quartzites, cherts, and obsidian. Flake tools, scrapers, piercers, and gravers are also present on a wide variety of materials. Ground stone tools are present, such as mortars, pestles, and hammerstones.

Within house pits, common features may include stratified hearths; posthole and beam depressions; roof-collapse deposits (often stratigraphically jumbled layers of burnt timbers, turf/sod, and clay interspersed with various artifacts atop of or between discrete living floors—rim deposits are often of similar makeup to roof deposits); internal cache/storage pits; site furniture, such as large mortars or grinding stones; large boulders or configurations of boulders; FMR concentrations; lithic debitage concentrations; and animal bone concentrations. Spatial analysis of within-house pit artifact and feature distribution regularly confirm the use of specific activity areas within the house, often (but not limited to): food preparation/processing; cooking; lithic tool manufacture/curation; fire- or hearth-related activities; common areas (areas of hard-packed floor conspicuously void of materials); and raised benches or scaffolds (often identifiable by regularly spaced postholes around the edge of the pithouse perimeter). However, representation of in-house activities should be considered with caution as there is evidence that houses were swept/cleaned periodically.

Petroglyphs, pictographs, and other forms of rock art are not uncommonly found to date from this period, particularly along water courses and areas with exposed basaltic rock such as river basins and canyon walls. Rock art motifs cover a variety of anthropomorphic, anamorphic, and geometric shapes. Stacked-rock features of various forms are common, though dating can be problematic. Rock cairns and burial mounds are found in a variety of contexts but are often on hilltop/bluff and terrace landforms adjacent to water sources or in some places within talus slopes. Burials are often grouped into cemeteries.

Phase/Period: Pithouse B: Winter Village (2000–400 B.P.)

The archaeological record indicates that during the last few hundred years of the Initial Pithouse period described above, considerable changes occurred in both mobility and subsistence strategies among Interior Plateau hunter-gatherers. By 2000 B.P., aggregate pithouse villages had become common across much of the Plateau and continued to increase in both size and frequency over the next thousand years or so. Root processing and use of storage continued to increase as did population densities and house-pit dimensions. Intensification of salmon fishing became nearly ubiquitous across the Interior northwest. As a general rule, house pits become larger in diameter, and at several sites, concentrations of house pits numbered more than a hundred and ranged in size from 6–22 meters in diameter. Such large villages reached their peak size in the Interior Plateau from about 1200 to 800 B.P. Sites that typify this trend include Bridge River and Keatley Creek in the Middle Fraser Canyon of the Canadian Interior Plateau, Vallican and Slocan Narrows along the Upper Columbia, and Hatwai and Strawberry Island on the Snake River. Many of these village sites have extensive occupation histories far predating pithouse village development, attesting to their value as base camps (e.g., occupations at Hatwai extended back to 11,000 B.P.). In addition to large villages, many variably smaller villages (numbering between 4 and 16 concurrently occupied pithouses) flourished throughout the Columbia Plateau such as those at Cassimer Bar, Spukpukomin, Sinkaspitluxten, Stsosixuwexsux, and others documented in central Washington (Chatters 1986). After about 1000 B.P., aboveground mat lodges became common. On the northwestern plains, tipi rings and other rock configurations dominated the cultural landscape. In many places across the region, the frequencies of exotic raw materials and prestige goods found in assemblages proliferated, illuminating a growing cultural complexity and interconnected social networks.

Site types present include all five types and are likely to be both extensive and considerable in the density and diversity of features present. Features are likely to include concentrations of house-pit depressions (circular, ovoid, and rounded-rectangular in shape, usually no deeper than 1–2 meters in a crater-like depression, often with a low sloping rim around the perimeter), storage-pit depressions, roasting-pit depressions (some stone lined), charcoal stains, stratified hearth features, stacked-rock configurations, variously organized posthole arrangements, scattered and concentrated lithic debitage, and lithic flake scatters and concentrations. Additional features include concentrations and/or scatters of FMR, storage pits, middens consisting largely of burnt, calcined, fragmentary, and complete animal bones from a variety of extant regional terrestrial, avian, lacustrine species, and fish, and highly concentrated bone beds from mass kills (usually *Bison* spp.), particularly at sites on the northwestern plains. In the Upper Columbia, Goodale et al. (2004:39, referencing Andrefsky et al. 2000) noted that storage pit features are likely to contain “a variety of stone tool artifacts, mammal bone, and some camas root remains.”

Lithic artifact assemblages include nearly identical technologies as evident in the previous Initial Pithouse period with the notable disappearance of even relatively small “dart” points and their complete replacement in the technological schema by much smaller projectile types sometime around 1000 B.P. Ground stone tools and chipped-stone cobble and pebble artifacts are found.

Within house pits, common features may include stratified hearths; posthole and beam depressions; roof-collapse deposits (often stratigraphically jumbled layers of burnt timbers, turf/sod, and clay interspersed with various artifacts atop of or between discrete living floors—rim deposits are often of similar makeup to roof deposits); internal cache/storage pits; site furniture such as large mortars or grinding stones; large boulders or configurations of boulders; FMR concentrations; lithic debitage concentrations; and animal bone concentrations. Spatial analysis of within-house-pit artifact and feature distribution regularly confirm the use of specific activity areas within the house, often (but not limited to) food preparation/processing; cooking; lithic tool manufacture/curation; fire- or hearth-related activities; common areas (areas of hard-packed floor conspicuously void of materials); and raised benches or scaffolds (often identifiable by regularly spaced postholes around the edge of the pithouse perimeter).

As with the Initial Pithouse period, petroglyphs, pictographs, and rock art of all kinds dating from this period are common and often located along water courses in areas with exposed basaltic rock such as river basins, canyon walls, and rockshelters. Rock art motifs continue to cover a variety of anthropomorphic, anamorphic, and geometric shapes. Stacked-rock features of various forms are common, too, although dating can be problematic. Rock alignments are also common, often taking on linear and circular motifs, sometimes encompassing large areas. Rock cairns and burial mounds are found in a variety of contexts, but are often on hilltop and terrace landforms adjacent to water sources or in some places on talus slopes. Burials may be grouped into cemeteries.

Phase/Period: Protohistoric—Protocontact 400–210 B.P. and Contact (210 B.P.–present)

The period from approximately 350 B.P. to roughly the mid-nineteenth century C.E. saw increasing incursion by Euroamerican settlers throughout the region. Government policies of the day systematically stripped Native Americans of land and water rights and forced the indoctrination of Western values on indigenous populations. Epidemic diseases and direct conflicts between U.S. military forces and Native confederacies during much of this period led to indigenous populations being drastically reduced, eventually subjugated, and largely removed from traditional lands to reservations. In general, by the mid- to late 1800s, the majority of traditional Native villages had moved or were abandoned.

All five site types are present, in addition to historic site types (see Section 6.4). Site Type 1 sites during this period are often smaller and more dispersed than their late-precontact equivalent and often exhibit features of both precontact and historical contexts. Site types 2, 3, 4, and 5 resemble their equivalents during the previous period.

6.3.3 Transportation, Exchange, and Trade

The presence of nonlocal materials is an indicator of Native American group range and/or networks of social interactions. In wide-ranging foraging societies, archaeologists believe that nonlocal utilitarian goods, such as obsidian, were collected as part of the cycle of movement and resource gathering. As settlement became more fixed around a set of villages and a more limited ranging territory, nonlocal goods are interpreted as indicative of long-distance interaction with both neighboring and more distant groups.

Nonlocal goods in the archaeological record provide an important avenue for the study of intergroup and interethnic interaction. Renfrew (1975, 1977) defined basic methods for studies of trade and exchange and clarified some of the ways in which nonlocal materials can make their way into the archaeological record, such as the "law of monotonic decrement" upon which a series of "distance-decay models" or "fall-off curves" are based. Direct-access, down-the-line, and intergroup exchange each have different correlated patterns in the archaeological record that can be queried via regression analysis (Earle and Ericson 1977). Contour maps displaying the frequency of a given artifact or material type in various locales—a technique that has become more popular through GIS studies (Neff 1998)—is another method of visualizing the movement of materials.

Early studies of trade have developed into more sophisticated social network studies, which often rely on mathematical modeling for the exchange of technological innovation and other nonmaterial forms of culture (e.g., Centola 2015). Intersociety exchange occurs at a variety of scales (Chase-Dunn and Hall 1998). The largest networks carry information, followed by prestige goods networks that transport high-value, low-weight goods considerable distances away from the source. Next largest are political/military networks, which are constrained in size by the necessity of face-to-face interaction and negotiation. The smallest network is that which acquires foodstuffs and raw materials called the bulk-goods network (Chase-Dunn and Hall 1998:28).

Hess (1997) used distance decay modeling to correlate obsidian source distance and tool form in the Late Pre-Mazama (Cascade I) and Late Precontact (Winter Village) periods. Archaeological lithic tool assemblages from excavations at more than 50 sites in Oregon and Washington were examined to build a picture of lithic production and wear during the two periods Distance from source emerged as a salient proxy for the time of artifact use for mobile populations, while it more directly measures the cost of raw material procurement for sedentary populations. A testable hypothesis relating distance from source to measures of use was queried using regression analysis and Pearson's coefficient of determination (Hess 1997:252). The results confirmed a change in procurement (from direct to indirect acquisition) that is linked to greater logistical organization in the later period. Sobel proposed the "Exchange Expansion Model" using archaeological data from the Plateau to examine changes in trade patterns that took place during the period of European contact (Sobel 2012).

Within kin-based societies, the bulk of all goods will travel through extended family networks, as described by Polayni in 1957 (cited in Stanish 1992). This type of “embedded economy” is different from the mercantile model with which most modern people are familiar. The motivations for trade under such as system might go beyond a simple economic transaction to include the maintenance of alliances and usufruct rights beyond the household economy. In the Pacific Northwest, a nonfamily trading economy developed particularly along the coast, as evidenced by the Chinook trading language and coastal Salish terms explicitly indicating exchange of goods with nonkin (Blake 2004:104). An entrepreneurial category of traders or “middlemen” has also been reported ethnohistorically (Stern 1998:643). Coast Salish maintained extensive trade with the interior Plateau, particularly along the Columbia River travel corridor. Both copper and labor (in the form of slaves) are reported to have been brought to the Coast from the CRB (Chase-Dunn and Hall 1998:56) although it is unclear if this represents trade or warfare.

The archaeological record indicates the presence of several large trading hubs that reached an extensive network. Highly prized items probably passed through one or more of these trading centers. Celilo Falls was one of these centers, perhaps for much of its history of occupation. In addition to having direct access to a highly productive salmon fishing ground in late prehistory, its location placed it somewhat central to the coastal groups, provided access to mountain and foothill hunting grounds as well as obsidian sources of central Oregon, and made it easily accessible to much of the CRB by way of the Columbia and Snake Rivers.

Ethnohistorical information describes the principal products that were made for exchange in the Plateau and along the Columbia River travel route. Unfortunately for scholars studying exchange, the majority of these were perishable items. Among the most popular trade goods of this region were salmon pemmican, along with dried salmon, wapato root, camas roots, wokas, berries, skins, silk grass, basketry, and shell beads (Stern 1998). Among these, only shell might preserve under normal conditions. For this reason, studies of trade focus on obsidian and shell beads and ornaments, principally dentalium (Galm 1994).

Other prestige items were popular in the Interior Plateau and may have circulated within the prestige economy. These include incised dentalia shells, nephrite, obsidian, and crafted items. Craft production was an important element of the prestige economy whereby labor costs increased the value of otherwise common items. Crafted prestige goods in the Interior included digging stick handles, antler combs, L-shaped awls, and gaming pieces. Sculptured stone items included statues, effigies, pendants, and pestles as well as eccentric obsidian tools. Many of these items have been found as burial goods, and it is unclear what role they might have played in an exchange economy (Hayden and Schulting 1997).

Raw materials (e.g., tool-stone blanks, animal hides) and fully constructed items (e.g., arrows, baskets and cordage, nets, clothing) as well as prepared food items (e.g., camas loaves, dried salmon cakes) would have been transported by specialists and middle-men marketers and exchanged during seasonal gatherings.

Bergland (2003) found redundant reduction materials on a single obsidian flow that indicated the production of material blanks of a consistent size. He interpreted that a particular group may have controlled the location, creating “standardized” blanks for exchange. In this scenario, one could expect that an extended family was the group producing the blanks, and they may have sold them to other specialists who produced finished projectile points from them. Other specialists may have provided the bows, arrow shafts, and quivers and sold them as units at a place like Celilo Falls.

Obsidian projectile points of styles that were produced only over a limited time span could be sourced and used to reconstruct precontact regional networks. By way of an example from an upper Columbia subbasin, archaeological projects in the neighboring watersheds of the Pend Oreille and Spokane Rivers have recovered obsidian artifacts from different sources. The Pend Oreille, more distant from the geologic source of these materials, has thus far yielded higher quantities and greater variety in obsidian than its neighboring watershed to the south. It is unclear if this is representative of sampling biases or a reflection of different precontact exchange patterns. Additional research into the precontact regional exchange networks both within the Pend Oreille Basin and other watersheds within the region should clarify if this approximate observation is valid. Variation in the numbers of sites from which obsidian has been recovered and in the number of items sourced needs to be controlled to determine whether they are participating in different exchange networks that focus on different obsidian sources.

6.4 Archaeological Research on Historic-Period Sites

The early years of archaeology at historic-period sites in the Pacific Northwest coincided with the culture history paradigm in American Archaeology, which emphasized typologies and bounded culture areas. Harlan I. Smith, conducting archaeological surveys and analysis in the Yakima Valley, was the first archaeologist in the Pacific Northwest to determine relative dates for burial practices based on trade goods (Adams 1993; Smith 1910, as cited in Sprague 1975). Other early historic-period grave excavations occurred at the Potlatch Creek site (where a Jefferson Peace Medal was discovered) (Spinden 1908), Miller’s Island on the Lower Columbia (Brownlee 1916, as cited in Sprague 1975), and the Waluke Slope area on the Middle Columbia River (Krieger 1927). Focusing on the study of Native American populations, none of the archaeologists working during the first quarter of the nineteenth century made strong distinctions between precontact and historic-period artifacts encountered during their excavations (Sprague 1975).

Between 1924 and 1926, Strong, Schenck, and Steward (1930) conducted excavations of burials and six habitations sites in The Dalles–Deschutes area. In their report (the first professional archaeological report produced in the Pacific Northwest), the presence or absence of “Articles of Caucasian Make” factored into their chronological typology for the region. “Articles of European Origin” were also identified on sites excavated at the Grand Coulee Dam in 1939–1940 (Collier et al. 1942).

Archaeology at historic-period sites continued across the United States from the 1930s through the 1950s. Federally sponsored excavations run by government agencies such as the NPS focused on sites that would help instill national pride among the American public while creating jobs for unemployed archaeologists and day laborers. These excavations were limited to sites considered important to the nation’s history, such as early forts and missions, or those endangered by other federal projects, including dam and reservoir construction along the Columbia River (Banks and Czaplicki 2014; Brew 1994; Cotter 1993; Gilmore 1984; Harrington 1957; Kelly and Kelly 1984; Schuyler 1976). Examples of these national trends in the CRB include Louis R. Caywood’s (NPS) work at fur trade sites, including Fort Vancouver, Fort Clatsop, Fort Spokane, and two Fort Okanogan sites between 1947 and 1955 (Caywood 1948, 1951, 1954a, 1954b, 1955). Thomas R. Garth (RBS) conducted excavations at Waiilatpu (Whitman Mission) and Fort Walla Walla during the same time period (Garth 1948, 1949, 1952). During the 1960s, the NPS continued excavations at Whitman Mission, Fort Vancouver, and Fort Clatsop. Archaeologists associated with regional universities took over excavations at the other fur trade forts, such as Fort Spokane and Fort Okanogan (Combes 1964; Grabert 1968; Sprague 1975; Swanson 1962). These investigations were conducted under a colonial paradigm. Research themes at the time included acculturation and assimilation of Native Americans into Euroamerican society. Acculturation models calculated the success of colonialism based upon the frequency of Euroamerican and Native American material culture at a site. Neither Native Americans nor Euroamericans were granted individual agency within these models of culture change (Orser 1996).

The first conference session devoted to historical archaeology in the Pacific Northwest took place at the nineteenth Annual Northwest Anthropological Conference in 1966 (Sprague 1975). The founding meeting of the Society for Historical Archaeology (SHA) was held the following year. Contemporary scholars cite the founding of the SHA as the professional origin of the discipline (Cleland 1993; Wilkie 2005). Concurrent with the professionalization of historical archaeology during the 1960s, American archaeology underwent a paradigm shift from cultural history to processual archaeology. Processual archaeologists sought to use scientifically modeled hypothesis testing to examine large-scale processes of culture change through time and space (Binford 1962; McGuire 2002).

The majority of archaeological projects undertaken in the CRB between 1970 and the present have occurred under the umbrella of CRM. Carried out by private companies as well as local universities, these projects were generally conducted on a smaller scale than the archaeological surveys in the early twentieth century (BPA et al. 2007; Wernz et al. 2005).

While archaeologists recognized the potential of historical archaeology to make valuable contributions to archaeological theory building in the 1960s, it took time to build a body of data that could address the research questions posed by processual archaeology. In the meantime, postprocessual archaeologists shifted away from studying large-scale processes, seeking to explore meaning and identities at localized sites (Binford 1977; Church 2007; McGuire 2002; Mrozowski 1988). Historical archaeologists focused on individual households as units of analysis for studying expressions of ethnicity, socioeconomic status, gender, and other personhood categories within historic populations (Henry 1987b; Joseph 2000; McGuire 1982, 1983; Praetzellis et al. 1987; Schuyler 1980; Spencer-Wood 1987a, 1987b, 1987c; Staski 1990; Wurst 1999). It is worth noting that the development of postprocessual archaeology coincided with New Western History, which also sought to highlight the contributions of various racial, ethnic, and socioeconomic groups within the American West (e.g., Limerick 1987; White 1991).

In 1980, Roderick Sprague and Priscilla Wegars (University of Idaho) conducted excavations at the Joso Bridge construction campsite on the Snake River. Research at the site examined consumption and disposal patterns of contract laborers in comparison to the Joso camp foreman and employees of the later Perry Station. Based on material culture at the site, Wegars and Sprague were able to ascertain site layout (distinguishing the bunkhouse from the mess hall), workers' leisure activities, and the presence of women and children living within the camp (Wegars and Sprague 1981). Sprague also published his functional classification system for artifacts found at historic-period sites in that same year (Sprague 1981). Archaeologists continue to use Sprague's system during analyses of historic sites throughout the Pacific Northwest.

Recent work within the CRB includes the Sandpoint archaeological project, which took place between 2006 and 2013. The research design for archaeological investigations conducted in advance of transportation improvements for the Sandpoint Byway (US 95) included precontact and historic components. As part of the investigation of the historic-period occupation of the site, archaeologists examined how socioeconomic status shaped the lifeways of Chinese residents in historic Sandpoint, Idaho. Archaeologists also analyzed evidence of regional ties between the Chinese community of Sandpoint and Chinese communities in other historic-period settlements in Idaho (Weaver 2014; Wegars 2014).

A series of CRM projects related to cleanup efforts at the Hanford Site have occurred during the twenty-first century. One such project involved the mitigation of adverse effects at two historic landfill sites associated with the Hanford Engineer Works. Researchers determined that one of the landfills, containing building debris with very few domestic artifacts, was created during deconstruction of plant facilities in the late twentieth century. The second landfill site was associated with the Hanford Engineer Works construction camp (occupied 1943–1945). Archaeological research at the construction camp landfill addressed lifeways of workers relative to gender, age, and ethnic identifications. Issues of institutional control, difficult labor conditions, and high security/secrecy associated with the Manhattan Project were also investigated over the course of the archaeological study (Smith et al. 2012). Within the Project Areas, extensive archaeological research has occurred at the Umatilla Town Site (archaeological site 35UM1 and 35UM35), near the McNary Dam. The multicomponent site was first documented in 1947. The historic component of the site (Old Town Umatilla) was the primary focus of Schalk's investigations at the site during the late 1970s (Schalk 1980, as cited in Dickson 1998). Recent work on historic sites within the Project Areas includes evaluations of the town sites of Old Keller (Coyote 2013), Marcus (McCullough 2013), and Old Kettle Falls (White 2014), within the Lake Roosevelt National Recreation Area in Washington.

6.4.1 Current Themes in Historical Archaeology Relevant to the FCRPS

Nearly 50 years after historical archaeology developed as a professional field, archaeologists have begun to strike a balance between processual and particularistic analyses. This is evident in the range of themes and data sets that historical archaeologists have investigated across the American West, from large-scale transportation networks and regional settlement patterns to the lifeways of Chinese residents in mining communities, railroad camps, and urban neighborhoods (e.g., Clark and Corbett 2007; McKay 2011; Merritt et al. 2012; Späth 2007; Voss 2015; Weaver 2014; Wegars 2014).

During the historic period, advances in transportation, communication, and production resulted in economic and social trends on a global scale. These trends include capitalist world economies, nation-states, global migration, industrialization, and urbanization. Given the integration and participation of historic-period populations within the CRB within these national and international processes, it is essential that archaeologists working on historic-period sites in the CRB be aware of recent historical archaeological research both within and beyond the CRB. Examples of historical archaeology projects within the CRB, such as Weaver's (2014) excavations at Sandpoint, Idaho, were reviewed with equal weight as Praetzallis and Praetzallis' (2009) study of neighborhoods in San Francisco, California, and Groover's (2008) review of North American farmsteads. Systematic federal and state context documents (Church et al. 2007;

NPS 2000; Oregon SHPO 2013), as well as settlement-type and industry-specific contexts (CalTrans 1999, 2007, 2008, 2010; HARD Work 2013; McKay 2011), were also reviewed.

This RD highlights four broad themes to help guide evaluation of historic-period sites within the FCRPS: Settlements/Community; Industry; Transportation; and Government. Overlaps between such broad themes are frequent, and multiple themes apply to the evaluation of individual sites. For example, a twentieth-century logging camp falls under both the Settlements/Community and Industry themes. If logging roads, railroads, or flumes are present, the transportation theme would apply as well. The historic-period context (Section 5.4) reviewed the exploration period and the mission era. Sponsored by the U.S. government, sites associated with Lewis and Clark's Corps of Discovery would fall under the Government theme as well as the Settlements/Community theme. The Settlement/Community theme applies to sites from the mission era. Various railroad resources have the potential to address the Transportation, Government, and Settlement/Community themes.

6.4.1.1 Settlements/Community

Archaeology of settlements/community is the study of how people live together in groups. This theme includes research on multiple types of personhood—ethnicity, socioeconomic status, gender, age, and other identities—that influenced how individuals lived within communities (CalTrans 2010; Clark and Corbett 2007). Settlements range from informal, temporary camps to permanent towns or cities to regional districts (e.g., mining camps). Elements of formal settlements are included in the settlements site matrix (Table 6-7; adapted from Clark and Corbett 2007) in recognition that most often, archaeological research recovers data from only a portion of a community, no matter which scale is used to define that community. Within this theme, individual households (e.g., rural farmsteads/homesteads or urban houses/lots) may be significant in that they have the potential to contribute information to neighborhood or regional community patterns (Clark and Corbett 2007; Groover 2008). Archaeologists recognize the household as a consistent unit of analysis for linking material culture to the expression of identity—ethnicity, socioeconomic status, or gender groups. Archaeological evidence of identities is discovered in subsistence practices, domestic architecture, and artifact class patterns indicative of consumer choice and resource availability (Carrillo 1977; Henry 1987a; South 1977; Spencer-Wood 1987a, 1987b; Staski 1990).

Table 6-7. Settlements Site Matrix (adapted from Clark and Corbett 2007).

Scale	Urban	Rural
Single Household	House/lot	Cabin, ranch, farm
Multiple Individual	Residence hotel	Camp
	Boardinghouse	Boardinghouse
	Other commercial (e.g., drug store)	Trading post
	Institutional	Other commercial
		Institutional
Multi-Household/Informal Settlement	Duplex/triplex	Informal settlements/temporary occupations
		Large ranches/farms
Elements of Formal Settlements/Rural Districts	Residential district	Elements of mining districts
	Industrial district	Recreation areas
	Mixed use	
Formal Settlements	City	Mission
	Dump	Town
	Cemetery	Company town
		Military installation
		Cemetery
Region	Greater metro areas	Mining districts

In the 1970s, William H. Adams (Washington State University) directed excavations in Silcott, Washington, a rural community in one of the Project Areas. His two-volume report for the project (Adams 1977; Adams et al. 1975) was one of the first major historical archaeological studies conducted related to this theme. In another early archaeological study, Wegars' (1991) examined domed rock ovens at railroad construction camps across the American West, including the CRB, and highlighted the presence and lifeways of Italian immigrants working on the railroads during the nineteenth century.

Recent excavations in advance of a transportation improvement project in the Bay Area, California, examined ethnic, socioeconomic, gender, and age divisions identified through historical archaeological research in three San Francisco neighborhoods. Archaeologists analyzed project data to address questions of community organization from multiple angles and telescoping scales (household, neighborhood, region) (Praetzallis and Praetzallis 2009). Within the CRB, the Sandpoint Archaeological Project examined socioeconomic organization within the Chinese community in Sandpoint, Idaho, as well as regional ties between that community and others in Idaho (Weaver 2014; Wegars 2014). Archaeological studies focused on the lifeways of different ethnic groups in the United States have increased our understanding of our national history and culture. Undoubtedly, historical archaeological studies of ethnicity continue to be avenues of research throughout the CRB, particularly when considered on a regional scale. It is important to note that other categories of personhood (e.g. gender, socio-economic status, religion, age) simultaneously shaped community development and lifeways, and may be evident on archaeological sites in the CRB.

6.4.1.2 Industry (Fur Trade/ Agriculture/ Fishing/ Mining/ Logging/ Hydroelectricity)

Archaeological research within the industry theme may be divided into two broad categories: investigations of human interaction with the environment and investigations of industrial social formations. Archaeological studies at resource-extraction, transportation, and production sites (e.g., wood-felling stations, sawmills, mines, ore-processing sites, fish wheels, canneries, etc.), and larger-scale industrial landscapes have tended to focus on technological developments associated with the industry in question and the environmental effects of industrial technologies (Hardesty and Little 2000).

Archaeological studies of industrial social formations center on the work camps and other social activity areas within a particular community to address questions about the lifeways of ethnic, gender, or socioeconomic groups within the industry (CalTrans 2008; HARD Work 2013; Hardesty and Little 2000; Merritt et al. 2012). This theme overlaps with the settlements/community theme discussed above. Research questions from the settlements theme should also be applied to sites where industrial social formations may be addressed.

Section 5.4 highlights the fur trade, agriculture, mining, logging, fishing, and hydroelectricity as the major extractive industries that occurred over the past almost two centuries in the CRB. Property types related to these industries fall into seven broad groups: resource-extraction sites, resource-transportation sites, resource-production sites, individual residences, work camps, industry town sites, and industrial landscapes (CalTrans 2008; Hardesty and Little 2000; Horn 2005; McKay 2011). Characteristics of sites within each general category vary by industry, with some sites serving multiple functions.

Fur trappers used temporary campsites for resource extraction and processing as well as for individual housing. These campsites and the trails used in the fur trade are among the most ephemeral historic-period sites that may be encountered in the Project Areas. Trading posts run by the HBC were multifunctional, involving resource production and settlements that fall somewhere between work camps and industry town sites. The HBC posts are the most researched historic-period sites in the CRB, with archaeological investigations run by the NPS, private CRM firms, and regional universities beginning in the 1940s and continuing through the present (e.g., Caywood 1948, 1951, 1954a, 1954b, 1955; Combes 1964; Dorset and Wilson 2006; Gembala 2003; Grabert 1968; NPS 2015c; Sprague 1975; Swanson 1962).

Other extractive industries follow patterns with regard to the general property types. Resource-extraction sites associated with industries within the CRB include farmsteads, ranches, commercial fields, placer-mining sites, timberlands, fish wheels, and dams.

Resource-transportation sites include flumes, skid roads, trails, ferry crossings, steamboat landings, county roads, railroads, state highways, irrigation ditches and canals, and transmission lines. In many cases, it may be difficult to associate a transportation feature with a specific industry. Resource-production sites within the various industries include gristmills, packing plants, ore-processing sites, sawmills, canneries, and dams.

Housing for workers associated with each industry comprise a range of site types from individual residences to work camps (e.g., logging camps, dam construction camps) or industry-specific town sites (e.g., mining towns). Industrial landscapes, such as mining districts, are larger-scale property types that should be considered. Industry-specific context documents provide more detailed information about the technologies and property types associated with each industry: agriculture (CalTrans 2007; Pfaff 2002); mining (CalTrans 2008; McKay 2011); logging (Lindstrom and Hall 1994, as cited in Hardesty and Little 2000); and work camps (CalTrans 2014).

The industry theme is structured around the major extractive industries in the CRB. Within this structure, commerce is an element within each of extractive industries and is not examined separately.

6.4.1.3 Government

Federal, state, and territorial governments directly influenced the historic-period landscape of the American West (Guilfoyle et al. 2007; White 1991). Federally sponsored expeditions (e.g., Corps of Discovery, Wilkes Expedition), the British Boundary Commission, the American Boundary Commission, federal land survey and distribution policies, the military, Indian agencies, public-works programs, NPS, USACE, USFS, and government-funded transportation networks (e.g., state and interstate highways) and the Manhattan Project at the Hanford Site[7] have each affected the CRB in their own ways.

The range of impacts of these government institutions and policies follow two separate tracks. The first track encompasses sites constructed, occupied, or used by government employees. Such sites include temporary portages and campsites used by the Corps of Discovery, the Wilkes Expedition, and other government-sponsored surveyors. Army forts and battle sites from the Indian Wars correspond to military (both volunteers and professional soldiers) presence in the

[7] The Hanford Site has had a profound impact on parts of the CRB since 1943. It is located adjacent to the northwest of the upper end of the McNary Dam Project Area, but the historic elements (e.g., the Manhattan Project buildings) are not close to the McNary APE and are not included in the research questions presented in Chapter 7. The Department of Energy maintains its own historic properties program on the Hanford Reservation.

CRB. Indian agency, Forest Service, and NPS buildings and infrastructure also fall into this category. Finally, the 14 federally funded dams, along with their related infrastructure and construction camps, are important illustrations of the federal government's role in the CRB during the twentieth century.

The second track within the government theme considers how land-distribution legislation influenced settlement practices in the CRB. The government passed a series of acts designed to stimulate settlement in the American West. The establishment of and modifications to reservations also fall within this track. Archival records available from the General Land Office provide invaluable context for rural sites, helping establish occupation dates for many.

Boundary negotiation is an important subtheme of the government theme, relating to both tracks discussed above. For example, sites occupied or used by the British Boundary Commission and the American Boundary Commission have the potential to be significant based on their association with United States territorial expansion. Boundary negotiations should also be considered in relation to the practical application of land distribution legislation in the CRB. A comparison of sites associated with different periods of reservations' relocation and reduction has the potential to contribute information about how households and communities adapted to the shifting boundaries around them. The presence or absence of irrigation features on homesteads settled under the Desert Land Act (1877) may indicate the extent to which homesteaders and government officials negotiated the realities of settling in the arid environment of the CRB.

6.4.1.4 Transportation

Cultural resources associated with the transportation theme include such linear features as trails, roads, canals, railroads, bridges, and ferry crossings as well as the infrastructure associated with each type of transportation network (Table 6-8). Over the last decade, historical archaeologists have increasingly recorded and evaluated linear transportation resources in the field. A transportation feature "is an element of a local network that forms integral connections within world systems" (Späth 2007:388). As a result, transportation features are often associated with broad patterns in history. An important consideration related to evaluating cultural resources within the transportation theme is the extent and character of the transportation network beyond the immediate project area. For example, individual railroad or road segments within the project area may be part of an overall resource that was influential in directing settlement and industry development in the CRB. Historical background research and archaeological resource research is essential to help determine what portion of the larger resource/transportation network is located within the project area and whether segments of the network outside of the project area have been evaluated previously (Oregon SHPO 2013; Späth 2007).

Table 6-8. Transportation Sites and Features		
Transportation	**Linear Resources**	**Nonlinear Resources**
Trails	Footpaths, horse trails, pack trails, wagon trails, livestock trails	Campsites, supply points, way stations, water crossings
Roads	Wagon roads; early automobile roads; local, state or federally maintained roads; industry roads (i.e., skid roads); bridges	Gates, toll stations, traffic signals, service stations, lodging, diners
Railroads	Tracks and roadbed; main or trunk lines, branch lines, spurs to industries or depots; bypasses; passing tracks; bridges	Depots, stations and terminals, loading facilities, construction and maintenance camps
Steamboat/Ferry Routes	Canals,[8] ferry cables	Portages; ferry landings

[8] This is specific to navigation canals, such as those constructed at Cascade Locks in 1896 and at The Dalles-Celilo in 1915 (Center for Columbia River History 2015). Canals associated with extractive industries are not included in the transportation theme. Agricultural irrigation canals and mining canals are infrastructure that fits best within the industry theme of this RD.

CHAPTER 7 – RESEARCH QUESTIONS AND DATA NEEDS

The purpose of the SWRD is not to produce an exhaustive list of research questions that could be asked about cultural resources in the FCRPS Program area. Such a list would be neither useful nor feasible, anyway, since good research and new data should always lead us to ask new questions. That said, the questions provided in this chapter are focused on the primary goal of the SWRD, which is to assist the Agencies in evaluating resources to determine if they are NRHP eligible. Our intention is for these research questions to expand on those questions commonly asked during individual property evaluations and which do not need to be reiterated here (e.g., When was the site occupied? What resources did the occupants utilize? What features are present, and what functions do they indicate occurred here?).

Instead, these research questions seek information missing from the thematic historic contexts described in Chapter 6. They are only a partial list of all questions that could be studied and are intended to offer guidance for determining eligibility of site. Other questions should be raised and researched. The types of data a study under this SWRD pursues should be appropriate for the scale of the study area and the goals of the research. While the research themes and subthemes presented in Chapter 6 apply across the Plateau region, these research questions focus on the FCRPS Project Areas wherein the Agencies conduct research as part of their regulatory compliance obligations. To the extent that data gathered in the Project Areas can speak to the archaeological record outside the Project Areas, these research questions attempt to anticipate that contribution.

This chapter also describes the kinds of information that should be sought to address the research questions. For the most part, the data needs described are archaeological, and the Best Practices appendices presents recommended methods for gathering applicable information. However, while this SWRD does not belabor the fact that information sources other than primary archaeological data are available that could contribute to answering these research questions, future researchers should not overlook these sources when working in the FCRPS Program area. There are nearly 40,000 recorded historic and precontact archaeological sites in Washington and Oregon alone as well as numerous sites in Idaho and Montana. Additionally, many of the sites have multiple components. Collectively, this represents a large body of data that can be applied to these research questions. Thousands of sites in the Plateau region have been excavated to some degree and the reports, records, and collections derived can help address these research questions. Not all of the results of previous studies are useful for intersite comparisons. But those that have usable records and analyzable collections represent the method of least impact for future research on sites in the FCRPS Project Areas. Therefore, these research questions should be read as applying to museum collections as well as those yet to be excavated.

7.1 Environmental Variability

For all of the research questions posed below that pertain to paleoecology, geomorphology, and landscapes within the FCRPS Project Areas, a primary data need is for a thorough understanding of the geologic and depositional context of each site. Geologists have mapped at varying scales the bedrock geology of each FCRPS Project Area, and surficial sediment and soils data are available for many of the areas. These data sets provide baseline expectations for sedimentary contexts within which archaeological sites should be found. Comparing and contrasting baseline expectations with what one actually encounters at a site are powerful tools for reconstructing environments and understanding site-formation processes.

At the site level, stratigraphy is of primary importance. Archaeological sites should be viewed relative to materials that were deposited before, during, and after people were using or occupying them. Stratigraphic analysis of unit excavations, backhoe trenches, and sediment cores can provide important information regarding stratigraphic context. Care must be taken to differentiate soil (pedo-) stratigraphy versus sediment (litho-) stratigraphy, and bounding surfaces must be analyzed to determine if a stratigraphic section represents continual time or if portions of the section have been removed (eroded or truncated). Chronostratigraphy can be applied using absolute and/or relative dating. Once established, chronostratigraphic sections can be compared and contrasted locally and regionally to aid in the reconstruction of past geomorphic processes and to provide relative chronological data for sites that lack material for absolute dating. The Environmental Variability domain was introduced in Chapter 4, and associated research themes presented in Section 6.1.

7.1.1 Paleoenvironmental Change and Human Mobility

This research theme focuses on environmental changes that could have affected the lifeways of the Plateau’s occupants through time, including changes to the setting (e.g., geomorphic changes to landscape/landforms) and environment.

24. *What evidence is available in the Project Areas for the nature and timing of climatic conditions in the Plateau Culture Area? How much variation was there across the region?*

Several broad-scale climatic changes have taken place within the Plateau Culture Area during the last 14,000 years. Globally, the response of human groups to changing environmental conditions during the end of the Last Glacial Maximum varied (see Strauss et al. 1996). Understanding the extent and timing of these climate shifts is critical when considering how people not only acquired resources but also situated themselves on the landscape in the past.

For example, after 14,000 cal yr B.P., the retreat of the Cordilleran ice sheet was not uniform across portions of the northern Columbia Plateau, creating variation in the environmental refugia and ice-free locations in the Hungry Horse, Libby, and Grand Coulee research areas, among others (Clague and James 2002). Understanding the timing of glacial advances and retreats is important when considering cultural chronology and early human occupation in each of the Project Areas. Similarly, geologists have revised and refined their analyses of the extent and timing of glacial floods in the last few decades (Clague et al. 2003), providing a more fine-grained and localized look at the effect of such events within the research area.

Data required to address these research questions include incorporating newly (post-2014) published paleoecological data into the existing FCRPS ecological context presented in Chapter 4, in addition to the collection of primary ecological data recovered from lake sediments, peat bogs, or other paleoclimate-rich deposits within each study area (if such deposits are present). In areas where primary ecological information may be acquired, methods and analysis of these data sets should be considered in conjunction with archaeological data. In research areas with forested environments, dendrochronological data in the form of tree cores or slices taken from living trees or preserved stumps should also be collected to help understand temperature, precipitation, and fire occurrence during the last few millennia. The tree species present in the study areas are good candidates for this type of research. In the northern Cascades, dendrochronological studies of subalpine conifers provide proxy data regarding snowpack and summer temperature (Peterson and Peterson 1994). Fire scars from ponderosa pine and Douglas fir have been used to determin fire frequency, extent, and severity in the eastern Cascades (Everett et al. 2000) and northern Rockies (Baker et al. 2006). Dendrochronological approaches would be useful for research areas in the Northern Columbia Basin, Rockies, and Cascades (Flower et al. 2014). Even in locations where forests have been logged, tree stumps may be present and preserved enough to provide tree-ring data that can be used to identify changes in precipitation (in moisture-limited species) or temperature (in growing-season-limited species).

While major climatic trends, such as warming at the beginning of the Holocene, are apparent across the entire Columbia Basin, environmental response may have varied within specific FCRPS Project Areas. The question of variation is critical when interpreting archaeological data sets and interpreting human response to climate change. Information required to address variation across the region includes paleoecological data encompassing the time pre- and post-event from each specific Project Area. These data sets may depict change or stasis in plant communities through time. Researchers should also use the NOAA global pollen database[9] and similar databases that provide raw data from paleoecological records in addition to citations to published articles. Comparison of these data sets between study areas will aid researchers in

[9] http://www.ncdc.noaa.gov/paleo/gpd.html

understanding regional and localized climate change in the FCRPS research area. Other avenues of research that can provide proxy paleoenvironment information can include more geomorphic, pedological, or geochemical approaches, such as stable isotope geochemistry of soil carbonates, paleopedology, and aeolian sedimentation rates (e.g., Busacca 1989; Davis et al. 2002; Deocampo 2010; Sweeney et al. 2005; Takeuchi et al. 2010). Research designs should incorporate existing geological and paleoecological data sets to address paleoenvironmental questions.

25. What is the history of landscape development within the Project Areas?

Landforms within each of the FCRPS Project Areas have formed and reformed over variable scales in time and space. Within each of the ecoregions, bedrock geology provides the foundation upon which geomorphic processes act and react. Large-scale geomorphic drivers such as glaciation, catastrophic flooding, mass movements, and loess deposition have modified and/or buried bedrock geological formations, while smaller-scale alluvial, aeolian, and colluvial forces have added to or reshaped existing landforms.

Most of the large-scale geomorphic processes modified the landscape during or at the end of the last glacial period. In many cases, these late-glacial landscapes represent the basal bounding surface for potential human occupation. For example, catastrophic flooding near the end of the Pleistocene stripped parts of of eastern Washington, northern Idaho, and western Montana of surficial sediment (see Figure 4-2). Had humans been present in those areas prior to the floods, evidence of their occupation would have been washed away.

Postglacial reworking and deposition of loess has buried much of the Plateau in thick fine-grained sedimentary deposits. Although most of these deposits were likely emplaced before evidence of human use of the area (McDonald and Busacca 1989), more local-scale aeolian processes may have buried younger stabilized surfaces (Chatters et al. 1995b; Gaylord et al. 2001).

Postglacial alluvial landforms present within each of the Project Areas are extremely variable in their age and extent. For example, while alluvial stream terraces began to form in much of the Plateau in the late Pleistocene and early Holocene (Chatters and Hoover 1986, 1992; Lenz et al. 2001; Mierendorf 1983), terraces did not form along some sections of the upper Snake River until the late Holocene (Plew and Guinn 2015).

For each of the FCRPS Project Areas, knowledge of the large-scale processes that have been active in the region during the late Quaternary will help set the stage for interpreting the landform history of the area. Site-scale geomorphic processes and landscape studies should be viewed at multiple scales over time and space. This information is generally available in the scientific literature. At the site level, detailed stratigraphic studies, including analysis of pedo-, litho-, and chronostratigraphy as well as bounding surfaces, should be performed to understand context at the local and regional scale in regard to site setting at the time of occupation and the forces that have affected or preserved the site since that time. Absolute and relative dating of deposits (above, within, and below the archaeological site) will aid in interpreting landscape development and site-formation processes (c.f. Davis 2001b).

While some of this work can be challenging given the altered (i.e., inundated) nature of many of the FCRPS Project Areas, original shoreline exists within each of the reservoirs and can occasionally be accessed. Additionally, higher elevation terraces relating to glacial backwater deposits or earlier episodes of terrace formation are found along some reservoir margins/terraces and can be accessed for examination for evidence of human use. A better understanding of the surficial geology surrounding each of the reservoirs can help identify high probability landforms.

Research at sites that have been heavily reworked by riverine or other geomorphological processes can help answer important questions related to environmental processes that have been active over time, even though these sites may lack elements of integrity that are normally deemed essential for conveying historic significance. Such sites can still provide information about the geomorphological processes that were operational when the site was occupied and which may have contributed to subsequent abandonment.

26. *Has the amount/timing of human use of landscapes changed through time in reaction to fluctuating environmental conditions? Or have humans occupied certain landscapes regardless of fluctuating resources by adapting to changing conditions?*

A thorough understanding of local/regional landscape and geomorphic conditions over time will aid in addressing this question. Ideally, multiple lines of evidence can be used to help reconstruct the setting of an archaeological site at the time of its occupation and abandonment, and to interpret the postdepositional impacts it has experienced since that time. At the site scale, soil analysis has been applied to myriad archaeological problems. Soils have been used as stratigraphic markers, to indicate stable surfaces, to indicate the presence and/or intensity of human occupation through soil chemistry, for interpreting the geoarchaeological context of deposits through soil micromorphology, to reconstruct landscape and climate, and as dating tools (Hammatt 1977; Mandel and Bettis 2001:174). Detailed stratigraphic studies and dating of deposits above, within, and below archaeological materials will help elucidate the history of landscape development over time. Sites with multiple components represented in discrete deposits are especially useful for establishing periods of site use/abandonment in relation to landscape setting. Sites can also be regionally compared in regard to age and associated landform to analyze changes in site use relative to geomorphic forces that might affect site use and preservation. Both absolute and relative dating techniques will aid in the analysis.

However, given the size of the FCRPS Program area, it is likely that geomorphic and environmental events affected individual watersheds differently. For example, Project Areas near major volcanic episodes will have been affected more than those at greater distance. Similarly, the lower end of the Columbia River system was more prone to major floods from weather events than any one of the tributaries, and the more sparsely vegetated central Basin area would be more susceptible to drought or damaging runoff than areas around forested tributaries. Identifying landscape features that have remained static versus more ephemeral features can aid in the understanding of archaeological potential. For example, the landscape surrounding rivers with large floodplains is in constant flux; the river meanders, forming and destroying landscape features such as terraces, side channels, oxbows, etc., over time. Deeply incised river channels, however, retain more static features, including small fans or terraces at confluences with tributaries. Flood events occur on all rivers, but their frequency and severity differ depending on watershed conditions. Fortunately, for major events (e.g., Bonneville landslide), a solid record exists that can be compared with archaeological and ecological records to discern the variability in cultural effects between the Project Areas.

Inter-Project analysis must consider that the Project Areas are artificial entities whose boundaries were not established for the convenience of cultural resources researchers. Some of the Project Areas exist entirely within similar topography and environmental zones, while others overlap differing topography and environments. When comparing the Lower Monumental Project Area's landforms and archaeological record with those in the Little Goose Project Area, one finds similarities in data. However, when comparing data from the Lower Monumental Project Area with that from Bonneville or Albeni Falls, one is more likely to find contrasts than similarities. While the FCRPS Program area is rich in diversity of topography and environmental niches, inter-Project research should consider grouping the Project Areas by similar topography and environment and contrasting the archaeological records of these groups. Proposed groups include: Columbia Gorge (Bonneville Project area to Roosevelt/Arlington area on the John Day Project/Lake Umatilla), Confluence (above Roosevelt/Arlington area to the Hanford Reach on the Columbia and to Ice Harbor Dam on the Snake River), Lower Snake River (Ice Harbor Dam to the upper reaches of the Lower Granite Project reservoir), Grand Coulee (Chief Joseph Dam Project Area upstream including the Spokane [River] Arm and to approximately the Inchelium Ferry on the Columbia River), Upper Grand Coulee (from Inchelium Ferry to the Canadian border), and Foothills (Albeni Falls, Dworshak, Hungry Horse, and Libby project areas).

27. *How did the physiography of an area help/hinder population mobility?*

This question can be addressed at several scales: within Project Areas, as part of catchment-area analysis; and between Project Areas, both along rivers and between watersheds. Within Project Areas and through adjacent Project Areas along stretches of a single river (e.g., the Lower Snake

River), canoes were the easiest means of travel, but times of high water and places where logjams, rapids, or slides created dangerous conditions would have represented barriers to their use. At these times, and when traveling away from the river or over short distances, people would have used walking trails that were well established and avoided topographic barriers. Such trails would have wandered laterally over time in response to vegetation changes (e.g., windfalls in forests), failing erosional scarps, and slide debris, but probably remained within a corridor that followed the shortest distance between two places with deviations for desired resource or ritual locations along the way. As archaeological sites are identified and their functions determined, pathways between them in the catchment area to which they contributed can be extrapolated based on topography. Archaeologists have long focused on ridgelines due to the awareness that these higher landforms are easier to walk than lowlands that can be heavily vegetated, but this can apply to only slightly higher ground in flatter topography as well, which also served for spotting game. These basic parameters of determining trail routes likely applied whether occupants were following a forager lifeway and moving their residences or as collectors on shorter, resource-procurement and exchange (including maintaining social relations) related trips. The potential for trails to be evaluated as TCPs is also discussed in Chapter 3.

Trade and exchange is a relevant topic for this kind of mobility analysis (see Section 6.3.2.2). Analysis of the presence of trade items relative to routes of passage, such as river systems and trail networks, can reveal additional site types as well. One of the most durable and most studied trade items for this analysis is stone tool raw material. For example, regional patterns of procurement and trade can be analyzed through obsidian source analysis.

7.1.2 Paleoenvironmental Change and Resource Availability

This Research Theme emphasizes plant and animal communities instead of topography.

28. *What are the primary floral and faunal resources demonstrated archaeologically in each Project Area? How are they distributed seasonally within and between Project Areas?*

A shift in the availability of an important resource, such as camas or salmon, may be detected archaeologically in several ways. Most simply, in sites with long-term occupation and dated (absolute or relative) layers of occupation, a shift in the frequency and diversity of plant remains can be used to determine a shift in resource use. A decreased occurrence of macrobotanical or archaeofaunal remains may suggest decreased resource availability. Additionally, in locations where botanical remains are not preserved, lack of available resources may be used as an explanation in the abandonment of a location or habitation structure (Chatters 2004). In both cases, the effects of taphonomy on relative data must be considered. Similarly, an increase in plant-processing artifacts/features may suggest a shift to more productive resource patches.

Paleoecological reconstructions can also be used to understand changes to local plant communities and may be used as a proxy for resource availability through time. For example, expansion of shrub-steppe environments may be interpreted from a shift in the ratio of grass and sagebrush pollen to arboreal pollen in sediment samples (see Mack et al. 1978a, 1978b). Each taxon has specific environmental tolerances and preferences and with data (e.g., lake cores, pollen counts), biogeography- and climate-linked shift in taxon availability can be addressed. Too often archaeologists based conclusions on the flora and fauna a site's occupants encountered and possibly used based on interpretations of lithic assemblage functions, instead of looking for direct evidence. The collection and analysis of soil samples for floral remnants and residues should be a standard part of archaeological excavation.

The establishment of the modern precipitation and climate regime on the Plateau between 5,000 and 6,000 years ago created more stable and predictable plant-growing conditions (Chatters 1998). As the location and availability of essential resources became more reliable, specific mobility patterns and seasonal rounds developed; plant stability also contributed to increased sedentism in locations resources were confined and could be intensified (Thoms 1989). In Oregon's Willamette Valley, increased sedentism between 3,000 and 4,000 years ago has been linked to resource intensification (Bowden 1995; Cheatham 1988). Similar patterns have been identified on the central Northwest Coast around the same time (Ames 2004) and in the northern Columbia Basin (Prentiss and Kujit 2004). The structure of archaeological sites and the level of mobility they represent have been used as a proxy for resource stability.

Macrobotanical remains recovered from archaeological deposits also provide information about past climate, and are especially useful when associated with radiocarbon or relatively dated strata. Botanical remains have been analyzed from archaeological excavations at the Marmes site (Mastrogiuseppe 2004), various sites within the Chief Joseph Project Area (Stenholm 1985), and elsewhere in the Plateau Culture Area (Herbel et al. 2012; Hicks 1995, 1996; Hicks and Morgenstein 1994; Hicks et al. 2006; Peacock 1998; Roulette et al. 2000; Thoms 1989) and used to infer local vegetation and climate.

Botanical records also provide information on some plant food resources, fuels, and textiles that were locally available to people who inhabited the site (see Question 29 below) and inform change or stability in plant use practices through the Ethnographic period. For example, charred serviceberry seeds were recovered from 5,000 year old deposits at Site 35OK11 at Chief Joseph (Stenholm 1985:432) suggesting longterm use of the plant by Plateau peoples.

Analysis of stable isotope geochemistry of freshwater mussel shell and sediments provide additional proxy paleoclimatic data. Davis et al. (2002) demonstrated shifts in climate during the Pleistocene-Holocene transition in the Salmon River Canyon of Idaho using soil stable isotopes and aeolian sedimentation rates. Precipitation rates were inferred for the same time period using

Margaritifera falcata shell stable isotopes (Davis and Muehlenbachs 2001). Stable isotope approaches may prove useful in the FCRPS Project Areas where intact sediments and/or mussel shell are present.

As described in Chapter 6, determining species of salmon and trout found in archaeological deposits is important for assessing their availability and dietary contribution through time, among other things. Vertebrae are the most common skeletal element found in archaeological deposits due to their durability. Analysis of aDNA by Butler and Bowers (1998) and Yang et al. (2004) has thus far been the only method of accurate species identification. However, like all DNA analysis, this analysis destroys testing samples and is subject to contamination (Yang and Watt 2005). Geochemical analysis of otoliths can address questions of life history (Campana 1999; Kalish 1989; Zimmerman 2005).

Perhaps the most important data need for addressing the floral and faunal resource representation question is consistently reported and well-analyzed data. Numerous investigators have commented on the lack of comparability among Plateau assemblages (e.g., Butler and Campbell 2004). Accurate and consistent species identifications are needed uniformly across all new data sets, and reanalysis of previous collections, specifically those originally analyzed in the mid-twentieth century, is also needed. Changes in rare taxa may not be detectable archaeologically for a number of reasons (Lyman 1995). These data needs and cautions hold true for all archaeological data but especially for the faunal and botanical data used to address subsistence and diet.

29. *Shifts in regional and local climate influenced the availability of important resources. Can this explain shifts in mobility and social structure available in the archaeological record?*

The complex archaeology and ethnohistory of the Plateau Culture Area suggests that not all human populations responded to shifts in climate or even the introduction of new technology (e.g., bow and arrow) in similar ways. In order to be able to answer this question, we must first understand the effects of climate change in the different FCRPS Project Areas to predict how important food resources such as bison, antelope, berries, and salmon responded before hypothesizing human impacts.

Addressing paleoenvironmental change linked to resource availability through the archaeological record is difficult for a number of reasons, including issues of temporal and spatial compression (Bailey 2007; Lyman 2003) and inherent bias in the archaeological record as a result of human activity and postdepositional processes (Lyman 2008; Schiffer 2002; Zohar and Belmaker 2005). Additionally, availability must be separated from abundance, which is nearly impossible to address through the archaeological record. Abundance must be viewed as a relative measure simply because of the numerous pre- and postdepositional processes that bias the record (Lyman 2008).

Key climatic events have occurred within the Plateau culture area during the last 20,000 years, many of which had direct effects on animal and vegetation communities within the FCRPS study area (Butler and Campbell 2004). As previously noted, increased temperatures and more marked seasonality during the Middle Holocene affected resource availability in the southern Columbia Basin (Chatters 2004). For example, during the Medieval Climate Anomaly (1200–700 cal yr B.P.), Pacific Northwest groups likely experienced drought-like conditions and increased forest fires. Changes in precipitation would have affected the timing and availability of some plant resources. High-intensity stand-replacing fires would have also altered forested environments, requiring precontact people to adjust their subsistence practices. The LIA appears to have been expressed across portions of the western North America between A.D. 1150 and 1370. Our current understanding of the effects of a colder climate on precontact people during the LIA is less understood.

Because the FCRPS Project Areas span a broad geographic and latitudinal gradient, there is potential for archaeological and paleoecological data collected in the FCRPS Project Areas to contribute to a wider geographic understanding of resource availability and climate change since the Late Glacial. As is the case for other research questions proposed in this chapter, consistently reported and well-analyzed floral and faunal data is key to addressing this question. Accurate and consistent species identifications are needed uniformly across all new data sets, along with reanalysis of previous collections, specifically those analyzed in the middle of the twentieth century.

Data needed to identify plant resource availability in the research areas include identification of floral resources from pollen and phytoliths collected from ground stone and other artifact washes, starch analysis on ground stone, and macrobotanical remains recovered from flotation of archaeological sediments. Excavation of hearth and roasting features and flotation of the sediments contained in them may provide evidence of processed plants and animals. For example, plant materials have been successfully recovered from hearth/feature contexts at Chief Joseph (Stenholm 1985), Lake Roosevelt (Roulette et al. 2000), Marmes Rockshelter (Mastrogiuseppe 2004), and other Palouse Canyon sites (Hicks 1995, 1996; Hicks and Morgenstein 1994). Comparison of newly acquired data sets with existing paleoclimate reconstructions and modern plant distributions can reveal how plants were distributed seasonally across the landscape.

Environmental effects on resource availability should be approached in stages. First, archaeological data from similar time periods within the same ecoregion (i.e., shrub-steppe) should be compared to see if there is synchronic response to environmental changes. For example, does the paleoecological record demonstrate a shift to open grassland steppe at the same time across the Plateau, but that is accompanied, however, by similar or distinctly different patterns in the archaeological record across the various Project Areas? In one area, there may be no noticeable change in cultural materials or mobility patterns during a major climatic event, while in another Project Area, there may be a shift from highly mobile task-specific groups to semisedentary seasonally tethered occupation patterns (and, perhaps, accompanying social changes such as fission-fusion of family groups at the Bridge River Site, for example). If these patterns are identified, the next stage of analysis of data relating to select resources should be considered. What are the important resources that are being utilized during that time period in each subregion/area? Would the climatic event affect the availability of that resource, and was that availability a contributing factor to archaeological changes? If the same key resource was used across the Plateau and there is still a change identified in some locations but not in others, then an environmental determinist explanation (by itself) is refuted and alternative factors outside of paleoclimate (e.g., cultural) should be considered.

7.1.3 Natural Events and Cultural Response

30. *What evidence is there for natural events apart from climate changes that had broad impacts on the environment? Did the shift to a warmer, more predictable seasonal climate lead to a change in mobility? Were areas such as the Snake River Basin refugia during major changes in climate that allowed groups to thrive?*

Researchers have suggested that natural events that caused changes in landscape morphologies have affected resource availability and the way that humans utilized and occupied their environments. Archaeologists should thus pay special attention to geomorphic processes that could have affected sites and their inhabitants when analyzing site distribution in an area. Trends in archaeological site presence or absence can be viewed relative to known geomorphic events.For example, O’Connor (2004:411–412) suggested that the salmon fisheries at The Dalles and Celilo Falls may not have been as productive prior to the Bonneville landslide as after it, resulting in fewer subsistence activities upstream of Bonneville before the landslide. Davis (2007) noted that local tectonic forces may have played a part in resource availability, while Plew and Guinn (2015) have recently hypothesized that local trends in alluvial deposition or erosion related to fires may have affected local resources and human land use. In areas that received large amounts of sediment as a result of primary or reworked tephra deposition during and after volcanic eruptions, changes in the river systems may have affected available resources.

Paleoecological research has shown pronounced shifts in vegetation directly following the Mazama eruption. This shift would have had a profound effect on plant (and animal) availability across much of the Plateau culture area. Comparison of pre- and post-Mazama archaeological deposits including changes/stasis in stone-tool technology, habitation type, site size, and location on the landscape, are all useful approaches to understanding how cultural groups responded to natural events.

7.1.4 Anthropogenic Influence on Paleoenvironmental Records

31. *To what extent did precontact populations influence local plant communities in the Project Areas?*

Because small-scale societies, such as those of the Columbia Plateau, often leave less of an ecological footprint than do agricultural or industrial-based economies, it is more difficult to identify these behaviors archaeologically. However, several fire and paleoecological reconstructions from the Cascades (Walsh et al. 2008) and Rockies (Hallett and Walker 2000) demonstrate that precontact people deliberately burned the landscape to alter local vegetation. A wealth of ethnographic information (see Turner 2014a, 2014b) has also shown that precontact people actively managed Columbia Basin plant communities to elicit desired results in key plant and animal resources. The extent to which precontact populations influenced local flora should be investigated within each of the FCRPS Project Areas.

Data required to answer this question include comparative analysis of chronology of human arrival and/or increased population with changes in paleoecological data. For example, on the Northwest Coast, the establishment of cedar plank house villages has been identified on Haida Gwaii, British Columbia, from pollen records. Cedar pollen is present in the record as a major contributing species prior to human habitation and then drops off dramatically at approximately the same time as long-term occupation of the island was established (Lacourse et al. 2007). Pollen and charcoal records should be obtained from sediment cores within each Project Area, and the results of each should be compared with known archaeological data. In instances where a shift in vegetation and/or fire frequency cannot be explained by climatological factors, humans should be considered as a major driver in ecological change.

32. *Can shifts in fire frequency that cannot be attributed to climate be considered anthropogenic in origin?*

Fire is one of the only plant management activities (e.g., weeding, pruning, transplanting) that leaves an easily identifiable physical signal in the archaeological record. Previous paleoecological research in areas near several of the Project Areas has demonstrated changes in fire frequency that do not directly correlate with climate change (e.g., increased dry, lightning-prone conditions). In some of these cases, researchers have attributed increased fire occurrence to indigenous burning practices (Hallett and Walker 2000; Hicks et al. 2006; Whitlock and Knox 2002).

Understanding the chronology of human presence within a specific environment is critical in answering questions of human-landscape interactions. In order to answer this question on a local scale within specific Project Areas, researchers should compile known fire-history reconstructions and extant archaeological data sets to determine whether human populations and fires were co-present. Lightning ignited fires should be more common during certain climate regimes than others. Soil core data can be correlated with climate records to develop hypotheses about the source of regular burns. In addition, some places are not susceptible to lightning strikes (narrow valley bottoms) or rarely are impacted by lightning started fires from adjacent areas due to their flood and vegetation regime (e.g., wet river valleys). In areas where known important resources that benefit from frequent fire, such as Garry oak or camas, are present and the paleoclimate data suggest that lightning cannot explain the pattern, additional radiometrically dated archaeological data should be compared with existing fire histories and climate reconstructions.

Sampling of lakes/bogs near known key resource locations (e.g., camas meadows) or long-term occupied archaeological sites should be cored to obtain sediment for charcoal analysis. Sediment cores should be sampled at an interval small enough (no greater than 1 centimeter) to allow the identification of regular burn episodes that may indicate intentional burning. Sediments should contain enough time depth to allow for comparison with the regional fire-history signal (e.g., 250-year fire return interval). Charcoal morphology, in addition to charcoal counts, should be included to allow for reconstruction of fuel types present. Anthropogenic burning practices in western North America were not deliberately stand-replacing fires but rather were low to moderate intensity understory burns (Derr 2014; Stewart 2002).

33. *Are zooarchaeological data available that demonstrate the loss of important species and subsequent environmental change?*

Humans have had an impact on faunal communities in myriad ways throughout history, but documenting these archaeologically can be difficult (see Chapter 6.3) as controlling for environmental (i.e., non-cultural) factors is laborious and prone to error (Lyman 2009b) (see Section 6.3.1.1).

If communal hunting was as productive as the ethnohistoric and historic accounts describe (e.g., decreased beaver populations led to hydrological shifts), then localized overhunting should have been a potential outcome. If overhunting occurred, people could have remained focused on the preferred prey species but broadened the area from which they took the resource; relocated their winter base camp to an alternate resource patch and left the previous patch to go fallow and restock; and/or broadened their prey spectrum to include less desirable (more costly) game. All three potential contingencies can be measured in a diachronic examination of the archaeological record. Expanding the hunting range while maintaining the same winter base camp should appear in the skeletal elements that were returned to the base camp: if the animal was attained nearby, then more of the carcass should be present in base camp assemblages; if game was harvested further afield, then primary butchery would occur elsewhere with fewer skeletal elements making their way back to base camp. In the second scenario, if winter harvest was systemically overdone, then there should be multiple winter encampments broadly contemporaneous with highly comparable butchery patterns in the food refuse. In the third contingency (expanded prey spectrum), there should be more winter encampments that contain a broad range of prey categories. Both expanding hunting range and relocating winter encampments presumes that there was additional resource space available to the community to use. However, if a territory had reached its carrying capacity, then broadening of the prey spectrum was the more likely outcome (Lyons 2013). The archaeological record can demonstrate broad trends occurring over centuries, but is not fine-grained enough to capture annual variations in predation choices.

7.2 Tracing Temporal Dimensions/Chronology

As stated above, the SWRD assumes that researchers will take standard steps to assign chronological dates to archaeological sites that they have recorded or excavated. This includes carrying out background research in the broader study area to determine which time periods may be represented in the Project Area based on previously recorded index artifacts and previously dated excavations. If testing or data recovery is carried out, it is assumed that stratigraphic associations and radiocarbon dates will be collected, recorded, and reported, and compared with all other previously reported chronological data.

This section offers additional measures to be considered to expand the number of temporal data points and to refine the conclusions related to occupations and uses throughout the FCRPS Project Areas that were introduced in Section 5.2 and further described in Section 6.2. Consideration of the methods that may be applicable to gathering such data points needs to occur as early as possible in pre-fieldwork planning and budgeting in order to maximize the data potential.

34. *How does the local chronology relate to the synthetic chronology described in Section 6.2.1? Which periods are represented in the subregion?*

The integrated cultural chronology proposed in this SWRD is intended for broad, Plateau-wide analysis. It also provides an initial means of identifying gaps in local models and areas where further research is needed. If evidence of all time periods is not present in all of the Project Areas, then hypotheses for why that is can be generated. This can focus future research toward the timing of changes in the hydrological regime (i.e., a period of higher floods removed shoreline site occupied at that time), alteration of transportation routes (e.g., a landslide leads to moving a trail to an adjacent valley), or other factors (including sampling bias) that may explain any gaps.

If all time periods are represented in the study region, then questions can be addressed relating to social and environmental conditions at periods of transition. For example, were transitions between periods rapid or gradual? Do they correspond to changes in the physical environment or are they the result of internal cultural developments? To address questions like these, diachronic data are needed. Single-occupation site data can be useful as a point of comparison to other known sites in the region.

If there is a robust record related to one or more time periods, research questions related to those periods should be formulated and are likely to be the most productive.

A number of distinctions have been made between Cascade I and Cascade II periods that needs further investigation as more assemblages of the Archaic period are discovered. Building on Muto (1976), collections of this period that were excavated from the Project Areas before the creation of the reservoirs should be examined wherever possible to clarify this distinction.

35. *Is there evidence for a hiatus in occupation or the construction of pithouses? What other chronological data is applicable to the timing of this occurrence?*

Chatters (1995) and Ames (2000) have postulated a circa 500-year hiatus in the construction of pithouses, which is reflected in gaps in the radiocarbon record of a similar magnitude reported from research in the Upper Columbia (Goodale et al. 2004) and Chief Joseph Dam (Campbell 1985) areas. Such gaps may indicate only that not all sites have been recorded and/or dated, but as a recurrent pattern it bears investigation. If there are culturally sterile deposits dating to the 500-year hiatus period present in sites then a cultural explanation is likely. If not, then a geoarchaeological explanation (e.g., erosion of site sediments) is likely.

An example of research on the existence of an occupational hiatus within the FCRPS Program area is a special study to support a Native American Graves Protection and Repatriation Act (NAGPRA) repatriation of materials from the Marmes Site 45FR50 (Salo 2010). This study examined whether archaeological data sets within the Palus Tribe’s traditional territory indicated a change in population size, using recorded radiocarbon dating results as a proxy for human occupation. Inventory information for the study area was obtained from WISAARD, the Washington State Department of Archaeology and Historic Preservation’s (DAHP’s) archaeological site database, along with all reported radiocarbon dates for those sites. The resulting archaeological sample represented 3,506 sites, with 140 dates on assemblages at 39 sites. To disclose possible hiatuses in occupation, numbers of dates were summed by 1,000-, 500-, and 250-year intervals, and the results were expressed as histograms (bar graphs) (the 250-

year clustering results are displayed in Figure 7-1).[10] The number of dated assemblages within the sample declined for the period between 4,500 and 5,000 years ago.

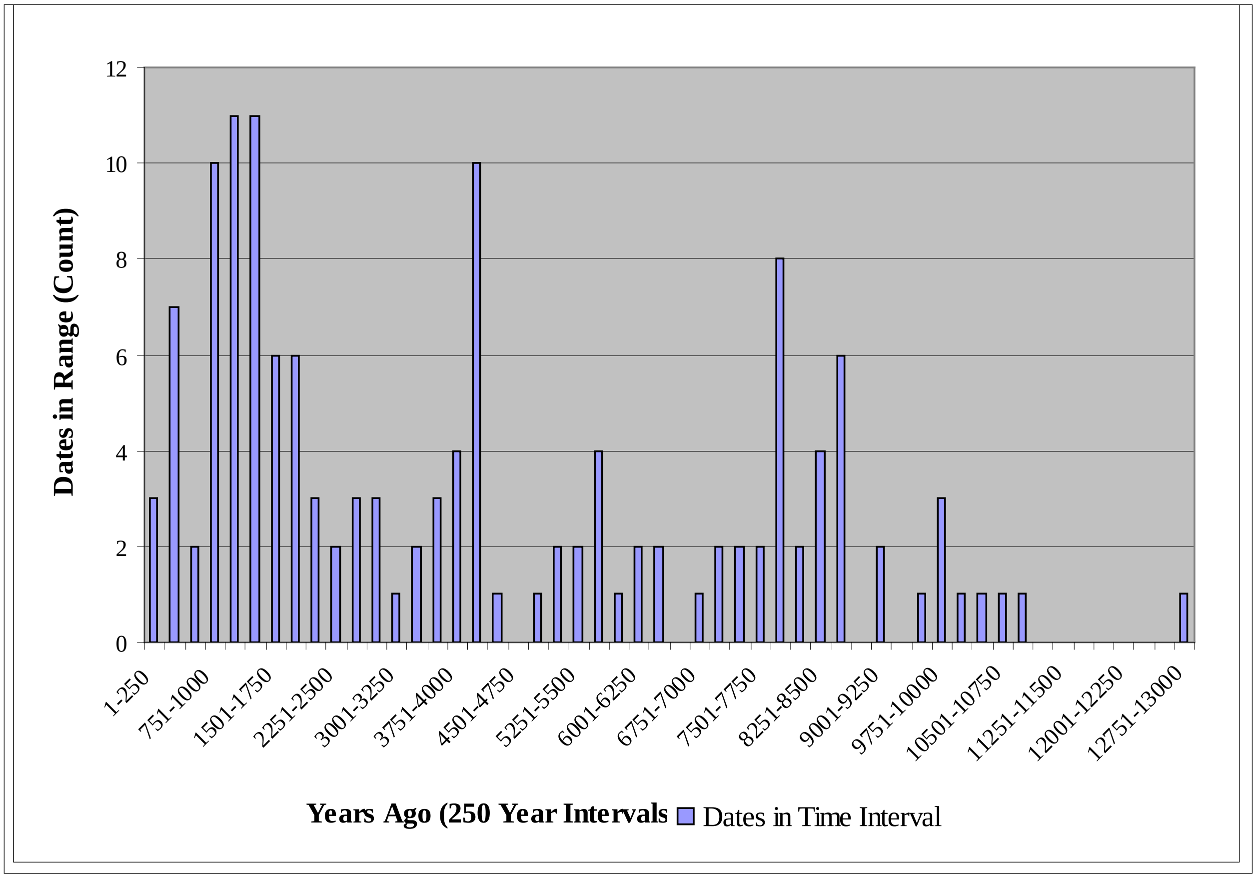


Figure 7-1. Radiocarbon dates associated with archaeological assemblages in Palus territory, from DAHP ^{14}C Database.

The study also attempted to look at the influence of sampling on the appearance of this hiatus. The Palus study area data sets were compared with a data set from a Columbia River area where formal sampling plans were used (Figure 7-2). The results showed a decline in assemblage dates in the 5250–6250 B.P. time period, nearly a millennium before that shown for the Palus study area.

Several hypotheses can be suggested, but sampling issues could be many. Adjustments in subsistence around that time could have led people to abandon previous, well-marked occupation sites in favor of more dispersed broader-spectrum foraging locations, resulting in more geographically dispersed and lower material density archaeological assemblages. Cycles of aggregation and dispersion might be inherently difficult to identify because of the lower identifiability of dispersed settlement. Such assemblages are less archaeologically obtrusive and

[10] The investigation employed a rough form of kernel density estimation (the Parzen window method).

may suffer from discovery bias, and may be harder to date, as occupation in any one place did not occur with sufficient intensity to result in deposition of charred materials that would leave datable samples. The sites also would not be attractive to researchers interested in large and complex sites with high material densities that would readily yield the kinds of data needed to investigate culture-historical topics, which was the focus of most of the research when the large projects were done in the CRB. Some adaptive changes manifesting archaeologically

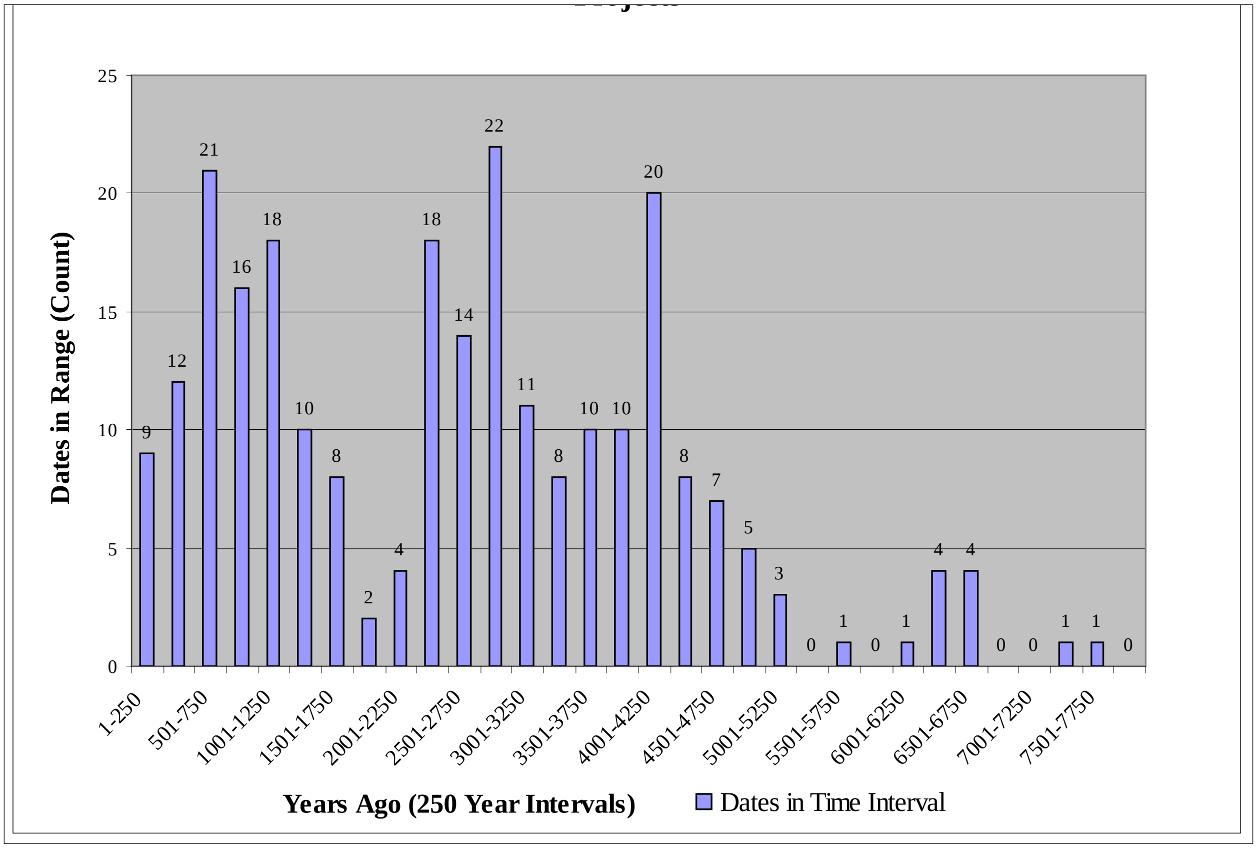


Figure 7-2. Archaeological radiocarbon ages from Upper Columbia River project areas with formal sampling plans.

may have been related to regional volcanism (see Section 6.1.1.4), but were more likely responses to larger environmental changes, including climatic changes related to stabilization of postglacial sea levels about 6,000 years ago. Geomorphic responses to environmental conditions (e.g., climate, base level change in river systems, neotectonic actions) could have triggered erosion of middle Holocene-aged sites, limiting their visibility in the archaeological record.

In the Palus study, the conclusion is weakened by the small data set where only one or two dates is available for a number of time intervals. The Upper Columbia River data set is more substantial and offers a stronger conclusion. One should not emphasize apparent hiatuses without considering all of the potential effects on the data used in analyses of this kind. Links between radiocarbon dates and actual past populations are tenuous at best, as the investigation methodologies and differential preservation environments can skew results. Identified hiatuses should be checked against all forms of temporal assessment, as well as against variation in radiocarbon curve, before a connection to paleodemographic significance is assumed. If they hold up, then the spatial coverage of the sample should be investigated as well. A CRB-wide examination using best-quality data with adequate control of key biases could illuminate foci for further research on regional chronologies and cultural development. It would highlight temporal representation and help identify priorities for improving the regional archaeological data base.

36. *Can nonstandard dating methods be used? Can the data be used to test and refine the reservoir correction for riverine shellfish radiocarbon dates? What methods or data can improve the resolution of the existing chronology?*

The Best Practices Appendices Table 8-1 lists a range of potentially applicable dating techniques. In conditions where traditional radiocarbon dating and artifact seriation cannot be used or need additional lines of evidence some of these less commonly used techniques might apply. For example, lichenometry or amino acid racemization of faunal bone might be possible, depending on the site's nature and environmental context.

Several researchers have been working to refine correction curves for riverine shellfish. Sites where radiocarbon dates from paired charcoal and shellfish with secured stratigraphic contexts can be tested and compared will be of great value in this effort (Culleton 2006; Deo et al. 2004; Osterkamp et al. 2014).

37. *What methods or data can improve the resolution of the existing chronology?*

The current state of research allows for only the most broad-brush periodization. Tracking cultural changes on the order of thousands of years is insufficient to address questions of social process. For example, the transition from foraging to collecting lifeways was not linear (e.g., Ames [1991a] provides evidence that Windust peoples practiced collector strategies) or inevitable, but did represent movement to greater logistical organization and population nucleation through time, which included periods of decentralization and returns to previous forms. This process cannot be traced without greater resolution of the chronological sequence. Ultimately, chronological resolution in increments of 100 years (or less) will be needed to improve the understanding of social process.

Prior to excavation, the nature of the archaeological deposit should be assessed for its potential to help discriminate between periods. Sites with stratigraphy and index or otherwise datable artifacts have the potential to contribute information that might tighten up our understandings of the chronological sequence. Research in legacy collections should be considered before new excavation occurs. Many older site reports distinguish components but don't report all the material associated with each component. Contemporary analysis of these previous collections may allow assigning of all excavated proveniences and associated materials to components. Appropriate excavation methods should then be selected to maximize the potential of this research, including excavation in stratigraphic levels or smaller arbitrary levels to recover and record as many *in situ* items as possible in order to clarify contextual associations between objects and datable materials. Archaeologists should prioritize the construction of a Harris Matrix (Harris 1979), where possible, for each site that can be referred to throughout the excavations.

Clarification of in-period changes in settlement patterns or index artifacts will be critical to more broadly refining the overall sequence. In addition to sites that were used in multiple time periods, special attention should be given to sites reoccupied during a single period (e.g., Cascade II). Careful excavation and analysis of such sites can identify changes within the period that might have temporal or evolutionary significance.

7.2.1 Geoarchaeology

38. *What contextual, geoarchaeological data are available to date sites indirectly? Can temporal associations with landforms, buried soil surfaces, or specific natural deposits be established? If so, can we use that information to predict site locations and/or site types on a more regional basis?*

Relative dating is a powerful tool in archaeological analysis when comparable data sets can be acquired. Geomorphic processes can provide stratigraphic signatures for date-bracketing sites; for example, tephra deposits are relatively well dated and can provide bounding dates for archaeological deposits found in association with them, if the tephra can be identified and represents a primary deposit. Discerning between primary and secondary tephra deposits can be aided through analysis of grain size, sorting mineralogy, and stratigraphic bedding/context (Leahy 1997).

Soil surfaces can also be used to bracket archaeological deposit age within constricted, well-studied areas; aeolian and alluvial deposits overlying soil surfaces in the Plateau have been hypothesized on both a regional (Lenz et al. 2007; McDonald and Busacca 1989) and local (Gaylord et al. 2001) scale. Good stratigraphic control and knowledge of pedo- versus lithostratigraphic sequencing will aid in relative dating when absolute dating techniques are not available

Both regional and local landforms were formed or altered by datable events. For example, at the Albeni Falls Dam and Pend Oreille Lake, the erosional terraces created when the Pend Oreille River downcut through glacial-age lacustrine materials represent a Project Area-scale chronostratigraphic marker or bounding surface. Occupations associated with this buried surface may be considered contemporaneous if buried by similar deposits (USACE 2008b).

Archaeologists would expect sites of a similar age and function to be found on this buried surface, so deviations would be of particular interest.

The Bonneville landslide provides another geoarchaeological example. While the landslide itself would have been a destructive force, carrying away or burying any evidence of human activity in its path, the blockage of the Columbia River created what scientists call the “Lake of the Gods” (O’Connor and Burns 2009). People may have occupied the land surrounding the ephemeral lake and evidence of this occupation may still exist. Identification of the former shoreline using traditional techniques or analysis of high-resolution LiDAR elevation data and systematic survey could identify archaeological sites associated with this short-lived but widespread geomorphic feature.

As discussed in the first paragraph of this research question, researchers have identified evidence of periods of regional landscape stability and soil formation followed by episodes of sediment deposition from aeolian and alluvial sources throughout the Plateau. If evidence of human activities is found in association with these buried land surfaces, systematic subsurface probing or remote sensing could trace them across space, providing a target surface for archaeological study. Correlating similar site types on the same landform types of consistent age between Project Areas may reveal a resource focus that can generate important settlement and subsistence hypotheses. Understanding firmly dated stone-tool typologies for various subregions in the study area may provide relative dates for site/features where stone tools are recovered and may also elucidate site activities such as hunting/butchering and plant collecting/processing depending on the types of tools present and the kinds of wear and/or residue present on them. Knowledge of nearby sites may also provide insights into the relative dating of sites/features encountered but should not be relied upon exclusive of more systematic means of identification (e.g., absolute dating techniques).

39. *Based on the geomorphic history of each Project Area, where might we be missing data and from what time period? Are we seeing gaps in the cultural histories of certain Project Areas that could be, to any degree, attributable to preservation processes? Has the construction of the reservoirs and their use, including drawdown, affected the stratigraphic record within the Project Areas?*

Erosional geomorphic processes have occurred in each of the Project Areas, including erosion related to alluvial, aeolian, and colluvial processes. In some cases, geologists have identified and mapped these processes, such as massive flood events or glacial advances. Within the FCRPS Project Areas, landsliding poses a danger to site preservation. Landslides have been documented along the margins of each of the reservoirs, compromising the integrity of archaeological materials on or beneath the slides. In other cases, erosional processes are more localized and may be noted only during site-scale analysis. Knowledge regarding the general geomorphic history of an area can provide hints as to whether large-scale erosion may have occurred. Careful inspection of a site's stratigraphic profile and bounding surfaces between strata is vital to identifying missing sediments and data.

In addition, siltation occurs within many of the FCRPS reservoirs where sediments moving with the river's flow drop out of the water column when the current slows through the reservoirs. This occurs differentially, not only from season to season (and particularly if exposed during annual drawdowns) but also over time as erosion alters the inundated topography. In the latter instance, some inundated terraces receive more silt cover over time and others may only lose sediment. In-reservoir current changes through time as landforms are affected, changing the silt deposition regime as well. Over time, this can mask deposits as silt accumulates on stable landforms, potentially hiding old sites. This, and the fact that many of the oldest sites may be on permanently inundated landforms, as well as the odds that early Holocene weather events may have destroyed the oldest riverine landforms in the Project Areas, reveals how difficult it may be to identify the older sites that have survived. Predam photographs and topographic maps may provide clues on where intact landforms are located that may be exposed during reservoir drawdowns. Those photographs and maps may also help to understand historic riverine versus modern in-reservoir currents to determine depositional versus erosional areas and proactively target potentially productive and threatened landforms for research. Predam photography can also help understand what landforms were created (i.e., filled) during construction of the dam facilities, railroad grades and highways, etc.

7.3 Economies and Resources

The Economies and Resources domain was introduced in Section 5.3, and associated research themes presented in Section 6.3.

7.3.1 Subsistence Resources

40. What is the variation in subsistence resource use between Project Areas?

All known data on subsistence resources should be correlated for each Project Area to determine the relative contribution of different resources to local diets through time. Patterns can then be compared to assess geographic variation, including among the different Project Area groups described in Research Question 26 in Environmental Variability (above) that may reflect topographic barriers or ecological niches. Where change is observed, comparable data sets are needed to identify the human effects. As is the case for other research questions proposed in this chapter, consistently reported and well-analyzed data are key to addressing broad questions of subsistence resource use. These data needs and cautions hold true for all archaeological data but especially faunal and botanical data used to address subsistence and diet.

In the last 30 years, isotopic assay of commensal animals, more specifically dogs, has provided insight into human diet (e.g., Noe-Nygaard 1988; Rick et al. 2011). This technique is predicated on the idea that dogs likely ate/were fed the scraps of foods that humans ate and therefore reflect the same general dietary mix (e.g., Cannon et al. 1999). In general, dogs appear to be good proxies for human diet (see Corr et al. 2009) and the application of this technique has grown since its initial applications.

Addressing human diet is difficult for a number of reasons. First, archaeologically available data (e.g., animal remains) have undergone significant postdepositional modification such as bioturbation and diagenesis. As such, animal remains may not provide a clear picture of animal use in the past. Second, archaeologists have well documented the fact that plants were a large part of precontact diets on the Plateau (Chatters 1998; Turner 2014a) as well as the fact that there are issues related to recovery and quantification of plant data (and for comparison with faunal data) (e.g., Thoms 1989; VanDerwarker 2010). Few macrobotanical remains have been recovered from excavations within the FCRPS research area due to the poor preservation of plant remains in open air settings. Finally, using geochemical methods on human remains is not a suitable solution to addressing questions of diet because many Native American groups hold human remains as sacred and do not wish to see the remains disturbed any more than they already have been through excavation.

41. *Do the food resources found at sites in the Project Areas represent local availability or were the resources transported long distances?*

Archaeologists assume that one aim of any investigation will be to determine the source of food resources found at a site. For our purposes, we define “local availability” to mean “within a site’s catchment area”; “long-distance transportation” would be from outside of the site’s catchment area. Determining if archaeological materials represent locally available resources or those that were transported long distances can be difficult, especially since the same food type may be present both within and outside a site’s catchment area. While a simpler distinction would be to focus on “exotic” resources (those that are not common within a much larger spatial range than a catchment area), such a distinction overlaps with settlement and exchange questions and may not be directly relatable to subsistence.

Faunal remains that are thought to be debris from subsistence activities should be identified and then the biogeography of those animals these specimens represent should be determined. If the taxon is not known to occur in the vicinity of the site, the date of the find should be compared with the environmental history of the region to verify that the animal or plant did not occupy the area at a time when the environment was different from the modern one. Researchers should consider conducting a basic plant identification survey of the areas surrounding the site across spring, summer, and fall to ensure that economic species are identified. In locations where this is not possible, published documentation of vegetation for a given Project Area should be consulted when interpreting archaeobotanical results. If the food species is not from the site's locale, hypotheses that people brought the material to the site directly or acquired it through exchange are appropriate.

Food plants may remain in sites as macrobotanical remnants (e.g., seeds, plant fragments, carbonized items) or be identifiable through pollen or phytolith analysis. Understanding precontact plant resource use is based primarily on ethnographic information and analogy (see Turner 2014a) and a few archaeological studies relating to plant procurement and plant production (see Lepofsky and Peacock 2004; Nicolaides 2010; Thoms 1989) and various nuts, seeds, berries, and other macrobotanical remains recovered from archaeological contexts (Hayden and Cousins 2004; Hicks 1995, 2004; Hicks and Morgenstein 1994; Stenholm 1985). By combining the results of macrobotanical and pollen analyses with changes in occurrence of economically important plant resources, it may be possible to understand changes in plant subsistence within a specific Project Area and across the entire FCRPS research area. When organic-bearing deposits are identified at an archaeological site, samples should be collected at known intervals and floated (or analyzed by another method) to identify species.

Chronological control will be needed in order to understand change through time. Plant species richness and frequency should be calculated for each stratigraphic sample. Researchers should consider taphonomic issues that may affect plant preservation and note that absence of a specific plant species does not necessarily mean that people did not use the plant.

The easiest technique used to address the source of fish in a site was employed by Stevenson (2011) and Butler et al. (2010) in their studies of the Upper Klamath Basin salmonid fishery. In short, the presence of skeletal elements associated with low-value portions of the body (e.g., cranial elements in fish), likely suggests local capture for two reasons. First, fish heads contribute to spoilage during drying, so they are removed early in processing. Thus, the presence of head parts signals local processing and/or immediate consumption (see also Smith 2000). Second, low-value body parts are often removed in order to make carcasses easier to carry (see Binford 1978b). Reasoning along these lines does not completely rule out the possibility that archaeological remains were introduced through trade, but it does provide a simpler means by which to explain whether animals were locally captured or not.

More complex techniques for addressing local capture include geochemical analysis and may in the future also include genetic analysis. Geochemical techniques include stable carbon and nitrogen isotope analysis (e.g., Aurioles et al. 2006; Jardine et al. 2003), Sr/Ca ratios (Butler et al. 2010), oxygen and strontium isotope ratios (e.g., Dufour et al. 2006; Ingram and Weber 1999; Prohaska et al. 2002), and carbon ratios (Hughes 2004). Although these techniques have been applied in archaeological research, following better protocols and building confidence with comparable samples will allow a better understanding of the variation in diagenetic processes among archaeological sites or regions (Budd et al. 2000). Bone is less desirable for genetic sampling and if teeth or other very dense calcium-based structures (e.g., otoliths) are present, they should be favored.

In the Plateau, shellfish (e.g., *Gonidea* sp. and *Margaritifera* spp.) are commonly found in streamside archaeological sites in varying numbers and ratios (Lyman 1980). While they have been found within rockshelters, it is often not clear if they were included in storage features as delayed return resources or were consumed fresh on site. As noted by Lyman, *Margaritifera falcata* prefers coarser-grained stream-bottom sediments (associated with faster-moving streams) while *Gonidea angulata* prefers siltier sediments (associated with slower-moving water). If native people used these taxa intensively, then their representation in such sites has more likely been affected by varied climate and hydrology than by occupants' consumption (or lack thereof) of them. In addition, variation in flow over time changes the stream bottom sediments at any given location, which could change the kind of shellfish being eaten there, not due to the occupants' food choices. Oxygen isotope data from freshwater shellfish can be a useful tool for reconstructing precipitation regimes (e.g., Davis and Muehlenbachs 2001).

Because the bulk of shellfish weight is in the shells, archaeologists expect that shellfish were largely shucked and eaten near their harvest location. This hypothesis is supported in Palouse Canyon, where many shells were found in Marmes Rockshelter, located adjacent to and elevationally just above the Palouse River, while few shellfish were found in Porcupine Cave and other rockshelters tested that occur 40 or more meters above the river (Draper and Morgenstein 1994; Hicks 1995, 1996, 2004; Hicks and Morgenstein 1994). Once harvested, the meat would have to be dried to avoid spoilage, and the amount of food that resulted may not have been worth the extra effort of transporting shells away from the collection location. Future studies should investigate this hypothesis by comparing shell weights in different landform types and distance from streams in multiple Project Areas.

42. *Did environmental shifts lead to a broadening or retraction of diet breadth?*

Archaeological evidence from the Pend Oreille River Basin and the northern Plateau demonstrates a shift to root-crop intensification during the late Holocene with an "intensive exploitation" pattern between 3500 and 2500 B.P. (Andrefsky 2000; Hayden and Cousins 2004:32; Thoms 1989). In the southern CRB, the establishment of modern salmon runs around 4000 B.P. also led to increased fish exploitation (Butler and Campbell 2004).

Changes in plant and animal diversity can be determined from the analysis of macrobotanical remains and archaeofauna recovered from archaeological contexts and the presence/absence of specific technologies (e.g., ground-stone metates) used in plant and animal processing. This question requires good chronological control for faunal and floral remains from sites, which can in turn be tied to local and regional paleoenvironmental data sets. Such chronological control will likely require advanced statistical techniques (e.g., Bayesian modeling) to reduce age estimate error and mixing resulting from both cultural and natural processes (e.g., Buck and Sahu 2000; Ramsey 2008).

Chronologically dated strata containing macrobotanicals and/or plant-processing artifacts/features should be compared with both local and regional paleoclimate reconstructions. In cases where shifts in climate correlate with adoption of new plant species into the diet or new technologies (or fuel types [e.g., Stenholm 1985]), researchers may attribute such behaviors as an ecological adaption and expect to find correlates to mammal and bird resources. In cases where the paleoclimate is not known to have shifted greatly, explanations outside of ecological adaption should be considered.

43. *What evidence is there for surplus production of specific resources and movement toward logistical organization in each of the Project Areas?*

Surplus is defined as the production of a resource beyond that needed for subsistence. Humans affect the array of available resources through their use. Lyons (Section 7.1.4) describes the potential responses of a cultural group to overhunting, which may or may not be a factor of intensification. Similar responses would be needed whenever an important resource was overutilized. Those effects could have been either detrimental (e.g., over hunting) or beneficial (e.g., weeding out competitors within root grounds) and may not always be directly observable in the archaeological record. Additionally, conservation for conservation’s sake was likely rare in small-scale hunter-gatherer societies simply because it was a less than optimal strategy in the near term (Smith and Wishnie 2000). Recently though, Campbell and Butler (2010) have argued that facilities such as fish weirs not only allowed for increased foraging efficiency but may have played a role in conservatio. In addition, Salmon Chiefs in some CRB Tribes played a part in making sure fisheries were not over-fished. There were similar efforts toward terrestrial animals with hunting prohibitions at certain times of the year. Despite the lack of direct archaeological visibility of people’s ecological effects, the application of controls during analysis may allow for us to infer patterns through faunalogical, taphnomic, and macrobotanical data sets when we associate them with individual sites or similar site types within a single catchment area.

Hunting was particularly important for communities situated on rivers that did not sustain anadromous fish (e.g., Pend Oreille River above Z Canyon) where ungulates represented a higher contribution to the annualized diet. Ethnohistoric research within the Pend Oreille watershed indicates that both selective early season harvest methods (i.e., predation on doe-fawn pairs) and reduction of forage competition through proscribed burning was used to improve forage quality; this also reduced the search and recovery times for hunters by removing shrubs from the forest floor (Lyons 1999–2011). These methods increased overwinter weights of local whitetail deer herds in the season when communal hunting was the principal subsistence activity.

The annual winter deer hunt not only brought fresh game into the diet but also the broke up the tedium of long weeks of winter inertia and aided in defusing the social friction that could arise that time of the year. The centrality of whitetail deer predation to the provisioning needs of the lower bands of the Kalispel was such that winter villages were placed in proximity to winter deer yards (see Figure 5-1 for a map of three contemporaneously occupied villages of the eighteenth and early nineteenth centuries). The seasonal gregarious nature of whitetail deer makes them particularly susceptible to mass culling methods in deep snow terrain, as in the Pend Oreille Valley. Hunters' use of snowshoes also gave people an advantage in deep snow. The productivity of communal hunting in a time of dietary stress was apparently very high; several Spokan accounts say 199 (Ross 2011:298) and 400 (Ross 2011:302) deer were taken in a single day's effort using different forms of communal game drives. The Coeur d'Alene Tribe drove herds of deer into the lake where they were dispatched from canoes and on shore. Variation in the focus of the subsistence prey spectrum between Columbia River tributary subbasins is to be expected, for while individual catchment areas may be based on the same principal resources, environmental variation assures that other parts of the diet will vary.

The impact of past human activities on animal populations has been documented in many instances throughout the world (Grayson 2001; Jeradino et al. 2007; Nagaoka 2002) and most important for this study, in many places across North America (Byers and Broughton 2004; Erlandson and Rick 2008; Martin and Szuter 1999; Newsome et al. 2007; Peacock et al. 2005). Lyman (2009) has cautioned that while anthropogenic factors may appear to drive decreased abundance, often climate or other proximate causes may provide more parsimonious explanations for lower numbers.

Population size within the catchment area is one datum that may be difficult to establish. Efforts should be made to do so, however, since one hypothesis about population increase in the Plateau associates it with intensified resource use. Campbell (1989) reviewed various methods of estimating population size and developed an approach for estimating population in the Chief Joe reservoir area. Such approaches need multiple sites and excellent chronological control to measure rates of accumulation of different kinds of materials. Studying food refuse over time—for example, to determine whether there were changes in butchery patterns of focal species or expansions or contractions in the prey spectrum—can illuminate some changes in human population densities.

The contribution of roots to the diet array can also be revealing, and evidence of intensification can be more broadly available than for faunal resources. Previous archaeological research suggests that camas was economically intensified across areas of the northern Columbia Basin in order to create surplus for storage, if not exchange (Andrefsky 2000; Thoms 1989). Data needed to identify plant intensification includes the frequency of plant-processing artifacts/features identified in the archaeological record through time. The presence and size of roasting pits and storage features may also be used as a proxy for plant production and surplus storage. Comparison of plant-processing sites' artifact assemblages with other known archaeological assemblages from the Project Areas and across the FCRPS research area also allows for an understanding of change through time. In most cases, economic intensification correlates with storage of a resource. The processing and storage of salmon for trade or potlatching on the Northwest Coast is an example of economic intensification (Ames 1988). The timing and impetus for such intensification is not fully understood across all areas of the Columbia Plateau (Andrefsky 2004:32), and the geographical breadth of the FCRPS research area has the ability to substantially contribute to answers to this question.

Plant remains that may aid in answering questions about intensification include pollen/phytolith/starch recovered from sediments in house depressions or storage pits. Archaeological data that may suggest economic intensification of plant resources includes an increased frequency of plant-processing artifacts/features in the archaeological record, increased occurrence of concealed storage pits (suggesting control over surplus), or excessive use wear of ground stone or lithic materials used for plant processing. Excessive use wear can also be a result of other behaviors, such as tool curation or limited raw material for ground-stone tools or increased population (i.e., processing more plant material for more people in the same amount of time [Adams 2014:123]), and should only be considered in conjunction with other lines of evidence for plant intensification.

Thoms (1989) calculated that the average size of a camas patch needed to feed a five-person family was 6.67 acres, using an assumption of both an average density of bulbs per area and bulb size. Large and abundantly moist wetland habitats (e.g., Calispell Valley) should have allowed for higher harvest rates so may not serve as the best proxy for the relative contribution of roots to the diet. Oral history can contribute to research about the effects on camas patches in the FCRPS Project Areas from agricultural conversion of valley bottoms and the historic practice of open grazing. Adjustments to Thoms' estimates and assumptions should be made if applied to other roots crops that did not occur (a) in similar abundance, (b) over such a long harvest season, or (c) in more dispersed locations (e.g., *Lomatium*). Attention to the larger camas patches does increase the likelihood that archaeological evidence of harvesting and processing activities is present and measurable.

Management of camas patches also extended the use of certain areas increasing the richness of the archaeological data available for analysis of this kind. Many CRB Tribes have reported the places they returned to regularly for root gathering, and both Native and immigrant stories from the ethnographic period describe Indians burning vegetation. The landscape management practice most strongly documented in the ethnohistorical literature is that of deliberate anthropogenic burning (Deur and Turner 2005). The more these reports coalesce around specific locations, the more likely it is that archaeological evidence will be available to describe specific food resources and their locations over time. For example, archaeologists have argued that precontact people deliberately created meadow complexes throughout western North America for a variety of reasons, including creation of browse for hunting ungulates or maintenance of productive roots and/or acorns (Stewart 2002; Walsh et al. 2010).

Direct archaeological evidence for precontact resource management is limited to date. Excavations conducted on the St. Joe River levee at Coeur d'Alene Lake found multiple examples of well-defined stratigraphy showing layers of flood sediments regularly separated by thin charcoal layers (Hicks et al. 2006:4-77–4-86; Figure 7-3). Radiocarbon dating through AMS of the charcoal layers in the St. Joe levee sites found four layers, each separated by flood sediments, dating to within 10 years of each other. Even accounting for their close overlap within the standard deviations, and problems of atmospheric carbon adjustments of the latest dates, the regular interval of the burn layers and the close proximity of the dates suggest that humans conducted field burning at least several times per generation, probably to clear out competing plants and encroaching tree line. The oldest date obtained on a grass burn horizon in this area was 2460 ± 90 B.P. and the most recent was 200 ± 40 B.P., indicating that the Coeur d'Alene people engaged in this practice for over two millenia until late protohistory (Hicks et al. 2006:5-9–5-14).

Figure 7-3 also shows an oven feature below the grass burn horizons. Ovens in various levels of intactness and exhibiting evidence of reuse, together with large, often dense, scatters of FMR and charcoal interpreted as cleaned-out sediments from reused ovens, were found in the St. Joe River levee sites and from all of the flat river terraces in the Coeur d'Alene Lake area. This pattern has been well established in the Calispell Valley (Andrefsky 2000; Herbel et al. 2010, 2012; Lyons 2006; Thoms 1989) and probably was present in most CRB watersheds that share similar environmental profiles.

Including additional data from archaeological sites within the FCRPS area that contain macrobotanical remains and/or plant-processing artifacts/features may enable recognition of a pattern different than the one Thoms (1989) recognized. For example, early Holocene-aged sites may be identified that contain direct evidence of plant processing, use, and intensification within the FCRPS research area. Sites that offer the data for testing alternative explanations will require researchers to consider alternative explanations of subsistence change, human mobility, and social change on the Plateau. Similarly, plant-resource intensification (specifically camas) dropped off in the Pend Oreille area between 2000 and 1200 B.P., according to Thoms (1989).

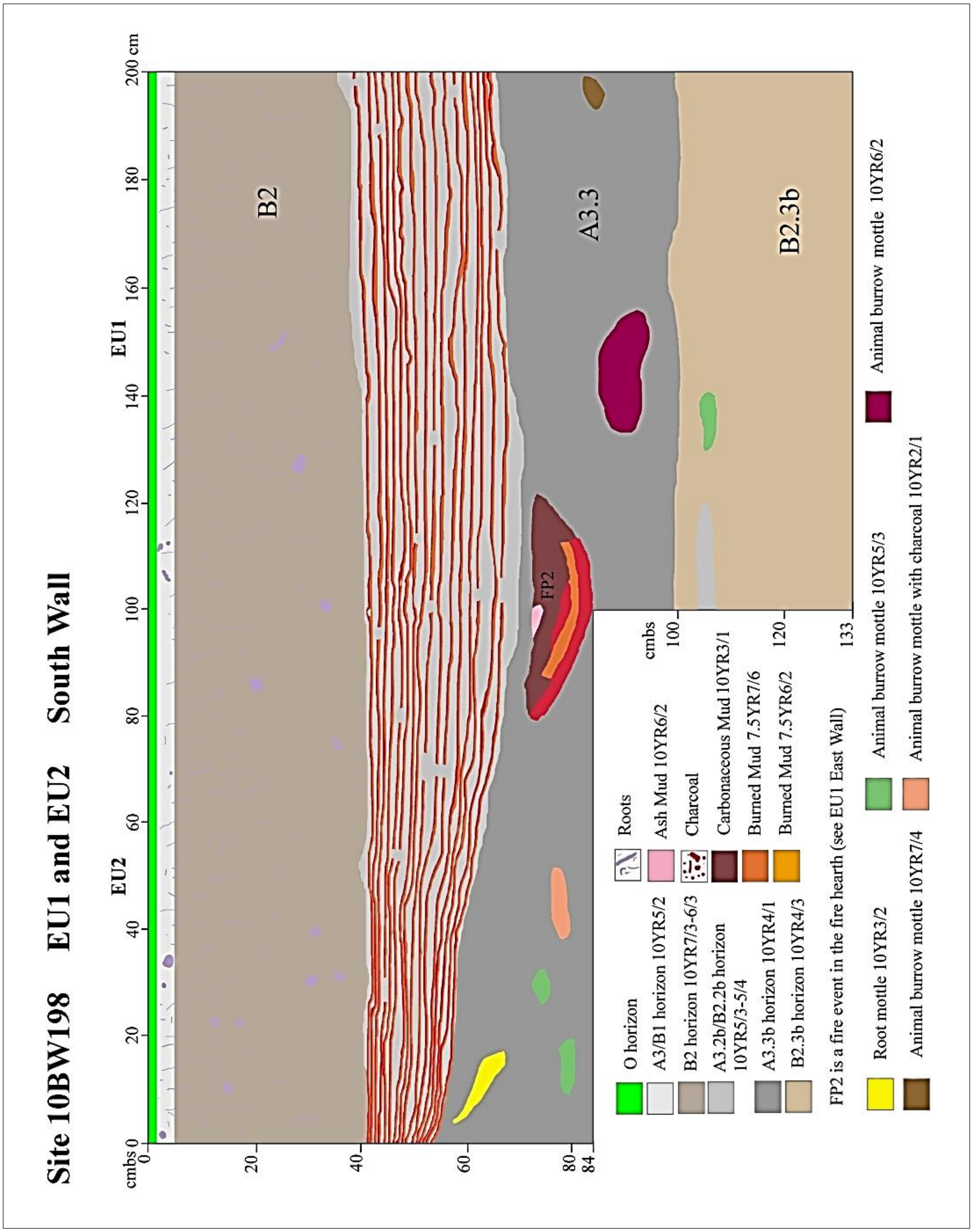


Figure 7-3. Stratigraphic profile showing grass burn horizons (Hicks et al. 2006:4-85).

Do the results of other camas production sites suggest the same pattern, or were there differing levels of plant intensification across the Columbia Basin? Additional radiometric-dated evidence may support or refute this pattern. Sediment cores recovered from meadow locations allow fire histories to be reconstructed from sedimentary charcoal. Fire frequency is then compared with known cultural chronologies within a specific area to correlate archaeological deposits with plant processing artifacts, storage, plant-processing features with meadows and their associated key resources. Sites that retain plant collection and processing evidence and that can be correlated with land management practices are very rare in the archaeological record and would likely be eligible under multiple criteria.

7.3.2 Settlement and Habitation Systems

7.3.2.1 Site Types and Representation

44. *What material culture and functional assemblages (site types) are present in the FCRPS Project Areas? What do ethnographic traditions tell us about perishable materials that may have been used and how does this expand our understanding of the range of activities that may have occurred at each site type within the FCRPS Project Areas?*

Chapter 6 discusses site-type definitions and their expected material and feature correlates. Differentiating between site types based on features and assemblages present/absent is necessary to properly identify how sites within a given area may be related and to be able to test whether such associations are found in other Project Areas.

Properly correlating material assemblages to site types should include lithic tool (including use wear) and debitage analysis (to help identify tools manufactured but not present); protein- and residue-analysis on samples of lithic tools, utilized flakes, and FMR; analysis of the extent of FMR exhaustion (Herbel et al. 2012; Schalk 2000); and analysis of plant and animal remains (including for seasonality information). In stratified sites, assessment of stratigraphic profiles may indicate relative temporal depth, patterns of site structure, and site-activity data (e.g., features, faunal remains, and artifacts) that may allow for the identification of compatible functions between and among sites/features.

Site function and seasonality of use/occupancy can be inferred through examination of component assemblages and food refuse. After Residence Bases, Short-term Occupation Sites will have the largest variability in artifact types and functional categories. Locations will have a narrow focus in their technological signatures. These two kinds of sites are expected to have been used throughout human history in the Plateau. Residence Bases represent longer periods of occupation, with more regularly used residential structures that leave a clear archaeological signature (see Rice 1985 for example dwellings). Little archaeological evidence exists of the residential structures people used prior to housepits. To the extent that they employed pole-sized wood as weight-bearing elements, they would have left less of a signature than housepits, and archaeologists might misinterpret these as later, nonresidential structures like drying racks, aboveground caches, and so on.

Older sites are expected to be rarer finds, not only because population density was lower but also because there has been more time for post-depositional processes to bury, alter, or remove them. Many sites—not just older ones—may be marked only by lithic artifacts. Chapter 5 noted that tools based on blade-core reduction are less common in the CRB and have been associated with Clovis sites in other regions. Early point forms in the CRB exhibit some of the same manufacturing features as those produced from blade-core products. The association between the manufacturing processes of the earliest lithic tools in the Plateau and later examples suggests continuity that should be investigated further using the full assemblages associated with these points.

Similarly, additional research is needed to understand the limited presence of the Plateau Microblade Tradition (Sanger 1968), including the small number of sites that exhibit it, its geographic limits, and its short duration. As a very efficient method of using rare high-quality toolstone, one would expect this technology to have persisted, if not flourished, in a collector settlement-subsistence pattern, but current (limited) data indicates the opposite is true. Technological capability with wood and bone may have surpassed the functions microblades filled; we should be willing to hypothesize alternative functions of items found in later collections as potentially indicative of earlier use that did not persist in the archaeological record. Alternatively, is the presence of blades really suggestive of high mobility generally, or is it just a specialized overall useful technology?

While nearly all site activities would have involved the use of items made of wood and fibers (e.g., basketry, digging sticks, traps, and snares), they rarely survive in CRB sites intact. New hypotheses about what their signatures should look like matched by accurate detection techniques are needed. The ethnographic record is replete with multiple and detailed examples of specific fishing technologies and methodologies that largely use items comprising composite materials of wood, fiber, bone, and occasionally stone. Collateral and indirect evidence of these technologies do persist but probably as patterns that need to be encountered often enough to be recognized by researchers. An example from outside the FCRPS study area, the Tacoma Creek trout fishery, consisted of multiple matched-pair FMR concentrations on both banks at the mouth of the creek where it meets the Pend Oreille River. The ethnographic record (Smith 2000) described the FMR clusters as being associated with smudge fires that would have been situated near a weir that could be moved into the creek bed to best meet fluctuating water levels from year to year (Lyons 2015). Nearby was found a cache of tabular slate knives, a common fish-butchery tool type. Even if faunal remains had been present, the contribution of ethnographic analogy was needed to identify this complex and its function. Had the same items been found in another watershed without such an illuminative ethnographic account, it may well have been interpreted differently. Lyons (2015) has pointed to analyzing blood proteins and DNA from the worked edges of butchery tools as a means by which to gather further evidence of the target resource and to corroborate natural and cultural histories. In addition to Smith (2000), a number of ethnographies and ethnohistorical accounts are available that relate to FCRPS Project Areas (e.g., French 1961; Haines 1955; Hunn 1991; Josephy 1965; Ray 1933, 1936, 1939; Ross 2011; Sapir 1909; Spier and Sapir 1930; Spinden 1908; Teit 1928, 1930; Uebelacker 1984). The 1998 Smithsonian *Handbook of North American Indians* for the Plateau (Walker 1998b) presents a comprehensive overview on the history, prehistory, and material cultures of the region as well.

45. *How does the patterning and diversity of site types change over time? Does this fit current regional settlement and subsistence system models?*

Once site types in a given area have been identified and compared with each other to establish patterns (e.g., catchment areas), archaeologists should examine how collections of sites relate to the model of Plateau lifeway. Section 6.3.2 summarized the settlement and subsistence system models for the CRB through time. To evaluate any pattern, significant data samples must be available. Information on known site types in the area (region, locality, Project Area, or catchment area, depending on the scale of analysis) is necessary to address patterns of diversity and change over time. Understanding the appropriate scale needed to observe a given pattern and a firm grasp on what should actually constitute a pattern are key in addressing this research question; each of these must be defined.

A macroscale is needed to examine mobility strategies over time. In this case, variability in the distribution between Site Type 1 and Site Type 2 sites may show a pattern of diverse land-use strategies on a given scale. For example, one might compare all known sites within a 5-mile buffer north and south of the Lower Snake River between Ice Harbor Dam and Lower Monumental Dam. Hypothetically, temporal and spatial distribution of site types within this larger area might show a pattern of continued use of the areas directly adjacent to the major river drainages with earlier occupations showing evidence of highly mobile residential movements of base camps along the upland slopes of the river basin (Site Types 2 and 3), changing over time to more frequent and extended use of pit houses on river terraces (Site Type 1). Another example of a macroscale analysis might consider the distribution of tool types from all Project Areas in a given geography (e.g., the lower river) in order to understand changes in hunting technologies as they relate to changes in assemblage diversity over the time period believed to include both forager and collector adaptations. Such analysis would require a sample of stone tools from a variety of site types across the region and from a number of time periods depending on the expressed temporal range of the study. In all of these examples, having a robust enough sample size from which to consider the space and time being observed is of the utmost importance if the conclusions are to be compared to another area or scale.

In terms of placing an identified site type on the forager-collector continuum to assert its place in either system, Short-term Occupation Sites are the most difficult, because a forager's Short-term Occupation Site may look much like that of a collector (Hicks and Morgenstein 1994). Locations also have applicability in both systems. The Residential Base sites should be the most distinct site type as long as an adequate sample of the site has been investigated. Ames has suggested six variables to be sampled in residential base camps that can clarify where a site falls on the forager-collector subsistence/residency continuum. Those variables are duration, seasonality of residence, permanence, size, organization, and investment of a residential encampment (Ames 1991a:110).

Lyons (2013) has elaborated on Ames (1991a), including elements of mobility, predation, and technology to hypothesize measurements for the opposite ends of the forager-collector continuum (Table 7-1); his scheme was intended to apply to more site types than just the Residential Base. It may be useful to combine all of Ames' and Lyons' variables, since most sites are likely to fall somewhere in the middle of these idealized schemes. Applied at a macroscale using the Project Area groups proposed above under Research Question 26 in Section 7.1.1, one may be able to identify spatial factors extrapolated as environmental variables that exerted influence on peoples choices to pursue either (or both) generalized foraging or collector strategies at the same time in prehistory.

Table 7-1. Adaptive Classification with Archaeological Measures Applied to the Pend Oreille Region.[11]

Stratagem Element	**Classificatory Dimension**	**Archaeological Measure**	**Expectations for Different Adaptive Strategies**			
			Forager (General)	**Collector (General)**	**Hypothetical Forager (Pend Oreille Area)**	**Actual Collector (Lower Kalispel)**
Mobility	Type (Residential—Logistic)	Tool Richness	Low	High	Low	High
		Tool Evenness	High	Low	High	High
		Feature Richness	Low	High	Low	High
		Feature Evenness	High	Low	High	High

[11] Notes: Classes and Measures from Chatters (1987); other aspects from Salo (1985). Expectations are generalized for the CRB; all measures should be applied to each site and statistically analyzed, where possible, to identify site types.

Table 7-1. Adaptive Classification with Archaeological Measures Applied to the Pend Oreille Region.[11]

Stratagem Element	**Classificatory Dimension**	**Archaeological Measure**	**Expectations for Different Adaptive Strategies**			
			Forager (General)	**Collector (General)**	**Hypothetical Forager (Pend Oreille Area)**	**Actual Collector (Lower Kalispel)**
		Anatomic Part Dispersion	Even	Clustered	Even	Clustered
		Bone Fragment Size	Large	Small	Small	Small
		Kinds of Sites	Few	Many	ca. 3	5-6
	Frequency	Midden Intensity (FMR Density)	Low	High	Low	Moderate
	Stability	Structure Permanence	Low	High	Low	Moderate
		Cemeteries	Scattered	Clustered	Dispersed	Clustered
	Demography	Site Size	Small	Large	Small	Large
		Dwellings per Site	Few	Few	Few	Many
		Dwelling Floor Area	Small	Large	Small	Large
	Scheduling	Site Seasonality	Even	Clustered	Even	Clustered
	Range	Lithic Suites	Many	Few	Many	Many
Predation	Prey Spectrum	Taxonomic Richness	High	Low	Low	Low
	Mode	Taxonomic Evenness	Low	High	Low	High
	Scheduling	Seasonality	Even	Clustered	Even	Clustered
	Tactics	Assemblage Age/Sex Structure	Broad	Narrow	Broad	Narrow
Technology	Time Budgeting	Tool Diversity	Low	High	High	High
		Percentage Curation	Low	High	Low	High
	Storage	Seasonal/Geographic Species Displacement	Rare	Common	Rare	Common

Seasonality figures into a number of these measures and can be interpreted from a number of sources. Faunal material can reveal juveniles for which the season of birth is known for many species. Timing of plant harvest and/or consumption can be determined from pollen (flowering), seeds, and fruit maturity (Turner 2014a). Some archaeological projects have used freshwater mussel growth-ring analysis to address season of site use, but the two most common shellfish in the Plateau (*Margaritifera* and *Gonidea*) both have brittle shells that are susceptible to degradation even while alive. In addition, Black et al. (2010) have documented localized variation in growth patterns. These factors limit the applicability of growth ring analysis as a way to address seasonality.

46. *Are there correlations between functional assemblages and landform types across the FCRPS study area? Is there evidence that landscape or geomorphic features drove site-location preference?*

Archaeologists generally relate the position of an archaeological site to its location on the landscape and associated resources. Residential sites were usually at lower elevation, sheltered locations adjacent to a productive resource, and formed the base of a catchment area that contained numerous resources within a reasonable travel distance (Leeds 1985). In late prehistory, residence bases could predictably be found along river terraces not susceptible to flooding and near good fishing locations and clean water sources. These factors can be duplicated along any of the major rivers in the FCRPS Program area that were not blocked to anadromous fish runs (Lyons [Section 5.3.2.1] noted that winter deer yards represented a similar resource on the Pend Oreille River above a hydrologic barrier to anadromous fish). If other site types that contribute to the definition of a given catchment area also are found on predictable landform types with environmental conditions favored by the target resources, then similar catchment areas can be defined throughout the Project Areas. Such catchment area definitions need to acknowledge that some resources that were part of the original system will not be observable now due to the changes in land use since Indian removal.

Correlating geoarchaeologically specific analyses of site locations generally includes incorporating geological, soils, and hydrological information. For example, in the HPMP for the Albeni Falls Dam and Pend Oreille Lake, the USACE writes: “There is ethnographic evidence (e.g., Smith 1985) that recent native inhabitants intentionally chose locations with specific soil characteristics for different types of sites (e.g., sites with hard ground and high water tables were avoided for winter lodges). In adjacent areas, early (ca. 5500 B.P.) pit houses were constructed in sandier well-drained sediments” (USACE 2008b:C9). Reimagining precontact vegetation on the topography of a Project Area is also necessary to better understand why certain landforms would have attracted certain uses that, in combination, can be defined as site types.

However, some aspects of the landscape do not need to be reimagined. A defining element of collectors was storage of surplus foods. Archaeologists have widely reported storage pits in the CRB as pits in house pits or in protected subsurface locations within or adjacent to villages, in talus slopes, and in caves and rockshelters. Topography was probably the main determinant of what kind of storage feature people used, but people likely used multiple types of storage features based on their knowledge of the adequacy of each type to protect and preserve different resources. As an example, research has found that the storage rockshelters in Palouse Canyon were intensively used for storage of various food resources in the late precontact era when Palus Village was occupied and appears to have been the Residence Base of a catchment area that included, at a minimum, the whole of Palouse Canyon (Draper and Morgenstein 1994; Hicks 1995, 1996, 2004; Hicks and Morgenstein 1994). There are numerous rockshelters within 3.7 miles of Palus Village that contain storage-pit features; collectively, there are more than 100 surface-visible pit features in various topographic positions. These rockshelters vary from large rockshelters with high drip-line berms (e.g., McGregor Cave) and usually but not always lowered floors to small rockshelters or caves with minimal berms and flat or slightly lowered floors. Small rockshelters with flat floors can have little roof-fall rock, and the storage pits are built up from the bedrock floors by stacking rocks. In addition, there are numerous minimal overhangs (more like angled walls) with single or pairs of pits dug in at the base that were used for storage, although not all in the same manner. The overhang features (like talus pits) are exposed to rain, so Hicks (1996) concluded that the length of planned storage time of food items must have been restricted. A tool kit associated with plant processing was found in one of these overhang features in sediments with high grass phytolith counts thought to have been stored in a fiber bag that contained the tool kit.

Archaeologists placed temperature and humidity sensors in the floors of tested rockshelters with storage pits in Palouse Canyon (Hicks 1995, 1996). The rockshelters selected for this analysis had different orientation of their openings (roughly cardinal directions). The sensors were collected after an annual cycle of seasons. Despite the dryness of the air in the southern CRB, rockshelter storage pits proved to be of relatively high humidity, but served well as refrigerators because temperatures remained lower than the surrounding air in combination with low moisture flux over the course of the year. The north- and east-facing rockshelters maintained a lower temperature with less flux than did the west-facing shelters. The storage pits were similarly constructed regardless of the size and orientation of the rockshelters they were in (where the construction materials remained), but the stored resource evidence varied, perhaps based on the Natives' knowledge of what types of foods persisted in each of the storage environments. Additional investigation of rockshelters, and the traditional knowledge their use demonstrates, should be a future research goal that should also seek information from Tribal elders and oral histories.

Like rockshelters and river corridors, visual analysis of topography can demonstrate other aspects of the use of a catchment area. For example, rock alignments, hunting blinds, and animal trails that are still in use can reveal the placement of game-drive lines. Viewpoints for hunters to observe game movements are easy to determine as well. Such information does not paint the complete picture of the reasoning behind site selection but does offer plausible variables in the decision-making process (water, food, and technological resources); archaeologists can map these variables on a local (catchment area) and regional scale. Statistical analysis of mapped environmental variables can enable development of models that include groupings of similar resource types to identify patterns of site selection and use. Analysis of a landscape in this way can provide hypotheses of the extent of a given catchment area (i.e., spacing of residence bases) that can then be correlated with those adjacent to it—for example, oriented along the river corridor, which is expected to be the anchor of any catchment areas in FCRPS Project Areas. If there are changes to similar site types in multiple catchment areas, hypotheses about environmental change or large-scale cultural processes are appropriate.

47. *What information is there about the use of capture facilities such as fish traps and game-drive locations?*

Artifact assemblages associated with fishing and hunting are well documented throughout the study area. Often, faunal assemblages attest to capture and processing locations, with or without associated tools. The ability to identify various faunal remains (mammals, birds, fish, and freshwater shellfish) is often necessary for identifying animal capture/kill and processing sites. In addition, the absence of certain resource types may be used to build hypotheses about organic elements of such capture facilities that generally do not persist in the archaeological record. For example, stone net weights imply that netting or cordage was used for fishing

Ethnographic accounts of the various types of capture/kill sites and drive strategies used in and around the FCRPS Project Areas is invaluable. Understanding the spatial distribution of different capture/kill sites is also important. For example, one is more likely to encounter a bison jump on the Northern Plains east of the Hungry Horse Project Area than a fish weir, which would be far more likely in the Columbia Basin or tributaries. Examples of identified animal drive features in the CRB include the Tsulim Site (Chatters et al. 1995b) near Hanford in south central Washington and in Palouse Canyon off the Lower Snake River (Hicks 1995). Native people also used game fences and hunting blinds, but these may be more difficult to identify, as Euroamerican sheep herders also built rock fences in steep, rocky territory (Hutchins and Simons 1999; Trafzer and Scheuerman 1986). Archaeological methods of distinguishing the age of such features are needed.

48. *Did changes in climate coincide with changes in site types and hunter-gatherer mobility shifts (i.e., mobile to semisedentary) on the Plateau? As environmental settings changed, were new means of adaptation incorporated or did populations move in order to maintain consistent subsistence and settlement mechanisms? Can either pattern be cited as a primary factor in the development of the trend to pithouse villages?*

Various scholars have suggested that the establishment of a stable and predictable climate and plant resource availability was a key influence on the shift in human-mobility patterns. Across western North America and the Plateau culture area, climate amelioration after 3,500 years ago appears to have contributed not only to increased human populations but also to a shift from small, mobile groups to semi- to fully sedentary residential patterns in many areas (Ames 1994; Chatters 1995; Prentiss and Kuijt 2004). The establishment of pit-house villages on the southern Plateau within the FCRPS research area has been attributed to increased populations approximately 4,000 years ago, while subsequent fissioning of the village pattern into smaller, more seasonally mobile groups is hypothesized to have coincided with a decrease in temperatures that affected resource seasonality (Chatters 2004:68).

Additional archaeological information acquired from sites within the FCRPS Project Areas can refine and/or may refute these interpretations of mobility, social structure, and climate change. Sites that are demonstrated to offer such information should be considered NRHP eligible. Archaeologists will need to establish both absolute and relative dating chronologies at sites in order to address questions of mobility and social change (see Section 7.2 for recommendations related to dating house-pit villages and the discussion of Intensification farther above). Questions of mobility and social change require a much larger geographical area of consideration than the specific Project Areas include because the Project Areas are all within river valleys and do not include a specific population's entire seasonal range. Researchers will need to include archaeological data and published interpretations from throughout the FCRPS Program area to be able to make conclusive statements about transitions in mobility and social change.

7.3.2.2 Exchange and Trade

Many of the modes and outcomes of exchange and trade have been previously discussed. This section focuses on questions related to the physical items that were exchanged.

> *49. How does the archaeology of the major aggregation sites (e.g. Celilo Falls, Kettle Falls, confluence of the Snake and Columbia) differ from other types of Residential Sites in the Project Areas?*

During the summer months, groups from the Pacific Coast, The Great Basin, and the Interior Plateau gathered for social events that included trade, gambling, and marriages (Schuster 1998). The Dalles and Celilo Falls was among the principle locations for these gatherings as noted in ethnographic accounts (Ames et al. 1998). However, any site that is located at key travel routes, at the convergence of rivers, and at the intersection of land and water travel corridors may have been a location for these types of gatherings.

Exchange items that are likely to be present in such sites include dentalium and other marine shells, food items such as dried salmon and meat and roots, and technological materials and items. Later, horses and European trade goods would also have been exchanged (Wernz et al. 2005).

50. *What nonfood durable materials or artifacts were traded within the Plateau region and how do these describe links between FCRPS Project Areas and other areas? What evidence is there for exchange of foodstuffs?*

The best way to locate trade networks at the present time is to identify the sources of raw materials present. For lithics, archaeologists must identify the rock type and general geological formations from which it was sourced. Elemental characterization of obsidian can be used to identify the source (e.g., Hess 1997). It may also be useful to identify the species of faunal remains and to gather palynological information regarding the plant types people were using. Nonlocal foods may have been traded into the study area. Bison hides could indicate a Plains connection. Identification of marine species of animals, fish, or shells indicates coastal contacts. Dentalium shells were prestige items and would indicate high-level trade contacts.

Exotic materials are present in CRB collections from the earliest periods, but appear with increasing frequency over time toward the present. The obsidian inventory in CRB collections is a primary resource for study of exchange functions. The ability to acquire relative dates through hydration analysis of obsidian may provide bonus information regarding the timing of trade or raw material movement. More local-scale analysis of obsidian trading is hindered by the paucity of obsidian sources in the FCRPS Project Areas. Other tool-stone sources, such as CCS or quartzite, were regionally available in both bedrock and glacial outwash deposits (e.g., USACE 2008b) and thus less traceable to a certain source. However, identifiable, location-specific raw-material sources may be present in the region and should be considered relative to localized trade practices. High-quality cherts available within the Plateau are spread from their sources, but geochemical sourcing of cherts is not as refined or source-specific as obsidian, and color patterns are not definitive, particularly between heat-treated and non-heat-treated items from the same source. Still, it may be useful within Project Areas to trace local-scale resource pathways (Maury Morgenstein, personal communication 2006). Other cherts can be uniquely characteristic depending on color and/or veining, such as Hozomeen chert (Mierendorf 1993), and identified in collections outside of their source watershed. Jadeite/nephrite objects from Salish Sea sources are exotic materials found in CRB sites, but are not useful for precise sourcing. In general, increasing the categories of items that can be recognized as coming from a specific source and tracing their movment will add evidence of exchange networks.

Exotic biological remains (e.g., *Dentalium*/*Olivella* and other marine shells, marine mammal teeth, whale-bone clubs) describe connections between the CRB and Pacific coast peoples. Least-cost-path hypotheses suggest that these items were traded along major rivers; however, there are archaeological sites at most of the Cascade mountain passes (e.g., Mierendorf 1986, 2015) and between the CRB and the Northern Plains as well. In addition, the amounts of eastern Washington cherts found in Puget Sound–area sites indicate that contact across the Cascades was not uncommon. Lyons (2011a [in Herbel et al. 2012]) conducted a simplified GIS-aided least cost path analysis for obsidians found in a Calispell Valley site over a distance of 1,132 kilometers from its Obsidian Cliffs, Wyoming, source. This technique may help identify pathways of exchange and focus future surveys on these routes.

The ethnohistorical record describes peoples from outside a given territory traveling to locations of abundant, in-season resources such as fishing locations and particularly productive root grounds. These resources were gathered in volume and processed for travel and/or storage, presumably for eating or trading later. It is expected that "market centers" like Celilo Falls represented opportunities to trade durable materials and constructed wares for foodstuffs, perhaps as part of a group's annual subsistence plan. Most of the evidence of such foods does not persist in the archaeological record at the macro scale or have been overlooked as minor contributions to a site's assemblage. Research into existing collections may reveal patterns of non-local resources in certain settings that could be explored further. Such evidence may also be present as residues and micro scale remnants that should be sought in new site investigation plans.

51. *How does iconography, for example on rock art, in any given Project Area compare with regional assemblages and known styles?*

Each culture area produces characteristic iconography and imagery that can indicate cultural affiliation. Rock art of the CRB is recognizably distinct from that of the neighboring areas of the Northwest Coast, Great Basin, and northwestern Plains (Keyser 1992:16). Coastal Salish iconography includes depictions of marine mammals and front-facing circular human faces. Plains and Great Basin iconography features more simple bipedal and quadrupedal figures, including horses in the late period (Loendorf et al. 2006). Similar inter- and intraregion iconography may be present in botanical artifacts such as basketry and carved-wood items.

52. *Are there manufactured goods indicative of contact with Euroamerican traders or settlers? When and how did Euroamerican-introduced items arrive in the Project Areas, and how did that vary across the region? How were Euroamerican trade goods incorporated into the Native American economy?*

The chronology proposed in Chapter 6 contemplated a protohistoric period during which traditional Native American lifeways continued but down-the-line and limited-contact exchange brought manufactured goods into the region. These would include porcelain beads, iron tools, and copper and other metal items from the Pacific Coast. For example, at 45OK2 in the Chief Joseph Dam Project area, data recovery excavations discovered a 4,000 year sequence of seasonal occupation with European trade goods in the latest level. The historic items included glass trade beads, ironstone ceramic, clothing fasteners, bullets, and a civil war button that had been repurposed into an ornament (Campbell 1984:162).

Items obtained directly from traders entering the CRB are expected to have dispersed throughout the preexisting exchange network, and discovery of these items can help delineate the paths of that network. Eventually, established trading posts became the focus for travel and direct trade, aided by the proliferation of horses, instead of through middlemen in the network, although this continued as well. To add understanding to this transition, firm dating of protohistoric and historic period goods is important.

7.4 Historical Archaeology Research Questions

Like precontact sites, historic-period sites offer rich data for comparative studies of trade networks, subsistence practices, resource procurement, and human interaction with the environment. Diachronic comparisons of sites spanning the historic period are key contributions of historical archaeological investigations. One rationale underlying the research questions presented in this section is that data recorded at sites throughout the CRB will contribute to a regional data set that fosters diachronic comparisons to investigate regional demographic and industrial patterns as they participated in and contributed to national and world economic systems.

The HPMPs for the individual Project Areas provide varying levels of detail regarding historic-period archaeological resource inventories. For example, the *Lake Roosevelt Historic Properties Management Plan* (BPA et al. 2007) does not distinguish between historic-period and precontact resources among the approximately 603 archaeological sites inventoried on the property. On the other hand, the *John Day Project Historic Properties Management Plan* (Solimano et al. 2013) reviews 64 historic-period or multicomponent archaeological sites (19 percent of the total archaeological sites inventoried) on the John Day Project (JDP) property. These resources include farmstead sites, irrigation components, homesteads, railroad and ferry sites, and six town sites. During their review, Solimano et al. (2013:5.13) note, “very little attention has been paid to the historic-period sites in the JDP.” Investigation and documentation at the vast majority of these sites (all but seven) were based solely on surface surveys.

Compiling a database of the historic-period archaeological resources inventoried across the FCRPS Project Areas would be extremely beneficial to the future evaluation and continued identification of these resources. A master database would help archaeologists and cultural resource managers evaluate the role of individual sites within local and regional contexts. It would also facilitate research designed to compare the influence of different site and industry types throughout the region (see Sections 5.4.1 through 5.4.4).

The range of inventoried historic-period resources and the potential for undocumented resources to exist within the Project Areas requires that the research questions within the Historic Period Domain remain broad in order to research and appreciate the extent of historic-period use and occupation within the CRB. With this in mind, a series of broad questions are presented below organized by the four themes discussed in Section 6.4: Settlements/Community, Industry, Government, and Transportation. Most often, questions from multiple, relevant themes apply to individual archaeological resources.

7.4.1 Settlements/Community

By nature of its definition—how people live together in groups—the Settlements/Community theme is the broadest theme presented in the Historic Period domain. Questions within this theme address site, neighborhood, and regional population demographics. They are designed to encourage investigations of the lifeways of subsets of the population, which will contribute more nuanced understandings of how various groups lived during the Modern Era. Such groups may include but are not limited to Euroamerican, Native American, Swedish, Chinese, and Italian populations, industrial laborers, managers, explorers, settlers, and tourists in the CRB. The study of settlements also encompasses the institutions through which communities organize and identify themselves: neighborhoods, religious institutions, local clubs, and so on. The regional scale of the FCRPS presents an opportunity to evaluate how cultural resources have the potential to contribute important information about community development across local and regional scales. To help guide research directions under the Settlements/Community theme, the following questions may be applied to a range of cultural resources:

53. *How did population demographics in the CRB change over time?*
54. *How was the material culture of sites related to a particular group (ethnic, socioeconomic, gender, other personhood category) altered as populations expanded or changed within the CRB?*
55. *How did interactions among groups shape settlement patterns and practices in the CRB?*

In order to address questions about the lifeways of groups within the CRB, archaeologists need to establish that a site is representative of a subset of the population (e.g., a boarding house occupied by employees of a specific industry, a saloon frequented by members of a particular ethnic group, or a homestead with a Euroamerican female head of household). This can be done by combining archival research and evaluation of material culture/artifacts/features present at the site. It is also helpful if features within the site can be reliably dated to brief periods of time. This criterion is met if a site was occupied for a short period of time or if a site occupied over a longer period contains discrete deposits datable to shorter periods (privies and stratified community dumps are often good data sources in this regard).

56. *How were population centers developed and maintained in relation to shifting land use/industries in the CRB?*
57. *What role did the site play in local and regional settlement patterns in the CRB?*

These questions center on community institutions and commercial sites that contributed to the success or decline of a community over time. Institutional sites include churches and other religious structures, schools, and community club headquarters. Commercial sites include stores, restaurants and saloons, and hotels. While institutional sites have the potential to address internal community development and continuity, commercial sites provide the links between local populations and national trade networks (Clark and Corbett 2007; Praetzellis and Praetzellis 2009; Praetzellis et al. 1987). Identification and analysis of institutional and commercial sites through a combination of archival research and archaeological survey and excavation facilitates a broader understanding of community longevity, including development, maintenance, and decline. The preceding discussion emphasizes commercial and institutional sites as elements of larger communities (specifically, businesses and community organizations within a town site). Earlier settlements in the CRB, including mission sites and fur trade forts, were structured in such a way that questions of institutional control and commercial networks should be applied to the entire site, rather than individual features within the site. This is also the case for intentional communities, if they are represented by archaeological resources within the Project Areas.

7.4.2 Industry (Fur Trade/Agriculture/Fishing/Mining/Timber/Hydroelectricity)

Industry is divided into two broad categories: human interaction with the environment and industrial social formations. Archaeological investigations of resource extraction, transportation, and production sites and larger-scale industrial landscapes assess the effects of industrial technologies on the environment and technological developments specific to particular industries (Hardesty and Little 2000). Industrial social formations are examined through archaeological work at labor camps and other social activity areas (CalTrans 2008; HARD Work 2013; Hardesty and Little 2000; Merritt et al. 2012).

58. *What items did the Euroamericans receive in trade from Native Peoples, and how did that vary across the region?*

Most of the focus of the market interaction between early Euroamericans and Natives focuses on the fur trade, but along with furs the traders also obtained foodstuffs that often them from going hungry and abandoning the posts. The traders also obtained cultural items (e.g., personal adornment, traditional weapons) that were passed along to their superiors outside the region. Many such items can be found in museum collections in cities where the trading companies were strongest. Trade in such items also represented a market for Tribal craftsmen and understanding the trends in that trade can shed light on the growing relations between Euroamericans and Natives at that time.

When considering industrial sites, technologies, and related social formations on multiple scales, researchers may apply the following questions:

59. *How were commercial industries introduced within the CRB?*
60. *What were the drivers of the introduction of industries within the CRB?*
61. *How did the industry develop over time (boom and bust, steady growth, etc.)?*
62. *What was the relationship between the CRB and advances in technology/methodology within industries?*
63. *Under what conditions was cheap, labor-intensive technology as effective as capital-intensive technology? How did technological advances in one industry influence the development of other industries?*
64. *How did a particular industry or industries change the ecology within the CRB?*

In general, the preceding questions fall within the human-environment interaction rubric. Data pertaining to these questions may be found at resource-extraction, resource-transportation, and resource-production sites. A thorough understanding of site geomorphology and ecology is necessary to assess the impact of industrial processes on the environment at the site. Likewise, specific chronologies of technological developments within the industry, available in industry journals, catalogs, and histories, provide essential context through which to understand the site's role in the development of the industry on regional and national scales.

65. *What was the relationship between community(s) and a particular industry?*
66. *What was the experience/lifeways of the employees (and their dependents) of a particular industry?*
67. *How did the demographics of an industry change over time?*
68. *How were various positions/roles within the economic system filled by individuals/groups/sites?*

The second set of questions in the industry theme relates to industrial social formation processes. As such, the data needs for these questions correspond with the data need of the other industry questions as well as the demographic questions in the Settlements/Community theme. Establishing an association between the site and a specific industry is crucial. Moreover, sites representative of statistical subsets of the industry population (identified by socioeconomic status, ethnicity, gender, age, or some combination thereof) are necessary to address the questions above. Discrete, relatively undisturbed deposits are also preferred. Multicomponent sites (e.g., a mining camp that was reoccupied as a logging camp) have the potential to contribute excellent comparative information, as long as discrete features/deposits can be attributed to each industry.

7.4.3 Government

The research questions below will help further contextualize historic-period sites within regional and national trends in the American West. The government theme is divided into two tracks. The first track considers sites occupied, used, or managed by employees of government agencies—the Corps of Discovery, the Bureau of Indian Affairs, the USACE, the British Boundary Commission, the American Boundary Commission, the territorial and federal military units, the NPS, the Forest Service, Reclamation, the Civilian Conservation Corps (CCC), and BPA. The second track recognizes the influence of federal land distribution and reclamation policies on historic-period settlement patterns in the CRB.

69. *What are the archaeological signatures of different government entities/agencies within the CRB (Corps of Discovery, the Bureau of Indian Affairs, the USACE, the British Boundary Commission, the American Boundary Commission, territorial and federal military units, the NPS, the Forest Service, Reclamation, the CCC, and BPA)?*

Sites that can be attributed to government agencies range from campsites used by the Corps of Discovery to construction camps associated with the federally funded dams in the CRB. Temporary campsites associated with the early expeditions are expected to be among the most ephemeral sites that may have been located within the Project Areas. Mid-nineteenth-century battle sites may also be more difficult to discern than better-documented government infrastructure, such as canals and other USACE sites.

Such broad questions are designed to encourage diachronic and regional comparisons of historic-period sites. As an example, one avenue of research within this theme applied to Lake Roosevelt would be an evaluation of how infrastructure and public use of the reservoir changed after the NPS assumed management of Coulee Dam National Recreation Area (Lake Roosevelt) from Reclamation in 1946. Continuing forward, links between national trends and the construction and maintenance of NPS infrastructure at Lake Roosevelt during the second half of the twentieth century should also be considered when evaluating relevant historic-period sites within the Project Area.

70. *How did the federal government shape settlement and resource extraction within the CRB?*

71. *How did the reality of land acquisition processes in the CRB compare to federal legislation outlining the government sanctioned official processes?*

Data necessary to address these questions require comparisons between the archival records associated with a site and the site's layout, as evident from archaeological features identified through survey and testing. The chronology of U.S. public land-distribution policies provides important context for this comparison. In cases where archaeological resources correspond to documented land claims, sites have the potential to contribute data about regional settlement chronologies. Archaeological sites diverging from or lacking legal documentation are equally valuable in that they illustrate local realities of settlement outside of officially sanctioned government policies.

7.4.4 Transportation

Transportation networks within the CRB are worthy of study because they directed population movement throughout the region. They are associated with broad patterns of history including regional settlement patterns and industry development on local, regional, and national scales. Posing the following questions during cultural resources investigations will help address the potential for individual sites to contribute data about demographic patterns and industrial processes during the historic period:

72. *How did people move within and through the CRB?*
73. *How did people import and export goods?*
74. *How did transportation networks and technology influence demographic and economic shifts in the CRB?*
75. *In what ways did the rivers influence (aid or impede) transportation in the CRB?*
76. *What was the relationship between the rivers in the CRB and advances in national transportation technology?*

Cultural resources associated with the transportation theme include linear and nonlinear resources that correspond to alternate transportation technologies (see Table 6-8 in Section 6.4.1.4). Sites that archaeologists can link to local and regional transportation networks are key to addressing the questions above. This is equally true for both linear (trails, wagon roads, railroad lines) and nonlinear (ferry stations, railroad depots) transportation resources. It is often possible to date the construction of such resources through documentary research. In many cases, links between local transportation resources (like railroad spurs and forest roads) and extractive industries (such as logging) become clear in regional industry and company histories. Likewise, ferry stations and steamboat landings may be associated with individual operators or large transportation companies (e.g., the Oregon Steam Navigation Company). When considering linear resources that do not appear on historic-period maps or other records, features that extend beyond the Project Area generally have greater potential to provide information about transportation networks than segments confined to an individual Project Area.

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Appendix A - Best Practices

Work conducted under FCRPS agency or contracted studies should employ methodologies designed to ensure high quality data comparable to that of other FCRPS projects. The following guidance and standards should be consulted in the design and implementation phases of all archaeological fieldwork conducted in the Project Areas[12]. This guidance is not intended to be prescriptive or relate to all possible techniques and methods. Where other methods apply, the terms and standards used should be defined and to the greatest degree appropriate related to these Best Practices.

This Best Practice Appendix is organized into following sections:

- Research Design and Statistical Description
- Field Applications for Excavation
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[12] Best practices for archaeological site monitoring are provided separately in Appendix B.

Research Design and Statistical Description

Research Design

Prior to embarking on field research, the goals and desired results of the project must be considered in order to devise and implement an appropriate methodology. The project size must be considered, since certain methods (e.g., statistical analysis) are only meaningful with large sample sizes. A thorough review of prior archaeological work in the project area will assist in generating meaningful and specific research questions that may be associated with those presented in this SWRD. These questions can be addressed at the scale of a given project. This research will identify existing theories that the archaeological field data will be able to support or refute or otherwise clarify.

The scientific method begins with data collection and observation. This leads to the formation of a model based on inductive reasoning. Through induction, a theory is proposed that is a plausible explanation for the phenomenon being observed. Once a plausible theory has been suggested, deductive reasoning is used to generate ways of testing it. These are hypotheses, or statements that can be confirmed or disconfirmed through empirical evidence that will be true if the theory is correct and can be proven false by data. A proposed hypothesis is accompanied by a list of possible outcomes that would tend to confirm or falsify the hypothesis. Similarly archaeological theories are tested through the collection and analysis of data. By way of a simple example (given a theory that trade occurred in a given time period), for a large site near the confluence of three rivers, Hypothesis A could be that it was an active trading location. In order to test this, the data collection and documentation strategy would focus on material types and culturally or regionally diagnostic artifacts in order to determine if exotic or non-local materials are represented in the assemblage. The presence of such materials would tend to confirm Hypothesis A, while their complete absence would tend to disprove it.

Statistical Description

One of the goals of the research design is to anticipate what types of data will be needed to address specific research questions and how it will need to be recorded in the field and laboratory. To this end, it is recommended that any statistical models or tests should be identified at the outset, so that the necessary measurements and quantification information is consistently recorded during fieldwork. Archaeologists make use of both qualitative and quantitative measures to advance the understanding of patterns created by past human activity. While there are many descriptive elements to the characterization and reporting of archaeological collections, aggregate studies are necessarily quantitative. When faced with large quantities of repetitive information (for example, measurements of stone tools) statistical analysis is necessary to bring out patterns within the data (Lane et al. 2015). Many of the most commonly used are simply ways of displaying attribute frequency, such as histograms, scatter plots, stem and leaf diagrams, pie charts, and bar charts (Shennan 1997). These can be generated in any spreadsheet program, such as Microsoft Excel or similar software. What follows are brief discussions of possible statistical methods and considerations in archeological and other investigations.

Since sampling bias is always a challenge to interpretation in archaeology, it is recommended that the sampling strategy be included in a research design. A conscious choice should be made at the outset between judgmental and probabilistic sampling. In probabilistic sampling, every element in the sample universe has an equal chance of being chosen, whereas judgmental sampling favors some based on an explicitly defined criteria. Also, choices must be made between simple random, stratified random, systematic, and stratified systematic sampling.

Stratification recognizes that the universe is not homogenous and divides the universe into explicitly chosen categories that will be sampled at the same level of intensity and in the same manner, or that mathematical corrections will be used if the data collected are unavoidably skewed toward a particular subset. This could be random or systematic sampling within each category.

Systematic sampling is also a valid probabilistic choice. For example, taking a matrix sample from every unit level is systematic sampling and meets the requirement of probabilistic sampling. Sampling of assemblages might relate to something like selecting a random sample of obsidian flakes for sourcing (if there were large quantities), or selecting thermally altered rocks to characterize morphologically. Simple random sampling is a completely valid choice for both of those, although they could also be sampled with stratified random sampling, i.e., taking a random sample of obsidian from each stratum or component identified in analysis, or from each activity area or house. Random sampling is less commonly used in archaeology, since researchers generally prefer to direct field investigations toward areas that have higher probabilities for identifying archaeology (e.g., based on topography or density of surface artifacts).

These strategies are not exclusively directed towards positive discovery, but also lead to a better understanding of patterns of zero recovery. For example, using surface artifact density indicators is certainly a good judgmental approach to maximize the likelihood that you won’t have an empty test unit, but it won’t help define the boundaries of a site or variation in density of use across a landform. Additionally, it will be biased towards activities of later time periods, or possibly the operation of erosive processes exposing older materials. For example, if there is a site with visible housepit depressions, and the strategy samples only in those areas, there might be a bias against encountering housepits old enough to have been buried with no visible surface depression or to discovering other types of site features.

When patterns begin to emerge, tests for the soundness of the observation can be made. The correspondence of observed data to theoretical predicted values can be calculated using Chi-square, Fisher's T, and Pearson's r tests. These all check for a correlation between (dependence or independence) variables or sets of variables and are useful in determining if results are statistically significant given the sample size (i.e., if the result is greater than would be expected by chance). Pearson's r is used for continuous variables (e.g., altitude versus faunal diversity). Chi-squared tests are used to test the relationship of categorical variables (e.g., presence/absence of trade goods versus dated components). Chi-square is calculated using a value called degrees of freedom which controls for larger or smaller sample sizes. Fisher's T test is used for continuous dependent variables (site size versus time period).

For example, the strength of a correlation between two variables can be expressed through the Pearson r calculation. The variables x and y are two potentially related variables, for example, length and width of a tool type. The value of r has a possible range from -1 to 1, where 1 indicates a perfect linear relationship between the variables, 0 indicates no linear relationship, and -1 shows a perfect negative linear relationship.

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

Figure A-1. Formula for Pearson's r correlation.

This can be used to check if statistical significance of an observed difference is greater than that which can be attributed to chance (Lane et al. 2015:328). Such a measure would be useful, for example, to determine if there is a meaningful difference in the observed quantity of salmon bone versus deer bone in an Archaic period deposit.

Professional standards for the reporting of radiocarbon dates should be followed and can be found in the American Antiquity Style Guide for authors (http://www.saa.org/Portals/0/SAA/Publications/StyleGuide/StyleGuide_Final_813.pdf). Standard deviations are important in reporting ages based on radiocarbon dates. The standard deviation is the square root of the variance, which is a numerical descriptor of the range of results. Carbon dates are often reported with two standard deviation (the plus or minus portion of a radiocarbon date) because that corresponds to a 95 percent likelihood that the target date falls within that range.

Linear regression and multiple regression analyses are used to make predictions from known variables. Simple regression computes a predicted variable based on the value of another single variable. This generally results in a scatter plot. The linear regression is then used to graph a best fit line onto the data plot in order to more clearly show the predicted relationship between the two variables. A standard error measurement is then calculated to show the accuracy of the predicted best fit line. Multiple regression makes predictions for the value of a dependent or target variable based on the values of two or more independent variables.

Several software programs are available to compute these formulas. Simple programs for use on smaller datasets can be found online. For larger data sets, SPSS software continues to be an industry standard (http://www.spss.co.in/), although its functionality is beyond that which is needed for most archaeological applications. Similar functions can be calculated and displayed using less robust statistical packages such as Microsoft Access or Apple's Filemaker. There are additionally free online add-on modules for Excel, and online customizable freeware packages such as R (http://www.r-project.org/).

Databases must also be intentionally constructed at the outset to provide comparability and to capture a range of salient data (without including extraneous information). To this end, metadata need to be explicitly described and selected. The term "metadata" refers to descriptive information about documents, datasets, images, and other material. Providing metadata facilitates discovery, accessibility, and usability of files in an archive, by giving standardized descriptive fields and terms for data files. It is key to understanding the quality and reliability of the data in the file. It can be thought of as the "who, what, when, where, and how" information relating to a file or project (Niven 2011). The process and rationale metadata creation are available in online guidelines by established repositories (e.g., Day 2005; Duff and van Ballegooie 2006; NISO 2004). The aim of metadata is to make digital resources easily retrievable and usable through the logging of descriptive and contextual information.

Field Applications for Excavation

This section provides guidance for field data collection for archaeological excavations. The intent of these procedures is to collect information of research value for future analysis to foster a solid legacy. Also included are methods for incorporating field data into the technical report. This listing is not meant to include site monitoring unless extensive data are collected during monitoring. Inventory and monitoring procedures are presented in subsequent sections of this Best Practices appendix. Current Field GIS/GPS data collection standards are included later in this appendix.

1. **At Each Site**
    a. Exact provenience – In UTMs, taken with a GPS unit (see "GIS Specifications for FCRPS Cultural Resources Program Data" in this appendix for data and metadata requirements).
    b. Site size and shape – record the extent of the visible site contents in meters for at least cardinal directions (north–south and east–west) correlated with a site map. For oblong shapes, draw the shape and show dimensions on a graphic or site sketch map, with scale and North arrow.
    c. Landforms – describe the principal topographic context of the area of the site contents and the surrounding topography. Describe the elevational changes that are present and the landform changes with which they are associated. For example, the front of a terrace should be described in relation to the eroding reservoir edge while the rear of the terrace described as an active talus slope, railroad grade, etc.
    d. Datum or primary benchmark, with x-y-z coordinates – select a permanent or durable feature to which you can adhere a datum marker, or set a datum stake in a manner that will not be disturbed while not endangering the public's health or property. Locate a site's main datum well above the high water line in reservoir contexts; this may require setting a subdatum in the drawdown zone with careful offset distance and bearing from the main datum located above the shoreline. The location of the datum must be shown on a site sketch map and recorded with a GPS unit.
    e. Subdatums or secondary benchmarks, with x-y-z-coordinates – subdatums must be recorded the same way as the primary site datum and shown on the site sketch

map. Subdatums are highly recommended for any areas where visibility is interrupted (large or long sites, land forms that intervene with line of sight). If a subdatum is established for the purposes of establishing or extending a site grid for intensive artifact collection or archaeological excavation, such datums must be recorded in relation to the primary datum with a total station or similar recording equipment of high resolution.

2. Site Survey for Site Evaluation

a. Record transect orientation and interval for pedestrian surveys, preferably using a GPS device set for continuous recording.

b. Estimate the percentage of visibility for mineral soil surface. In drawdown settings, this should be an estimate of the site area that is covered with reservoir silt or dense aquatic vegetation and the amount of site area that has lost sediment due to erosion. This can change each time a site is visited, so the location of silt cover should be recorded on drawings or digital maps upon each site visit. Use of a digital tablet is recommended so GPS-fixed points on a site map can be compared during each visit.

c. Location of all datums, discovered items and features, must be recorded using a GPS instrument.

d. Listing of items recovered and of items not recovered, and the rationale. Artifacts should not be collected unless it is specified in the design of the site investigation. All diagnostic items should have the following data recorded whether they are collected or not:

    i. Location using GPS instrument (or radial offset from an established datum, where convenient and sufficient).

    ii. Description including three dimension measurements (metric for prehistoric tools and U.S. customary units for historic artifacts)

    iii. A photograph of the item in place and showing it in relation to associated items or features, if applicable

    iv. An outline drawing with sufficient detail to illustrate its diagnostic characteristics.

3. **For Probes**

   a. Size, depth, and type (shovel or auger), and shape of Test Probes (TP) – TPs are to be used as a presence/absence investigation of the potential for buried artifacts or deposits, and to establish an estimate of the boundaries of a site. Shovel test probes should be used when visibility of the subsurface stratigraphy is desired (to examine potential subsurface disturbances or when looking for an expected soil layer indicative of cultural material in the area) and when a larger volume of excavated sediment is considered necessary to meet the expectations of the project's research design. Shovel probes should be no smaller than 35-centimeter in diameter at the surface and should seek to reach the depth appropriate for the sediments and the intent of the project's research design. Probe depths should extend to sediments understood to be older than known occupation of the region unless halted by an obstruction (e.g., large rock or root) or the soils are observed to be disturbed. A sample of probes should be extended with an auger to verify that cultural deposits are not present at greater depth than is apparent in the probe. Auger probes may be used within the understood boundaries of a site when applied on a grid as an explicit investigation of relative amounts of cultural material, if allowed by the project's research design, and only if the difference in excavated volume is not considered important or if the different in the results of different sized probes is controlled statistically. All excavated probe sediments will be screened; 1/4-inch mesh is generally considered adequate for the purposes of presence/absence investigations.
   b. GPS location of each probe – this will require submeter accuracy to be meaningful.The GPS reading should also indicate whether the probe is positive or negative for finds.
   c. The contents, and the level depth at which they were found, must be recorded on appropriate forms. All finds must be accurately counted and described as to material type and degree of intactness; debitage must be described as to the general stage of tool production; changes in sediments must be described in relation to the levels used (the size of arbitrary levels must be described in the project research design and must be appropriate to the investigation's purpose).

Reporting of finds must state the # of items found in relation to the approximate volume of sediments excavated.

d. Document non-recovered items, and rationale for non-recovery – cultural material found through excavation must be collected unless explicitly denied by the ARPA permit under which the study is being conducted.
e. A map must be prepared showing probe locations within site locale, cultural and topographic features within the site boundary and in relation to the surrounding topography. Prominent environmental factors will be illustrated (large trees, wetlands, shorelines) as well as modern buildings, structures, or features (e.g., trails). The map will show the site datum and include a legend that shows true North, and all symbols and line interpretations (e.g., site boundary line). The map's author must be shown and the date the map was prepared in the field. All maps (including georeferenced photos) should include a grid with the referencing system identified in the caption.
f. Photographs will be taken showing particular probes and their surroundings, as well as the general environment and topographic circumstances of the site.

4. For Test Units

a. Size, depth, and shape, and purpose of test units – unlike probes, test units are intended to be volumetrically controlled data gathering samples (i.e., square holes), generally applied once the size and contents of a site are somewhat known. The size of the unit and the excavation levels must be established in the project's research design and then consistently applied.
b. GPS location of all test units, mapped with unit designations.
c. Rationale for test unit placement will be established in the project's research design but may be adjusted in the field based on ongoing results (e.g., where probes yield positive results or where sediments offer promise of addressing specific research questions).
d. Excavation levels must be recorded whether arbitrary (usually 5-10 centimeter) or natural (based on changes in soil composition); it is best to excavate natural stratigraphy even in arbitrary unit levels.

e. Stratigraphic profiles for test units – at least one wall of each test unit must be recorded on profile forms and photographed. If adjacent units are excavated (e.g., as a 1 by 2 meter unit), at least one of the shared walls will be documented; additional walls may be documented if there is an abiding reason to do so (e.g., presence of a feature).

f. Contents and the depth of items encountered will be recorded on unit level forms for each excavation level. The form will note cultural finds, soil changes, types and numbers of cultural items found and any patterning to the finds, and the floor of the level will be drawn to show the locations of particular items (e.g., diagnostic items) or features. Photographs will be taken as appropriate.

g. Features encountered: type, all dimensions, and contents. Include actual weight and volume of fire affected rock wherever possible (but see 4(i) below).

h. Type and quantity of all samples taken, and strategy (e.g., SW quarter of each 1 by 1 meter test unit, for each 10 centimeter layer, 0.5 liter for pollen, carbon, etc.). Whenever possible, soil control samples (SCS) must be submitted with artifacts or soil samples intended for radiocarbon or protein residue analysis. SCSs are analyzed to verify that the target sample is not contaminated by carbon-bearing organics (for C14 analysis) or protein residues. In the case of protein residue, for example, a positive result on the SCS may indicate that the target sample was not used to dispatch an animal if the unit's soils are impregnated with the same residue; the tool may have received the residue from a later butchering episode. SCSs must be collected for each associated C14 and protein residue; the soil control sample should be 3 grams or more of sediment (not gravels) located at least 20 centimeters away from (the farther the better), and within the same stratigraphic level as, the target sample. Both samples must be marked as to their shared association so the lab knows which belong together. Methods specific to geological and paleoecological sampling are presented in the Geology and Paleoecology sections in this appendix.

i. FMR must be analyzed in the field and not collected unless for C14 dating, thermoluminesence, or residue analysis. Analysis of FMR should follow procedures outlined by Schalk (2000) in which rock type, weight, cortex shape (i.e., angular, subangular, rounded, indeterminate), percent cortex, number of ridges, number of vertices, fracture type (i.e., spall, bedding plane, contraction/polygonal, exfoliation, and other), fracture shape, degree of cracking, and degree of discoloration are all cataloged in the field. For sites with large amounts of FMR, Schalk (2000) outlines the following sampling method; specifically, a constant volume sample is attained by the displacement of 2 liters of water. FMR is selected randomly from the overall sample (e.g., all FMR from a unit level or feature) and added to a 5-gallon bucket containing 2 liters of water. Once the water volume is fully displaced, the rock is removed and subjected to the analysis described above. Should the FMR from a given level or cultural feature not displace the entire volume of water, all rock is analyzed. Conversely, once the displacement level is reached, the remaining FMR that is larger than 4 centimeters maximum dimension can be analyzed by material, number, weight, and cortex shape only.

j. For each test unit, individual features and artifacts should be mapped to at least centimeter-level accuracy.

5. **Field catalog of recovered items; to include:**
   a. Site Name or Number – a site number, even if temporary, must be recorded on all forms and bags generated during field investigation.
   b. Unit or Probe Number – all excavation units, including those emplaced for geological/ sedimentological study, must be given a unique designation and shown on the site sketch map.
   c. Provenience including level/depth – specify if the level is arbitrary or natural/stratigraphic.
   d. Locus or Feature if applicable – all parts of a site that are sampled in isolation (e.g., features, loci, structures) must be assigned a unique designation and all items or samples collected, forms generated, and photographs or drawings made from investigation of it bear that designation.
   e. Unique item or lot catalog number – a catalog must be kept that records the unique bag numbers assigned to each item or sample collected while on site. The name of the person making entries in the catalog must be recorded. Information

entered on bags should be what is required by the curation facility that will ultimately receive the collection to maintain consistency from the field to the lab to the curation facility.

f. Item or lot class (not type but simple descriptive, e.g. projectile point; sherd; bone fragment) – more studied identifications should be made in the lab as it is not a good use of field time and avoids single artifacts being referred to as two different things (making it appear as if an item has gone missing between the field and lab).
g. Excavator and Date.

6. **Photodocumentation**
   a. Take lots of photos, from multiple angles, and, if possible, under different lighting conditions. At a minimum, take the following photographs: Overview (view of site looking toward the reservoir if visible), all features (overview and detail shots), diagnostic artifacts (dorsal and ventral side and any distinguishing features of the artifacts).
   b. Always use scale, North Arrow, and mug board, where feasible.
   c. Use color-calibrated scale, such as the IFRAO scale, on all pictures of a distance to clearly see the scale. For pictures that may be shown to non-technical audiences, take a second photograph without the color scale.
   d. Unload picture files every night, attribute them, and archive them.
   e. All photo locations should be marked on the site map, with a small arrow pointing in the direction of the photo. In site photos, place a person within the view for scale.
7. **For the technical report**
   a. State the contracting entity and land management jurisdiction
   b. Background section: Do not describe climate/environment/landscape/flora/fauna in detail unless it has never been done before or is somehow different for the specific environment of the study location. If this information already exists, summarize briefly and cite to a source. Important ethnographic information may be presented in more detail but it's not necessary to repeat information if already available elsewhere.
   c. Methods Section

d. Report graphics should include:
    i. Maps showing the site's location – U.S. Geological Survey (USGS) topographic background is preferred and 1:24,000 scale is common, but a different scale may be used if that scale offers a view or interpretation that is preferred for what is being displayed;
    ii. A map showing the area examined and, if inventory was conducted, the area surveyed and pedestrian transect orientation (with interval if scale permits);
    iii. Site map(s) showing site boundary, site datum and subdatums, features, landforms, and historic and modern disturbances (including roads);
    iv. Shovel or auger probe and unit locations with symbols for positive/negative;
    v. Plan and cross section sketches of features;
    vi. Individual units in plan view by level, with artifacts mapped in;
    vii. Soil profile drawings with clear legend, preferably presented alongside a photograph of the same view; and
    viii. Individual illustrations and photographs of diagnostic and representative samples of artifacts – show scale, and both faces and a side/profile view of formed tools. Use a color-calibrated scale (e.g., IFRAO scale) for artifact photographs.

e. Wherever possible, present data in tabular or graphic form and support with brief narrative for analyses of all classes of material for which a moderately large or large sample has been collected (e.g., debitage, shell, faunal). Of particular importance are summary tables of artifacts including class, type, count, and weight as determined in the lab.

f. All reports must specify what horizontal and vertical datum are used, which coordinate system is employed, what units are used, and which projection (if any), where applicable, is applied. The report also must state whether the data set being presented has been differentially corrected.

g. Big tables like the field collection catalog, detailed artifact and feature listing, and the photo log should go in appendices. Use software program that is easy to convert into other formats (e.g., PDF tables to Excel workbook).
h. Outside lab reports also should be included in the appendices (radiocarbon dating, residue analysis, macrobotanical and flotation, geochemical characterizations, sediment analyses, etc.). Make it clear in the text of the report what reporting conventions are being used for each analysis (e.g., OxCal calibration software for C14 dates, which half-life).

Dating and Analytical Techniques

Tables A-1 and A-2 represent a survey of methods for collecting, analyzing, and presenting data. While no project will make use of all these techniques, they are presented as a primer and review of important potential avenues of study available within the field of archaeology. The best practices given here do not include human osteology because it has been the practice to not conduct analysis at the Tribes' request. All archaeologists should be familiar with the range of potential analytical techniques and make appropriate use of them when their application can further research goals.

Table A-1. Dating Methods.

Method	**Date Range – Applicable Context**	**Methodological Considerations**	**Example of Appropriate Use or Source Study**
Stratigraphy	From development of the landform to today – Excavation or erosional/cut bank.	Law of superposition – must be attentive to taphonomic and geomorphic processes.	Gasche and Tunca 1983; Rapp and Hill 1996; Stein 1990
Typology	Classification according to physical characteristics.	Useful for organizing and managing large data sets. Statistical methods (Cluster analysis, principal components) can be helpful to identifying meaningful types.	Whallon and Brown 1982
Artifact Seriation	Change in frequency of artifacts relative to one another over time.	Seriation / battleship curves.	Deetz and Dethlefsen 1967
Historical Texts	Early explorers, settlers, missionaries, government records.	Author bias can skew the account, or lead to omissions. A good source of questions to be tested.	Documents and archives
Radiocarbon	From earliest occupation of North America through AMS on samples of 5-10 mg. Hard to calibrate dates after the industrial revolution due to Seuss Effect (circa 350 B.P.) – but there are other periods of atmospheric fluctuation (800 to 400 B.P., prior to 12,000 B.P.).	Material Type – Calibration (recommended INTCAL98 calibration data set) – Reporting conventions (report as "Cal BC/AD or Cal BP" with calibration dataset, along with accompanying stable carbon isotope measurement – report with 2 standard deviations = 95.4% confidence interval.	OxCal calibration https://c14.arch.ox.ac.uk/embed.php?File=oxcal.html Reimer 2004 Shellfish corrections: Deo et al. 2004; Osterkamp et al. 2014 Calcined bone preserves in acidic soils well enough for AMS dating (Brown et al. 2015)

Table A-1. Dating Methods.

Method	**Date Range – Applicable Context**	**Methodological Considerations**	**Example of Appropriate Use or Source Study**
Tephrochronology	Multiple sources of identifiable large-scale eruptions since human occupation of FCRPS region. Linking ash to known volcanic eruptions.	Dateable ashes limited to plume coverage and where not removed or redeposited; databases of previously identified ashes are available only in select labs.	Sarna-Wojcicki 2000
Dendrochronology	Tree ring sequence. Present to 13,000 years ago globally, 1,420 years in the Pacific Northwest.	The discovery of well-preserved remains of enormous Kauri trees in New Zealand may enable the extension of dendrochronological calibration back to 50,000 globally (Barry 2007).	Wright and Agee (2004) [Fire history reconstruction from East Cascades] NOAA dataset https://www.ncdc.noaa.gov/cdo/f?p=518:1:0:::APP:PROXYTOSEARCH:18
Lichenometry	Present to 4,000-5,000 years. Best results within last 1000 years.	Not well-suited for forested areas due to wildfire and competition from fast growing moss (Benedict 2009).	Aside from dating, lichen growth patterns can be used to determine disturbance of rock features (Benedict 2009)
Varve Dating	Annual cycles appearing in lake sediments.	Varves (layers) can be very thin, unless the lake is fed by glaciers.	Verosub 2000
Uranium Series	50,000 to 500,000 years.	Limited utility for archaeology in the Americas. Uranium and radium decay rates have been used to calculate rates of rind formation in andesitic and basaltic rock.	Morgenstein et al. 2003
Obsidian Hydration	Since human occupation of the FCRPS Program area to the present. Obsidian artifacts.	Relative measure of the exposure of a surface to the atmosphere; no absolute growth rate to hydration rind, depends on atmospheric and soil conditions.	Pierce and Friedman 2000
Thermolumin-escence (TL)	Since human occupation of the FCRPS Program area to the present. Dates last heating of material above 500 degrees C.	Can be used for ceramics, lava, and buried surface sediments. Must collect sample of surrounding soil as measurement of age based on decay rate of surrounding elements.	Aitken 1985; Liritzis 2011

Table A-1. Dating Methods.

Method	**Date Range – Applicable Context**	**Methodological Considerations**	**Example of Appropriate Use or Source Study**
Optically Stimulated Luminescence (OSL)	Since human occupation of the FCRPS Program area to the present. Dates last exposure to light (e.g., sunlight for buried surfaces).	Similar to TL. Must collect sample of surrounding soil as measurement of age based on decay rate of surrounding elements.	Feathers 2000; Habermann et al. 2000; Lubinski et al. 2007; Morgenstein et al. 2003
Electron Spin Resonance	Since human occupation of the FCRPS Program area to 3,000 years.	Measures trapped energy in crystalline material, most commonly applied to tooth enamel but also applicable to quartz, cherts, and fossil.	Han et al. 2012; Schurr et al. 2001
Archaeomagnetism / Paleomagnetism	Since human occupation of the FCRPS Program area to the present. Location of the North Pole the last time object was heated above 600 degrees C.	Useful within the last 10,000 years. Applicable to lava flows, kiln bricks. Original orientation of object in the ground is critical.	Eighmy and Howard 1991
Amino Acid Racemization	Dates bone from 1,000 to 100,000 years old. Based on the decay after death of amino acids from L-enantiomers to D-enantiomers (referring to the direction that they rotate polarized light).	Temperature dependent – relative measure based on site conditions.	Johnson and Miller 1997; Kaufman 2005

Table A-2. Field and Laboratory Analysis Methods.

Categories of Analysis	Method	Applications and Methodological Considerations	Example of Appropriate Use or Source Study
Mapping	Ground Penetrating Radar	Location and mapping of subsurface features without (or prior to) excavation.	Conyers 2013; Jol 2009
Mapping	Global Positioning System		BPA 2015 (in this appendix); Reid 2008
Mapping	Geographic Information Systems	Presentation of archaeological data for spatial and geographical visualization; including data management, spatial analysis, and cartography.	ESRI 2015; Wheatley and Gillings 2002; http://www.arcgis.com/
Mapping	LIDAR	Creates bare earth relief elevation models for illustrating features that might be indistinguishable on the ground. Suitable for most aspects of terrain representation and under most environmental conditions.	Devereux et al. 2008
Mapping	Total Station Survey	Site-specific mapping, typically used during data recovery excavations.	Guide: http://www.saa.org/portals/0/saa/publications/saabulletin/14-4/saa16.html
Mapping	Drone / Kite Photogrammetry	Site-specific aerial photography.	Esposito et al. 2013
Faunal (also applicable to Osteology)	DNA Studies	Thermally altered bone is not ideal and retains less genetic information than non-thermally altered bone.	Cannon et al. 2006; Stevenson 2011
Faunal	Comparative Collections	Faunal identification and analysis.	Collections available for professional use with permission at Burke Museum (University of Washington); Department of Anthropology (Washington State University; Portland State University; University of Oregon)
Faunal	Otoliths - Other Growth Structure Analysis	Diet and season of use.	Cannon 1988 (Salmonids); Casteel 1976 (Fish); Chatters et al. 1995a (Molluscs); Disspain et al. 2015 (Otoliths); Kay 1974 (Mammals)
Mapping	Magnetometer	Non-destructive identification of burnt and anomalous subsurface features.	Aspinall et al. 2008; Burks and Cook 2011
Elemental Studies	Raw Material Identification and Sourcing	Trace Element Analysis –scatter plots Neutron Activation Analysis – X-ray Florescence.	Shackley 2005 (obsidian); Wilcox et al. 2008 (turquoise)

Table A-2. Field and Laboratory Analysis Methods.

Categories of Analysis	**Method**	**Applications and Methodological Considerations**	**Example of Appropriate Use or Source Study**
Elemental Studies	Oxygen Isotope Analysis	Reconstructing past climate – sourcing limestone or other deep sea formed rocks. Stable isotope rations: 16O to 18O ratio in foraminifera http://www.ucl.ac.uk/GeolSci/micropal/foram.html. More than 18O means colder climate (due to evaporated H_2O being locked up in ice on land).	Shackleton and Opdyke 1973
Elemental Studies	Carbon Isotope	Reconstructing past climate; used in faunal analysis to reconstruct diet (C isotope).	Hughes 2004; Newsome et al. 2007
Elemental Studies	Nitrogen Isotope	Used in faunal analysis of the food chain (trophic analysis).	Price and Burton 2010
Elemental Studies	Strontium/Calcium	Can be useful to identify movement of individual through life history.	Butler et al. 2010
Elemental Studies	Strontium Isotope	Can be useful to identify movement of individual through life history.	Bentley 2006; Dufour et al. 2007
Past Diet and Climate	Phytolith Analysis	Reconstruction of past climate, season of site use, and diet. Identification of certain plant taxa that produce identifiable, decay-resistant, intracellular silica; Samples collected from archaeological and lake sediment contexts must be pre-processed.	Dunn 1983; Piperno 2006, for additional resources
Past Diet and Climate	Starch Residue Analysis	Reconstructing past subsistence/diet. Requires infield or laboratory processing of groundstone/lithics for samples.	Pearsall 2013
Past Diet and Climate	Palynology, Diatoms	Reconstructing past climate; subsistence/diet. Samples collected from archaeological and lake sediment contexts must be pre-processed. Diatoms indicate past alluvial conditions and environmental change.	Faegri and Kaland 2000; Smol and Stoermer 2010
Past Diet and Climate	Macrobotanical Analysis	Reconstructing past climate and plant use. From excavations - Flotation Samples must be taken and pre-processed.	Sullivan and Forste 2014
Past Diet and Climate	Coprolite Analysis	Reconstructing diet. Excavated contexts.	Sistiaga et al. 2014
Technology	Blood Residue Analysis	Reconstructing tool use. Control soil sample must be taken in same stratigraphy but away from potential liquid "puddling."	Newman 1990

Table A-2. Field and Laboratory Analysis Methods.

Categories of Analysis	Method	Applications and Methodological Considerations	Example of Appropriate Use or Source Study
Technology	Replication Studies	Use-wear analysis. Proper level of magnification – Microscopes / hand lenses.	Keeley 1980; Shea 1992
Technology	Petrography	Material identification and sourcing.	Hermes and Ritchie 1997; Reedy 1994
Statistical Analysis and Data Presentation	All Quantitative Data	Histograms, scatter plots, stem and leaf diagrams, pie charts, and bar charts, probability sampling, chi-square, Fisher's T, regression, multiple regression.	Shennan 1997 SPSS http://www.spss.co.in/ R http://www.r-project.org/

Inventory Methods

Survey Plan – Pre-Field

Conduct background research in the appropriate SHPO and Federal agency files to identify all past fieldwork completed in the survey areas and identify all previously recorded sites in the survey area. A copy of each site form should be obtained. Additional research may need to be conducted at local historical societies, or by reviewing ethnographic studies, survey/testing/excavation reports, allotment and insurance records, maps (GLO and Sanborn), photographs, journals, oral histories, and DOE for the NRHP (NPS Form 10-900) for sites listed in or eligible for the NRHP.

If required, obtain an ARPA permit for survey from the Federal agency before survey begins.

Survey Plan – Site Identification Strategy

The following site identification and survey strategy applies in most FCRPS Project Areas; however, specific contract scopes of work may alter the metrics shown here.

<u>High Probability Areas</u> – most likely to contain significant archaeological sites, with slopes less than 10 degrees near a permanent water source. Surveys in high probability areas will receive 100 percent pedestrian inventory.

<u>Medium Probability Areas</u> – areas where archaeological sites are less likely with slopes between 10–30 degrees. These areas receive at least 50 percent pedestrian survey.

<u>Low Probability Areas</u> – areas where archaeological sites are unlikely, and slopes (greater than 30 degrees) away from water and secondary landforms. Survey of these areas should be limited to inspection of select landforms that might contain rock art, talus pits, and other archaeological features typically found on steep slopes.

Survey Plan – Field Methods

Transects

In High Probability Areas, as described above, transects are to be no more than 10 meters apart. In Medium Probability Areas, transects are to be no more than 15 meters apart. In all cases, transects are to follow the natural contours of the area being surveyed, with one person, the person closest to the water, recording transects on a GPS. The person farthest from the water is to mark the edge of the transect with toilet paper, or some other biodegradable marker. If flagging tape is used to mark transects, it must all be removed prior to leaving the field at the end of each work day.

Areas of No Intensive Survey

Areas with slopes over 30 degrees should not be intensively surveyed. These landforms should be reviewed, if possible, for typical site types that occur on steep slopes and record either the location of any sites discovered or the potential for sites to be discovered for those landforms, depending primarily upon safe access.

Shovel Probes

Intensive survey includes subsurface testing through the use of test probes. Shovel test probes are described in #3 Test Probes of the Field Application section above.

New Site Recording

All new sites are to be recorded on the appropriate state site record form. Information for the form should be collected in the field. Site boundaries should be defined with surface artifacts and features. A description of all features must be written, including type of feature, measurements, and artifacts associated with the feature. A description of artifacts present at the site should be included. If there are artifact loci, describe the general nature of the artifacts present and provide an approximate count. If there are diagnostic artifacts present follow the *Recording Diagnostic Artifacts* section below. Record all diagnostic artifacts. A general description and approximate count of non-diagnostic artifacts is sufficient. A datum needs to be established above the full pool level, if possible, otherwise, as close to full pool level as possible. The datum should be recorded with the GPS unit and a description of the datum is to be included in the site information (rebar in ground, tree trunk, specific land feature, etc.). In addition a good field map must be drawn (see Maps section below for map requirements). Photographs need to be taken of the site, artifacts, and features (see Photographs section below for photo requirements). The established datum must be drawn on the field map, and a GPS point location must be taken. If information on the site was found during the Background Research, that information should be included on the site form. The site form should be submitted to the SHPO and Federal agency's archaeologist.

Reevaluation of Known Sites

All known sites within the survey area should be reevaluated to ensure the previous site form is still accurate. The previously established site datum should be relocated, recorded with the GPS, and marked on field maps. If the datum cannot be relocated, follow the instructions defined above to establish a new site datum. After establishing the site datum, the site dimensions should be checked. Look for additional features or if features have been destroyed. Compare the artifact descriptions on the site form to surface artifacts. Check the soil coloration for midden deposits or other features. If the site is different than described on the site form, a new site form or addendum will need to be filled out. In this case, follow *the New Site Recording* methods outlined above including performing new field mapping and photography. The updated site form should be submitted to the SHPO and Federal agency archaeologist.

Recording Diagnostic Artifacts

Artifacts are not to be collected during survey. If a diagnostic artifact is found during survey the artifact should be recorded by doing the following:

- Point locate artifact on the GPS.
- Write a description of the artifact, including type of artifact, material used, measurements, distinguishing features, etc.
- Photograph the artifact with a scale. Photograph the dorsal and ventral sides, and any distinguishing features.
- Draw dorsal and ventral sides of the artifact to scale (if it is a stone or bone tool).
- Do not write on the artifacts.

When you are done recording the artifacts, be sure to put the artifact back exactly where it came from.

Recording Scarred Trees

If culturally modified scarred trees are located they must be recorded. Be sure to look for scarred trees, as well as surface artifacts and features. A scarred tree should be recorded as a feature of a site. If there are multiple scarred trees close to each other, they should be recorded as multiple features of one site.

When recording scarred trees be sure to include in the description:

- Type of tree
- Dimensions of the scar (length and width)
- Height off the ground where the scar begins
- Diameter of the tree at chest height

Be sure to take both an overview photograph and a close-up photograph of the scar. It can be difficult to determine if a tree is culturally modified or modified by animal or fire. When uncertainty exists it is best practice to record a potentially scarred tree.

Photographs

See Photodocumentation above (#6 in Field Applications).

Maps

All field maps (hand drawn or computer generated) must include the following:

- North arrow
- Scale
- Location of datum
- Location of archaeological/historical features
- Location of artifact concentrations
- Location of all diagnostic artifacts
- Location of photographs, with a small arrow pointing in the direction the photo was taken
- Major topographic features and important contours
- Location of at least three of the GPS points collected for the site (for Geo-referencing)

Site Descriptions

Site descriptions for each site located during survey should be written following the format below.

The heading of each site will include the following information:

- **Site Name (Smithsonian Number/Common Name)**
- Other Site Names:
- Site Type:
- Pre-Contact/Historic:
- Time Period/Age (if known): Site Dimensions:
- Site Elevation Range from GIS Bathymetric Data:

Written description should include:

- Site description, including general site description, features descriptions, and artifact descriptions
- Monitoring history – when it was last monitored and mention of at least one other previous monitoring episode if there is one

- Site condition and description of impacts if there are any
- NRHP assessment
    - Identify the criteria or criterion under which the site is/is not eligible
    - Provide a rationale/explanation for why site is/isn't eligible (i.e. "Site is eligible under Criterion A for its association w/ Big Bird. Site elucidates his contribution to childhood education on the Sesame Street program at a time during which social values emphasized honesty and trust (by letting Snuffleupagus out of the closet)."
    - Include a statement about how site illustrates the quality of significance in American history, architecture, archeology, engineering, and culture (select one or more)
    - Identify the site as a districts, site, building, structure, or object that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and explain why it retains integrity relative to the NRHP criteria under which it is eligible (if it is).
- Other pertinent info to include if available
    - Site investigations/excavation
    - Artifacts collected – where curated
- Management recommendations

Site Monitoring Methods are included in a later section of this appendix.

Geoarchaeology

For research questions pertaining to the landscapes and geomorphology of archaeological sites within the FCRPS Project Areas, a primary data need is a thorough understanding of the geologic and depositional context of each site. The bedrock geology of each FCRPS Project Area has been mapped by geologists at varying scales, and surficial sediment and soils data are available for many of the areas. These datasets provide baseline expectations for types of sedimentary contexts, within which archaeological sites should be found. Comparing and contrasting these baseline expectations with what is actually encountered at a site is a powerful tool for reconstructing environments and understanding site formation processes.

The objectives of stratigraphic studies are succinctly summarized by Waters (1992:61):

> (1) to subdivide and group the sediments and soils at the site into meaningful packages or physical stratigraphic units based on observable characteristics and to record the nature of the contacts between those units; (2) to order these stratigraphic units into their proper relative sequence from oldest to youngest; (3) to determine the absolute age of the stratigraphic units and the amount of time represented by sediment accumulation, stability (soil development), and degradation using chronometric dating techniques; and (4) to correlate the stratigraphic units at a site with the regional stratigraphy adjacent to the site.

All stratigraphic profiling should follow standard geologic and soil description methods. Descriptions of soils and sediments should use standard terminology defined in field guides such as the U.S. Department of Agriculture's (USDA) *Soil Survey Manual* (USDA 1993) or the U.S. Department of the Interior (USDI) Bureau of Reclamation's Engineering Geology Field Manual (USDI 2001).

Descriptions of soils should include Munsell color, mottling, texture (grain size), structure, consistency, cementation, inclusions, coatings, fabric (bedding characteristics), and boundary type. For coarse-grained inclusions or deposits, descriptions should include clast size (average and range), morphology (rounding, sphericity), sorting, fabric, and mineralogy (if discernable). Post-depositional disturbances should be considered when viewing the archaeological record, including cryoturbation (freeze-thaw), pedoturbation (disturbance from natural soil processes such as clay shrink-swell), mass wasting (soil creep), and bioturbation (e.g., plant roots and animal burrowing) (Leigh 2001). Control samples of sediments from outside of the archaeological deposit can be collected in order to compare natural to cultural conditions. Collection strategies for location, quantity, and types of samples extracted off-site should be strategically designed to help elucidate research questions regarding on-site phenomenon.

Once sediments and boundaries are appropriately described, sediments can be grouped into definable packages or facies, a three-dimensional deposit that is discernable from deposits surrounding it and that represents a unit of analysis. Stein (2001:5) defines the concept of deposit as "the unit identified in the field as representing similar context of artifacts and defined using any physical property at any scale that is convenient for the research question." Researchers should state explicitly their criteria for defining specific deposits so that other archaeologists can replicate field procedures, compare results, and evaluate results relative to research questions (Stein 2001:6).

Understanding the ecological setting of a site within its regional context can aid in establishing regional site chronologies, help to identify locations where sites (including buried sites) may exist, and facilitate understanding of larger-scale processes that affected site selection, site preservation, and site disturbance/destruction. For example, aeolian deposits, including loess and reworked dunes, are common within the FCRPS Project Areas, especially those in the Plateau ecoregion. Understanding the timing of emplacement of these landforms is important for understanding regional ecosystem conditions through time. In particular, variables such as moisture conditions, wind direction and speed, flood frequency, and other factors could affect sediment supply, availability, and transport capacity (Kocurek and Lancaster 1999).

Radiocarbon dating of soil surfaces (and associated cultural remains) can provide information regarding periods of regional landscape stability. Alternatively, periods of sediment transport, deposition, and dune formation can be dated using radiocarbon methods, when datable material is present, or luminescence dating, especially optically stimulated luminescence (OSL) (Halfan et al. 2015). Tephra sourcing has proven a reliable source of dating information for stratigraphic studies, as eruption dates for specific tephras are relatively well-constrained. However, care must be taken to determine if deposits are in their primary context or have been redeposited.

Source materials for dune field production can be identified using mineral analysis of dune sediments. Other stratigraphic provenience and correlation studies have included such analyses as granulometry, clay mineralogy, x-ray diffraction, x-ray florescence, total element analysis, soil chemistry, magnetic susceptibility, and weathering (Canti and Huisman 2015; Ferring 2001).

Laboratory analysis of site sediments may be appropriate, depending on research questions and with costs/benefits in mind. Laboratory analyses can help to test hypotheses pertaining to environments of deposition, origins of sediment, cultural modification of sediment, and post-depositional impacts to the archaeological site. For example, particle size analysis can clarify the origins, mechanisms, and energy of depositional processes, as well as degree of post-depositional alteration (Huckleberry 2001). Soil chemistry looks at the enrichment or depletion of chemical elements in sediments that are the result of human activities (Oonk et al. 2009). While phosphorus (P) has been the most widely used chemical indicator of human occupation, other elements, such as heavy metals, calcium, potassium, and magnesium, have also been studied and have been found especially useful when applied in multi-element analysis (Holliday et al. 2010). Other indicators, such as loss-on-ignition (measuring organic content), pH, and sediment mineralogy, also have been studied at archaeological sites.

Paleoecology

Archaeologists have argued that precontact people deliberately created meadow complexes throughout western North America for a variety of reasons, including creation of browse for hunting ungulates or maintenance of productive roots and/or acorns (Stewart 2002; Walsh et al. 2010). As such, it is important to consider whether existing meadow complexes within the FCRPS research area indicate past human landscape management. Researchers should use paleoecological reconstructions, modern vegetation maps, historic USGS maps, General Land Office (GLO) maps, and historic photos (both landscape and aerial) to determine if meadow complexes are or were recently present within a specific Project Area. In many cases, removal of indigenous populations from their traditional territories, cessation of landscape management practices, and modern fire suppression have contributed to forest encroachment of once fire-maintained meadow systems.

In Field Approaches

Collection of sediment samples from archaeological contexts can provide various lines of site-specific data used to understand subsistence, local ecology, and local climate at a specific site. Intact macrobotanical remains have been recovered and pollen preservation has been demonstrated at sites within the FCRPS Project Areas (Grand Coulee [Roulette et al. 2000], Chief Joseph [Campbell 1985]), and paleocological reconstructions from the region (see Chatters 1998; Mack 1978a, 1978b) highlight the potential for sediment samples in the region to contain paleoecological information. Sediment samples should be collected from all archaeological excavation units for macrobotanical, pollen, or other paleoecological analysis. When organic rich deposits are encountered and the likelihood of preservation of plant remains is high, sediment samples of more than 1 gallon should be collected from each 10 centimeter natural or arbitrary layer and stratigraphically from within any features identified.

If charcoal is encountered during excavation, it should be collected *in situ* and three-point provenience recorded when possible to allow for radiometric dating. Charcoal samples should be placed into separate aluminum foil pouches within a labeled sterile whirl-pak bag. Charcoal should be photographed and sent for botanical identification prior to submitting for radiometric dating.

If macrobotanical remains are identified *in situ* during excavation, they should be photographed in place and three-point provenience recorded. Samples should then be transferred to a sterile container (non-bag) to ensure protection. A sediment sample from the location should also be collected to provide pollen/phytolith background information. When it is not feasible to collect groundstone artifacts from archaeological sites, and in-field analyses are required, the following protocol should be followed for collection of groundstone washes for pollen/phytolith/starch analysis. In-field and laboratory pollen/starch wash protocol can be found on the PaleoResearch website (PaleoResearch Institute 2015).

Surface "pinch" sediment samples should be taken at every archaeological site where paleoecological analysis is planned. Surface samples contain modern pollen and can provide baseline ecological data and information about pollen preservation at a given location. Enough sample to fill a 15 milliliter sterile sampling bag (whirl-pak brand or similar) should be collected. Additionally, if surficial groundstone artifacts are identified, sediment adjacent to the find should be collected for a comparative modern pollen background to paleoecological data obtained from groundstone washes.

In locations where enclosed (endorheic) lakes and/or peat bogs are identified, the collection of sediment cores for paleoecological analysis should be considered. Lake sediment coring requires specialized equipment depending on several factors such as water depth, reservoir/lake bathymetry, and sediment type (various core retrieval methods are provided in Smol et al. 2001). For sediments near land or in peat bogs, a hand percussion corer (i.e., ESP soil probe) may be used to collect samples. All cores should be stored in a cool environment until they can be transferred to cold storage and a laboratory facility.

To ensure that pollen, charcoal, phytoliths, and other paleoecological materials are well preserved, sediment core sampling locations should have remained consistently wet (i.e., natural lake basins) or consistently dry (i.e., cave sediments). Excessive drying and wetting can destroy or degrade microscopic paleoecological materials. In most cases, charcoal does not appear to be greatly affected by these mechanisms. However, charcoal and fire history reconstructions may be able to be produced from cores with poor pollen preservation.

If extant forests or remnant preserved tree stumps are present within the Project Areas and near an archaeological site, dendrological samples in the form of tree cores or slices may be obtained. The researcher must be sure to obtain all necessary permissions and permits from landowners and agencies prior to sampling. Dendrological information can provide information about stand age, precipitation and/or temperature change, local fire history (if the tree survives and records fire events), and other climatic/beetle kill events.

Laboratory Approaches

Flotation of samples can be conducted in a variety of ways. Consult Pearsall (2013) for in field and laboratory flotation procedures. In some cases, floatation is not possible and sediment may be sifted through nested screens to recover botanical material of different size classes. Subsampling of flotation samples should follow procedures outlined by Nicolaides (2010:62) which entail documenting the weight and volume of the sample and then dividing the sample into "size fractions through the use of four nested geological screens (2.00 mm, 1.00 mm, 0.50 mm, 0.25 mm)" and further dividing each subset into descriptive categories: Nicolaides used the following three categories for sites on the northern Canadian Plateau: 1. Wood charcoal, 2. Carbonized twigs and branches, 3. Needles, seeds, and other tissues, but additional categories may need to be added and/or combined depending on the flotation results. Researchers should be careful not to shake screens too vigorously or push sediment through the screens since fragile botanical materials may be destroyed. All identified macrobotanical remains should be placed in labeled, hard plastic or glass vials/jars to protect materials prior to analysis.

Sediment cores should be split vertically into two uneven pieces (2/3 by 1/3) and the smaller portion wrapped and stored as an archival core in cold storage. The larger portion of the core should then be photographed, stratigraphic changes marked, identified, and measured. In order to evaluate changes in sedimentation, magnetic susceptibility (MS) measurements should be taken at the same sampling interval used for obtaining samples. Sedimentation rates vary, depending on the location and environment of the sampling location. A general rule is to sample at no greater than 1 centimeter intervals to capture decadal ecological changes. However, sampling intervals of 0.25 to 0.5 centimeters should be used when possible to allow for identification of human-environmental interactions.

The cores should then be sampled by making perpendicular slices. Slices should be stored in labeled, sterile whirl-pak–type bags in cold storage until analysis. Any tephra or ash/charcoal identified in the core should be photographed and sampled separately to retain chronological control. A sub-sample of 1 to 5 cubic centimeters of sediment should then be taken from each slice for pollen and an additional 1 to 3 cubic centimeters for charcoal analysis.

Samples should be sent to a qualified laboratory for analysis. Pollen processing requires a fume hood, formal training, and the use of dangerous and caustic chemicals. There are various approaches for isolating pollen and phytoliths depending on the type of sediment being analyzed. See Faegri and Iverson (1969) and Pearsall (2013) for specific protocol.

Charcoal is isolated using a simple method of soaking for 24 hours in sodium hexametaphosphate, rinsing through nested 150 and 125 micron screens to isolate localized from more regional charcoal (see Whitlock and Larsen 2001) and then bleaching the sediment for 4 to 12 hours. Charcoal is then counted and charcoal morphology determined for each sample on a gridded petri dish at 40 times magnification. Morphology types follow those established for similar fuel types (Enache and Cumming 2007). After each sample is counted, charcoal frequency and diversity should be calculated for the entire core. Charcoal sent for radiocarbon dating should first be identified to plant type, if possible.

Faunal Analysis

Analysis of faunal remains should be performed by a trained and well equipped faunal analyst who has gained experience working with or under established practitioners. As with other specialties, many best practices are held in common among faunal analysts (e.g., use of comparative specimens); however, a number of methodological disagreements are well documented (e.g., Brewer 1992; Klein and Cruz-Uribe 1984; Reitz and Wing 2008). Generally these disagreements center on quantification, which forms the ground work for all further statements regarding resource use and selection. Recently, Steele (2015) has provided a useful review of zooarchaeology and suggests that the field has grown into an influential sub-specialty in archaeology.

Identification

A general discussion of guiding principles for faunal identification is provided below. The reader is referred to Driver (1991) and Reitz and Wing (2008) for a more detailed review and critique of identification procedures.

Zooarchaeological analyses begin with grouping taxa into meaningful, explicitly identified, and comparable categories (Driver 1991). Taxonomic terminology should include Linnaean binomial nomenclature (e.g., *Bos taurus*) along with a consistently applied common name at first mention of a taxon. After this paired definition, it would be suitable to use Linnaean terminology or consistently use the common name. In cases when genus or species level taxonomic identifications cannot be made, gross classification is necessary (e.g., large ungulate). Occasionally highly fragmented or generally non-descript portions of elements may be assigned to even grosser taxonomic categories (e.g., Linnaean Class), but may be assigned to an unidentifiable or indeterminate category. Each skeletal element should be assessed on its own merits and should not be assumed to be representative of a taxon that dominates the assemblage. The temporal and geographic context should be considered during identification.

Physical guides for identification are important and should be used extensively during the analysis process. There are many kinds of guides that can be used, but the most common include: 1) written descriptions; 2) photographs or hand drawn illustrations; and 3) comparative specimens. Identification should include at least the following categories: taxon, skeletal element, presence of non-repeating landmark, and mass. Description of identification characteristic and photographs of unusual specimens may also be useful. It may also be useful to collect information suitable for age, sex, and season of death (e.g., Livingston 1985). Consistency in use of recording makes intra- and inter-site comparison simpler and allows calculation of different counting measures (see Quantification discussion below).

Analyst experience is one aspect of faunal analysis that can provide substantial bias in the archaeological record (Reitz and Wing 2008). Inexperienced analysts should work more closely with those who have led more analysis projects and a QA/QC process should be implemented in order to provide consistent and accurate identifications.

Genetics

The field of aDNA has expanded dramatically in the last 20 years (Richards et al. 1993; Witt et al. 2015). The field has become increasingly important to faunal analysis because it can provide precise and accurate taxonomic identification that may not be possible through typical macroscopic analysis techniques (see discussion in Stevenson 2011). Additionally, genetic data can be used to address population level research questions that would be otherwise unanswerable (e.g., Ames et al. 2015; Witt et al. 2015). To date, the field has relied most heavily on the extraction of mitochondrial DNA (mtDNA) from archaeological specimens because there are many more copies of this type of DNA per cell than nuclear DNA (but see Barta et al. 2014). aDNA is often highly degraded and requires strict contamination controls to properly extract, amplify, and correctly identify (e.g., Yang and Watt 2005). Labs lacking these contamination controls and protocols may easily produce false results; therefore, only established aDNA labs like the Kemp Lab or Molecular Anthropology and Ancient DNA at Washington State University and the Ancient DNA Lab at Simon Fraser University should be used for aDNA research. One drawback of aDNA is its cost (as much as $300 per sample); however, given the potential to yield information about past biogeography and human activities that cannot be obtained any other way, the cost may be justified, especially on larger projects where it could be a smaller percentage of the overall budget.

Quantification

Quantification issues have occupied a substantial amount of archaeological thought (Casteel and Grayson 1977; Driver 1991; Grayson 1984; Reitz and Wing 2008. A review of this discussion is not necessary in a document of this scope or scale. The reader is referred to Grayson (1984) for a critical review of issues in quantification.

Importantly, quantification for projects conducted under this research design should employ common methods. Number of Identified Specimens (NISP) (Grayson 1984) is the simplest counting measure in faunal analysis and should be used and reported in all circumstances. Other counting measures, such as Minimum Number of Individuals (MNI) can easily be calculated from NISP if element/portion frequency is reported as part of the raw data. Specimen mass should be recorded because allometric analysis (e.g., Quitmeyer and Reitz 2006) can provide useful insights into foraging; however, this technique, as many others, has issues with data aggregation and averaging.

Taphonomy

Understanding taphonomy is crucial for accurate interpretation of archaeological deposits (Elder 2010; Gifford 1981; Lyman 1987). In essence, taphonomic factors are those factors that contribute to how we perceive the archaeological record including: creation of deposits, post-depositional processes, and, finally, archaeological recovery methods that inherently introduce bias. Without proper consideration of the bias introduced by these factors, interpretation of archaeological data may not be accurate. Lyman (1994) and Behrensmeyer and Hill (1980) present detailed considerations of taphonomy, development of the field of study, overview of considerations, and practical examples. Butler's (1990) dissertation provides an excellent case study for the consideration of taphonomy and its role in archaeological interpretation in the Pacific Northwest, especially one that has ramifications for Columbia River subsistence pursuits. Marks on bone such as gnawing marks (e.g., Haynes 1980; Selvaggio 1994), cut marks (e.g., Lyman 2005; Willis et al. 2008), and digestive etching (e.g., Butler and Schroeder 1998) can also provide useful insight into taphonomy.

Bone Modification

Modifications to bone are important for understanding how resources were used. Morlan (1984) commented on the appropriate identification of bone alteration and distinguishing intentional bone modification from modification as a result of natural processes. These modifications can include cut marks (Blumenschine et al. 1996; Lyman 2005), digestive etching (Butler and Schroder 1998), heating (Bennett 1999; Church and Lyman 2003; Stiner and Kuhn 1995). Bone modification is also important for understanding its use as a medium for tool production (Shipman and Rose 1988). Bone tool replication is a common method for providing this understanding (see Newcomer 1974). Study of legacy collections can also provide modern investigators with a greater understanding of bone tool forms.

Faunal Analysis in Practice

Because faunal analysis varies substantially from investigator to investigator it is important to identify exemplary studies that can provide a guide for new efforts. Although some techniques have advanced dramatically in the last 30 years, Livingston (1985) still provides an excellent overview of methods and techniques relevant to Columbia Plateau faunal analysis. Butler's (2003) analysis of fish remains from Marmes Rockshelter stands as one of the most concise and well formulated analyses of fish remains from the Columbia Plateau. Additionally, Ford (2004) provides an excellent example of invertebrate faunal analysis for the Marmes Rockshelter. Lohse et al. (1984) includes a detailed analysis of mammal and avifauna that is a good example of Columbia Plateau non-fish faunal remains. A detailed analysis of intentionally modified bone and shell was performed for the Wells Reservoir project (Chatters 1986) and provides an excellent example of analysis of these kinds of tools.

Lithic Analysis

Most importantly when reporting a lithic assemblage is to clearly define the terms that will be used, and then use them consistently. Terms that are common in one area, or among researchers trained at a particular school (for example), still need to be defined for a general audience and as a check on regional differences. For large assemblages and data recovery projects, it is advisable to subcontract to a specialist lithic analyst if one is not available in house. However, the majority of inventory and testing projects will produce only a few artifacts, which can be reported by any qualified regional archaeologist using the following conventions. Additional technical details can be found in Clarkson and O'Connor (2006) and Andrefsky (2000, 2003, 2009).

The "lithic reduction sequence" and "*chaîne opératoire*" are key concepts for understanding stone tools as components of past economic and social systems (Figure A-2). These two concepts are functionally very similar and encompass the entire use life of the artifact. A complete analysis begins with properties of the raw material environment, through acquisition, production, use, refurbishing and reuse, curation, and/or discard (Andrefsky 2009). These concepts also include social organization (e.g., division of labor) and social planning (logistics of provisioning), as well as considerations of the cultural significance of tools or raw materials (e.g., is exotic obsidian higher status than local chert?). To build up to such broad inferences, a suite of solid data recording and analytical methods are employed. The following techniques are generally accepted and have analytical utility for the types of assemblages found in the CRB.

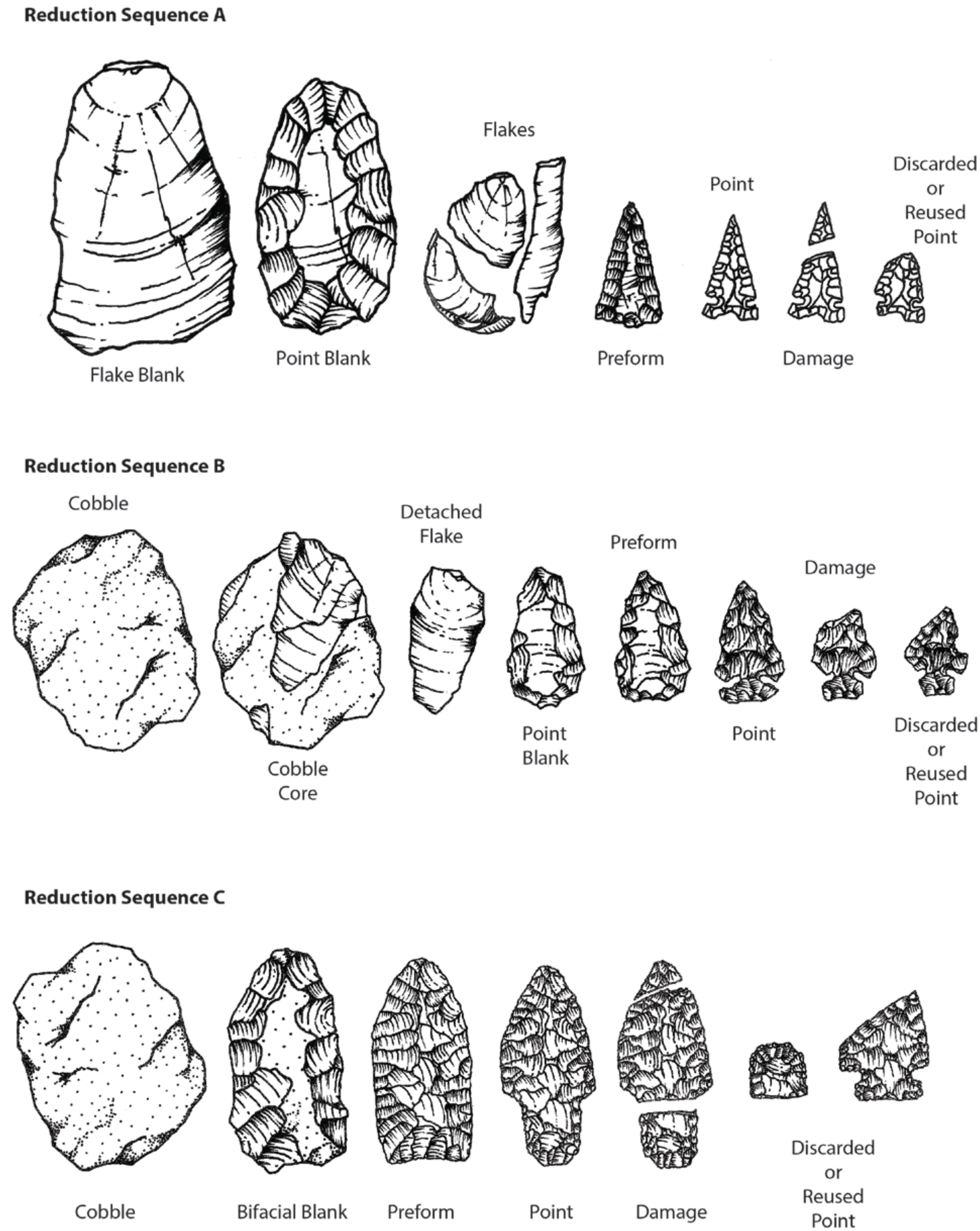

Figure A-2. Stone tool reduction sequences typical of the CRB.

Projectile Points and Bifaces

Minimum reporting requirements for projectile points and bifaces are an outline of the artifact shape, measurements in three dimensions (maximum length, maximum width, and maximum thickness), and an estimate of material type. This is because meaningful analysis of projectile points and bifaces first considers morphology and style as chronological and potential ethnic markers. Then it moves to technical considerations of manufacture, and the potential reworking or recycling of earlier, larger forms into smaller variants. Identification of the raw material type is important for questions of technology (i.e., workability, durability, and suitability for a given task). Material type is also needed for considerations of distance to the source, which will have implications for questions of mobility and the extent or range of social networks. Bifacial knives, burins, gravers, drills, and cobble tools can range from formal to informal types.

The majority of work in the CRB has been focused on questions of morphology and stylistic variability in order to perfect a chronology of point types. To this end, battleship curve presentations of point types have been advocated by Lyman (2000). Lyman has argued that chronological sequences in the Pacific Northwest track too closely to major geological strata and that seriation analysis should be employed to gain a more nuanced view of the transitions between periods (as reflected in diagnostic artifact types). A description of index projectile points can be found in Section 5.2 (Figure A-3).

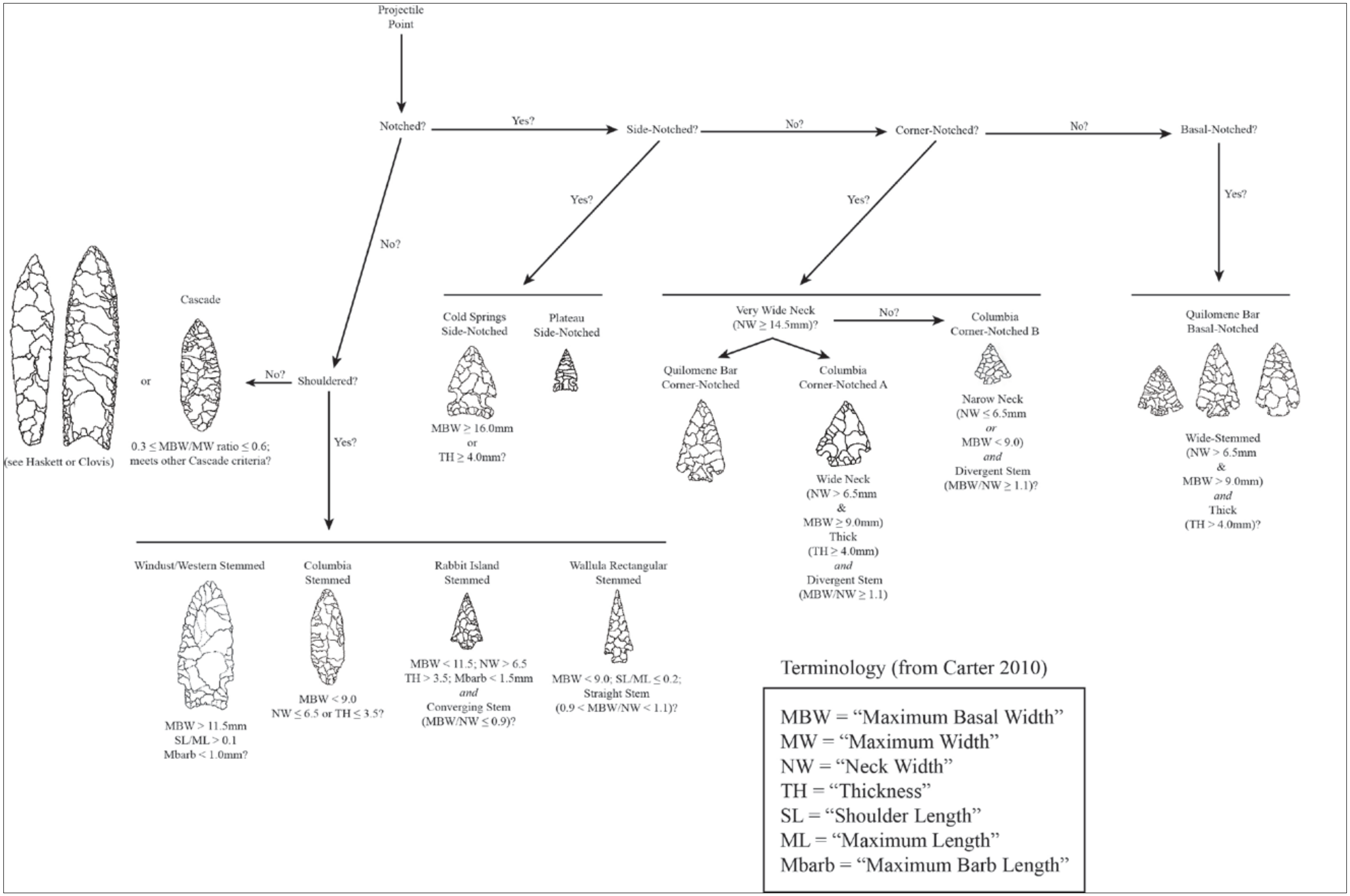

Figure A-3. Decision tree for typing projectile points (after Carter 2010; Lohse 1985).

Informal Tools and Debitage Analysis

Informal tools, as defined here, include flakes or cobbles exhibiting retouch or obvious use wear. Unifaces, scrapers, and utilized flakes all fall into this category. Some useful measures for describing these in reference to questions of mobility and use life have been devised. Retouching is indicated by flake detachments that modify the flake or tool margin. Hiscock and Attenbrow (2003) developed two simple measures of stone tool retouch in their study of early Australian scrapers. These can also be used in the CRB. The measures are called the Retouch Perimeter Index and Extent of Retouch Index. The first is simple ratio between the length of the retouched edge and the total available tool edge. It has a value between 0 and 1, where 0 is a lack of retouch and 1 is a completely retouched edge. The Extent of Retouch is calculated by dividing the tool into eight segments and tallying the number of segments that contain retouch. Kuhn's geometric index measures the amount of reduction of a unifacial scraper (Kuhn 1990). It is the ratio between the height of the scraper edge and the thickest part of the tool (Figure A-4). The underlying assumption is that more reworking will bring the edge margin thickness closer to the thickness of the stone.

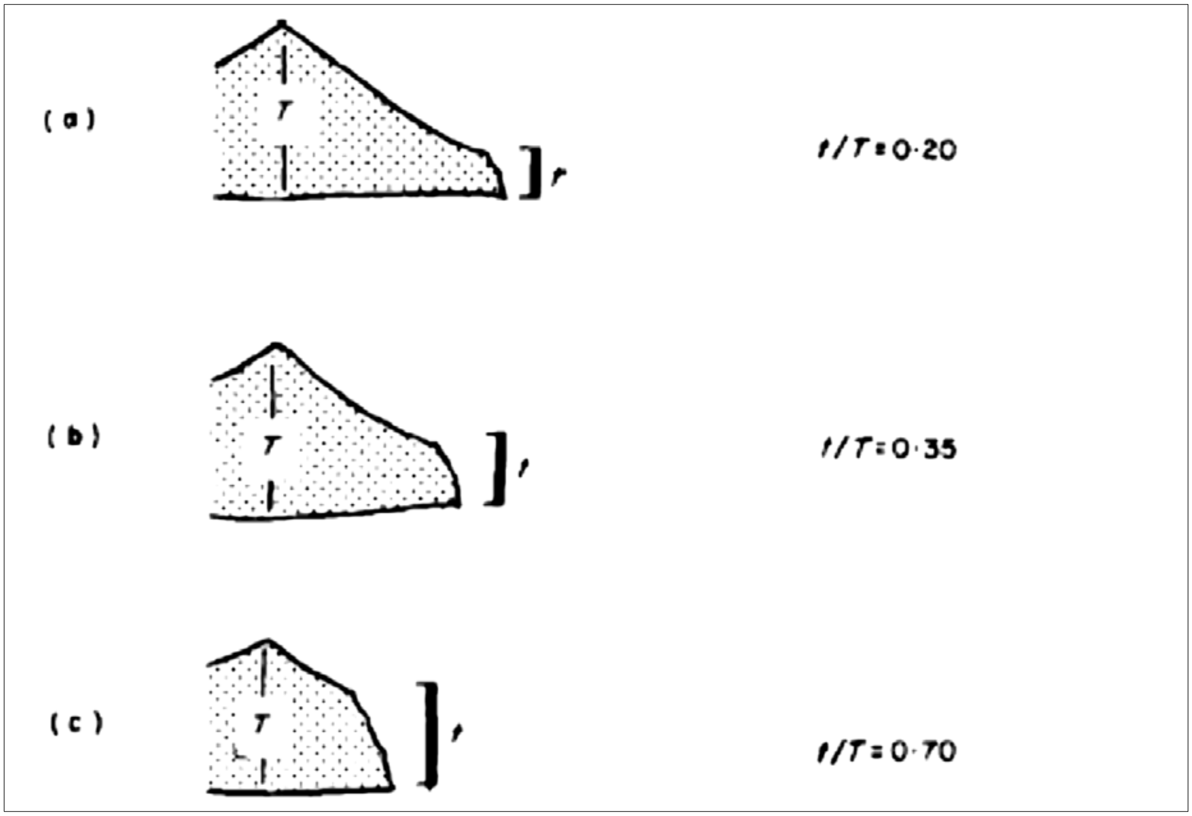

Figure A-4. Schematic of the Geometric Index measuring reduction sequence of unifacial scrapers, expressed as a ratio of t/T (reproduced from Kuhn 1990:585).

Debitage as a category includes cores, flakes, and shatter left over from flintknapping. In addition to the measurement and stylistic study of formal tools, an analysis of the products and byproducts of flintknapping can be very informative of past lifeways and economic strategies. Greater familiarity with the knapping process will help the researcher in identifying flakes and interpreting how they were formed. Several general texts are helpful (Crabtree 1972; Inizan et al. 1992; Whittaker 1994), and hands-on experimentation in flintknapping is strongly recommended.

For studies of mobility and social networks the single most important variable is raw material type. The artifacts should first be divided by material type, so that some understanding of distance to the source can be ascertained. Material type is also important for studies attempting to identify the *chaîne opératoire* of a stoneworking industry. Flintknapping, referring specifically to the production of points and blade-like cutting tools, can only be achieved using crystalline, glassy, and large grained homogenous stone (Clarkson and O'Connor 2006). However, stoneworking for other purposes is also observed on granitics or even sandstones, through mechanisms such as pecking, abrasion, and polishing to produce artifacts such as groundstone and sculpture (Adams 2002).

Lithic assemblages can be divided between informal tools, cores, flakes, and shatter (aka tools and debitage). Flakes are defined by the presence of a striking platform, bulb of percussion, and other characteristic attributes shown in Figure A-5. The Hertzian cone that is formed when a suitable stone is struck will produce these attributes that are indicative of conchoidal fracturing. Shatter as a category includes additional smaller pieces of the same raw material broken off during the knapping process, but without clearly intact striking platforms. The analytical value of flakes is much greater than that of shatter.

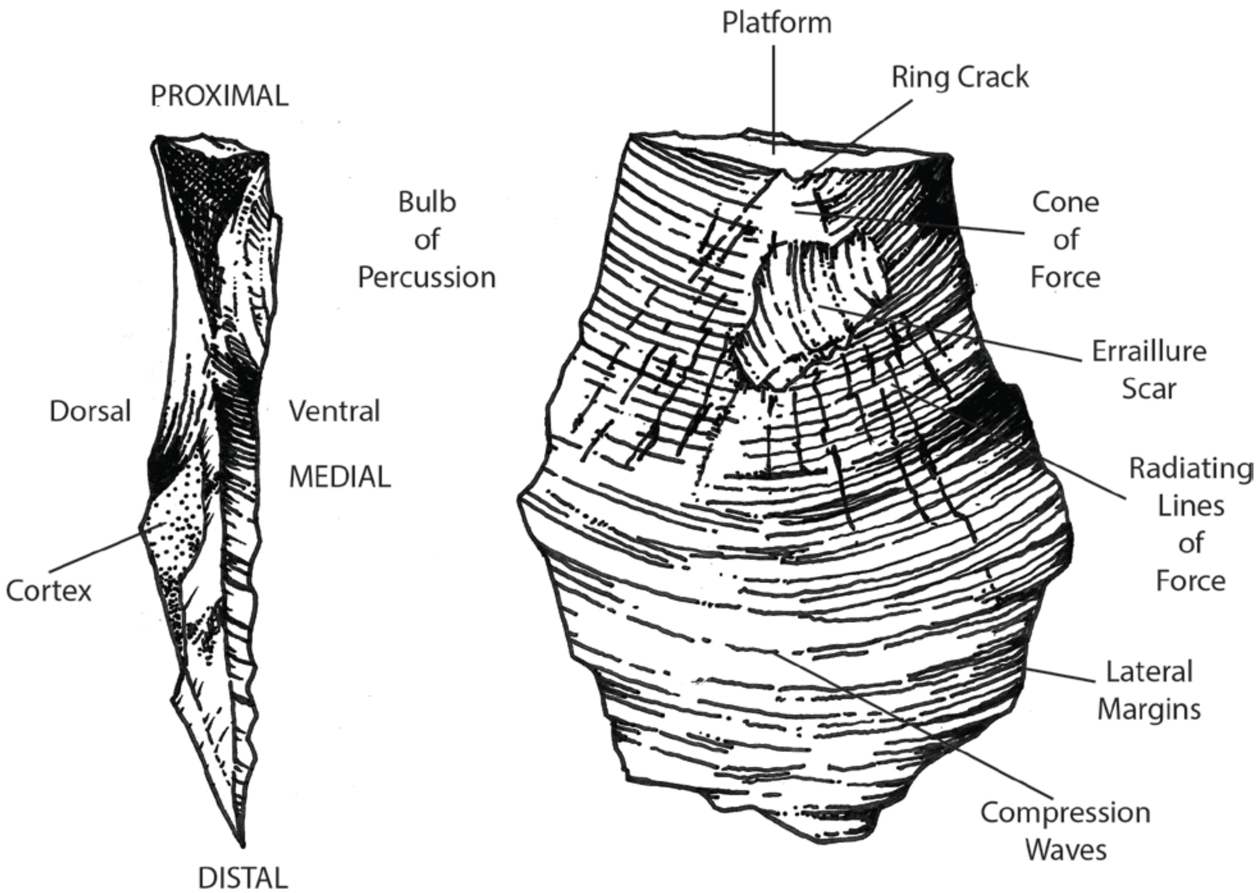

Figure A-5. Flake attributes and descriptive terminology (reproduced from Clarkson and O'Connor 2006:53).

Size and cortex (exterior rind of the original rock) are the most useful measures of stage of reduction. Measures of cortex can be reported as simple presence/absence or using a three-stage categorization (Primary, Secondary, and Tertiary). These terms vary between researchers and, therefore, it is necessary that these terms be defined wherever they are used. One possible definition is for primary flakes to be those having cortex covering the entire exterior (dorsal) surface. Secondary flakes have some fraction of cortex (percentage defined by researcher), while Tertiary (aka Interior) flakes have no remaining cortex. Although very simple in concept, this is a remarkably powerful measure of site activity. For example, Kuhn has used the presence or absence of cortex on endscrapers to help build a case for changes in provisioning strategies at an upper Paleolithic rockshelter in Turkey (Kuhn 2004). Using these same concepts, a complete reduction and reuse sequence of local materials was documented in the Lake Roosevelt region on Deadhorse Site 45ST63 (Roulette et al. 2000:307–310). At the extremes, domestic contexts are expected to have a preponderance of interior flakes, while sites near a quarry will exhibit mostly cortical flakes.

Mass analysis has been a popular method for rapidly gaining metric data regarding debitage size that does not require handling each flake. The method is to sort the entire assemblage through progressively smaller screens in order to get a general measure of flake size as a proxy for stage of production. Such analysis is appropriate for shatter that has been separated into material types. However, for flakes this method has been criticized, in that it may produce inaccurate impressions of an assemblage if the material types are mixed or if the core technology varies (Andrefsky 2009). Some experiments have shown that debitage size variability may reflect the individual toolmaker rather than the technology (Olausson 1998; Shelley 1990). In homogenous collections, this method might be useful for corroborating a first impression, for example, at a quarry site where the debitage is made up exclusively of large cortical flakes. However, distinctions between technologies will be lost using mass analysis/size grade segregation techniques on the flakes as a group.

More information is available through a careful examination of the flake types in the assemblage (Table A-3). Replication experiments in flintknapping have been of use in associating characteristics of flakes with specific technologies of reduction (e.g., Cotterell and Kamminga 1990; Flenniken 1985; Wilke 2002). Hard hammer techniques have been observed to produce pronounced bulbs of percussion, compression waves, radiating lines of force, and expanding flake margins. Soft hammer percussion should produce narrower flakes with more diffuse bulbs and fracture surfaces. Pressure flaking is identifiable on the artifact by small, regular, parallel detachments with deep initiation points. Deep and narrow notches formed by multiple flake detachments may also be indicative of pressure flaking. Pressure flakes themselves may be identified by the small size, thinness, high ventral curvature, possible bifacial platform, and exterior flake detachments, although hard hammer percussion cannot be entirely ruled out for such flakes (Clarkson and O'Connor 2006:8). Bifacial reduction flakes are identified by the presence of complex faceted and ground platforms, anterior flake scars, and the removal of the opposite margin, among other measures of curvature and platform angle. Bipolar flakes can also be identified by the presence of striking force on opposite ends of the flake or core.

Core reduction strategies include unidirectional, bidirectional, multidirectional, and bipolar flake detachments. Core rotation is identified by the orientation of flake detachments, and in the presence of redirecting flakes that reorient the flaking direction (Clarkson and O'Connor 2006:9). There are also a number of blade core and percussion industries that can be identified through core preparation strategies, such as the levallois or microblade traditions. Mass and size of cores are taken to be indicative of levels of reduction, where the size of the available raw material is known. Otherwise, the numbers of flake scars and remaining edge angles are more meaningful relative measures of reduction.

Table A-3. Frequency of Debitage Features in Stone Tool Manufacture (from Clarkson and O'Connor 2006:50).

Feature	Flaking				Abrasion	Pecking
	Hard Hammer	**Soft Hammer Flake**	**Pressure Flake**	**Bipolar Flake**	**Ground Implement**	**Pecked Implement**
Platform	Tend to large size and triangular	Variable size, tend to plano-convex	Small			
Bulb of force	Pronounced	Diffuse	Diffuse	Flat/Pronounced	N/A	N/A
Compression waves	Pronounced and closely spaced	Subdued and widely spaced	Subdued and widely spaced		N/A	N/A
Bulbar fissures	May be present	Rare	May be present			
Erraillure scar	Common (95%)/shallow	Less common/shallow	Rare/deep	Absent	N/A	N/A
Ring crack	Common (60-80%)	Rare (5-10%)	Rare	Absent	N/A	N/A
Bending initiation	Rare (<1%)	Common (20-60%)	Common			
Shape	Variable	Thin and expanding	Thin and parallel	Parallel	Variable	Variable
Platform scarring	Variable	Facetted/Crushed	Facetted	Crushed	N/A	N/A
Ventral curvature	Variable	Pronounced	Pronounced	Flat	N/A	N/A
Thickness	Thicker than soft hammer	Thinner than hard hammer	Much smaller			
Termination	Variable	Tend to feather	Variable	Crushed	N/A	N/A
Striations	N/A	Platform	Platform	Absent	Present	N/A
Impact pitting	N/A	Absent	Absent	Platform	Absent	Present

Refitting of flakes onto tools and cores has also been a successful method of reconstructing reduction technologies (Cziesla et al. 1990; Hofman 1981) where the full range of productive debris is available. Heat treating is known to improve the quality of marginal material (for example, lower quality cherts). It can cause alterations to the homogeneity of the stone when viewed at high resolutions (Flenniken and White 1983). Rapid heating and cooling will produce a variety of surface phenomenon, including potlids, crazing, and changes in color (Clarkson and O'Connor 2006).

BPA GIS Specification for FCRPS Cultural Resources Program Data

Updated 7/22/15

1. GPS/GIS STANDARDS FOR ARCHAEOLOGICAL FIELD INVENTORY

The Agencies seek assistance to use GPS (global positioning system) to collect cultural resource Site, Survey, Documentation Methods, and Cultural Material locations within the Location of Work, as defined in the main body of the Statement of Work. The contractor will collect, edit, and differentially correct GPS files and then transmit projected ESRI geodatabase feature classes with tabular information and FGDC metadata as a deliverable. See Attachment 1: GIS data dictionary for a list of required fields, field definitions, and values. This data dictionary is not intended to represent all of the possible information collected in the field. It is the information the agencies need for internal purposes.

1a GPS data collection

The contractor will load a Data Dictionary or XML to the GPS unit. The Data Dictionary or XML file must match the BPA FCRPS Cultural Resource Program specifications[13] for Feature Class Names, Field Names, Data Types/Lengths, and Field Definition and Values (Domains). If the contractor is unable to use the BPA's XML data dictionary or geodatabase template, the contractor will create the data dictionary using the information provided in Attachment 1: GIS Data Dictionary.

1b GIS Data Formatting

GIS Deliverable requirements:

<u>Geodatabase Format:</u> Tabular fields will be populated with information as specified in the Attachment 1: GIS Data Dictionary. All feature class names, field names, and value choices must match the naming conventions in Attachment 1: GIS Data Dictionary. The deliverable will include one geodatabase containing all deliverable feature classes. The deliverable will include one feature class for each type of feature. For example, all survey polygons will be in the Survey_Poly feature class. GIS features of the same type stored as individual features or individual shapefiles will not be accepted.

<u>Spatial Reference:</u> All GIS data will be correctly projected. Questions about appropriate projection should be directed to the BPA COTR.

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[13] Note that BPA maintains two separate Data Dictionaries: one for the jointly managed FCRPS Cultural Resource Program, and one for cultural resource compliance in support of transmission and fish and wildlife projects.

GIS Metadata Format: There are twelve feature classes in Attachment 1: GIS Data Dictionary. Each feature class in the GIS deliverable will have metadata. The required metadata format is ESRI ArcCatalog Metadata using the FGDC standard: North American Profile (NAP) of ISO 19115 2003. The ESRI ArcCatalog Metadata will have these fields populated; Tags, Summary, Description, Credits, Citation Contact(s), Resource Citation Date(s).

Deliverable: Final ESRI geodatabase on two (2) compact disks shall be submitted with the final report.

1c Review

GIS deliverables will be reviewed to ensure that they meet the requirements described in Task 1a and 1b. The contractor must remedy missing or incorrect requirements by the date or timeline specified in the contract.

Any questions concerning GPS or GIS should be directed to Melanie Wadsworth 503-230-5143 or mlwadsworth@bpa.gov.

GIS Attachment 1

GIS Data Dictionary

Field definitions for cultural resource geodatabase. **Highlighted fields should be filled out while field work is being conducted.**

Site Feature Classes; Site_Poly, Site_Pt, Site_Ln				
(Used to define site boundary during initial documentation and subsequent updates associated with condition assessment monitoring and /or resurvey. Also used to document evaluation field methods. **Use "Cultural Materials" feature class to document features and artifacts.**)				
Field Name	**Alias**	**Data Type**	**Field Size**	**Field Definition and Values**
Smith_Numb	Smith Number	Text	30	*Smithsonian Trinomial if applicable (8 digit string)*
Temp_Site_No	Temporary Site Number	Text	40	*Temporary site number used by contractor*
Site_Name	Site Name	Text	50	*Known site name*
Visit_Hist	Visitation History	Text	10	*Distinguish between newly recorded sites and revisitation associated with site condition monitoring* – Values: New, Monitoring
Field_Date	Field Date	Date	-	*dd/mm/yyyy*
Contractor	Contractor	Text	50	*Name of contracting company, agency, or tribe*
Site_Type	Site Type	Text	50	*General type of site*- Values: burial/grave/cemetery, camp, feature, quarry, rockshelter/cave, scatter, village/community, historic, homestead, structure, multicomponent, unknown, other
Cult_Period	Cultural Period	Text	100	*Cultural period in which site was utilized*- Values: **unknown**, **Paleo** (10,500 BP or earlier), **Archaic** (Specific period not established), **Early Archaic** (10,500 BP-7,000 BP), **Middle Archaic** (7,000 BP-2,000 BP), **Late Archaic** (2,000 BP-Contact), **Contact period**, **Historic, 19th Century**, **Early 20th Century** (1900-1930), **Depression/WWII** (1929-1950), **Recent** (post1950), **Multicomponent (Historic & Prehistoric)**, **Multicomponent** (Prehistoric Only), **Multicomponent** (Historic Only), **Prehistoric** (undetermined pre-contact)
Nreg_Status	National Register Status	Text	35	*Status of National Register of Historic Places*- Values: Eligible, Evaluation Testing Recommended, Not Eligible, Listed, Nominated, Recommend Eligible, Recommend Not Eligible, Unevaluated, Unknown

Site_Condition	Site Condition	Text	30	*Site condition observed during this visit-* Values: **Unknown** [no data or condition unknown], **Excellent** [<5% damage], **Good** [between 5% and 40% damage], **Fair** [between 40% and 60% damage], **Poor** [between 60% and 95% damage], **Destroyed** [>95% damage]
Site_Impact	Site Impact	Text	40	*Impact to site-* Values: bioturbation, erosion (wind, sheet wash), grazing, recreation, reservoir erosion, undisturbed, vandalized
Min_Elevation	Minimum Elevation	Text	15	*Elevation of site in meters at lowest point*
Max_Elevation	Maximum Elevation	Text	15	*Elevation of site in meters at highest point*
Data_Der	Data Derived	Text	25	*How was data derived?* Values: GPS, digitized, report narrative, personal communication
Lnd_Man	Land Manager	Text	30	*Responsible land management party-* Values: United States Army Corps of Engineers, Bureau of Reclamation, National Park Service, Forest Service, Tribal, Private, and Unknown
Comment	Comment	Text	255	*Open field for additional information*

Survey Feature Classes; Survey_Poly, Survey_Pt, Survey_Ln				
(Used to document new survey and resurvey transects.)				
Field Name	**Alias**	**Data Type**	**Field Size**	**Field Definition and Values**
Field_Date	Field Date	Date	-	*dd/mm/yyyy*
Survey_Tp	Survey Type	Text	20	*Type of survey conducted* – Values: **New** [area not previously surveyed using systematic transect intervals], **Re-survey** [area previously surveyed using any methods], Reconnaissance [area surveyed, but not using systematic transect intervals]
Contractor	Contractor	Text	50	*Name of contracting company*
Title	Report Title	Text	255	*Full title of report*
Dt_Report	Date of Report	Text	4	*Date report was completed;* Stored as year
Data_Der	Data Derived	Text	30	*How was GIS data derived?* Values: GPS, digitized, report narrative, personal communication
Interval	Transect Interval	Text	20	*Interval of survey in meters (use "N/A" for reconnaissance survey)*
Comment	Comment	Text	255	*Open field for additional information*

Documentation Methods and Control Points; Doc_Poly, Doc_Pt, Doc_Ln				
(Used to document methods employed to document and evaluate cultural resources, including excavation and condition monitoring.)				
Field Name	**Alias**	**Data Type**	**Field Size**	**Field Definition and Values**
Cont_Pt_Tp	Control Point Type	Text	50	*Type of control point(s) used for NR determination and/or condition monitoring-* Values: Site Datum(s), Erosion Control Point, Photo Point, Shovel Test Probe, Excavation Unit/Trench, Surface Collection Unit (no excavation), Disturbed Area, Waterline, Cutbank, Other
Cont_Pt_Nm	Control Point Name	Text	30	*Name of control point* (examples: "Datum-1", "STP-3", "Disturbance Area-2"). **A corresponding description of each control point must be included in field notes (Example: "Disturbance Area-3 measures 8m N-S by 6m E-W and ranges from 3cm to 20cm deep. Artifact context has been altered by ATV use in area, which has churned sediments).**

Cultural Materials Feature Classes; CultMat_Poly, CultMat_Pt, CultMat_Ln				
(Used to record cultural materials within or outside a site boundary during initial documentation, or subsequent monitoring - artifacts collected, diagnostic artifacts, features, site datum, photo points, erosion station points, etc.)				
Field Name	**Alias**	**Data Type**	**Field Size**	**Field Definition and Values**
Smith_Numb	Smith Number	Text	30	*Smithsonian Trinomial if applicable (8 digit string)*
Temp_Site_No	Temporary Site Number	Text	40	*Temporary site number used by contractor*
Field_Date	Field Date	Date	-	*dd/mm/yyyy*
Contractor	Contractor	Text	50	*Name of contracting company*
Obj_Type	Object Type	Text	25	*What is being recorded?* – Values: Artifact, Feature, Loci (artifact concentration), Isolate (use only if object is outside site boundary)

Obj_Type_Nm	Object Type Name	Text	100	*Name of data being collected* (example: Feature-1, Projectile Point-3, Ground Stone-13, Locus-2, etc.) **Object Type Name and description must be included in the field notes/monitoring form (Example: Ground Stone-13 is a basalt hammerstone 13cm x 6cm x 8cm with use wear on one end)**
Art_Collect	Artifact Collected	Text	5	*If Object is an artifact, was it collected?* Values: Yes, No
Art_TCM	Artifact Temporary Catalog Number	Text	20	*If Object is a collected artifact, what is the temporary field catalog number?*
Comment	Comment	Text	255	*Open field for additional information*

Artifact Curation

Introduction

A required outcome of fieldwork associated with monitoring, inventory, evaluation, or data recovery is proper curation of the objects and data that result from these investigations. The importance of proper curation of products cannot be understated. The FCRPS Program is designed to foster legacy, and a large part of the legacy is in the curated collections of objects and data.

In 1990, Federal curation issues were highlighted by two legal requirements. The first is a Federal regulation, 36 CFR Part 79, Curation of Federally-Administered and Managed Archaeological Collections, which provides general guidance on the care of Federal agency archaeological collections. The regulation outlines basic collections management procedures and standards, including access to and use of Federal collections. It presents general criteria for evaluating curatorial services provided by collection repositories and provides sample contract language that may be used by Federal agencies in procuring curation services. As implementation of the requirements of 36 CFR Part 79 was left to each Federal agency the participating FCRPS Agencies have different agency-wide written curation policies.

The second requirement was NAGPRA (25 USCS 3001 et. seq.). NAGPRA requires that all Federal agencies determine if their existing archaeological collections contain Native American, Native Alaskan, or Native Hawaiian human skeletal remains: funerary objects; sacred objects; and/or objects of cultural patrimony. These items are then to be offered for repatriation to lineal descendants or to culturally affiliated tribes. Similar items discovered in future intentional excavations or by inadvertent discoveries are also regulated by NAGPRA. Additionally, this law also addresses the disposition of new discoveries of human remains and associated grave goods.

Scope of Collections Statement

Each of the Agencies is responsible for the collections made from that particular Agency's managed lands. As a result, BPA is responsible for some limited collections recovered from past activities. In an ongoing manner, Reclamation and USACE are responsible for the fee lands they manage and actively budget for collections curation.

The FCRPS Program collections are generally limited to collections of material culture and associated hard copy and electronic archival documents. The material culture collection includes archaeological materials either systematically excavated or otherwise recovered during compliance efforts from within defined reservoir Project Area boundaries. Some of the collections predate the creation of the FCRPS, with the bulk of those being recovered during the early salvage activities conducted prior to the construction of the dams and subsequent filling of the reservoirs. Some of the collections contain program associated ethnographic materials. In addition, and generally curated within the same facility, are hard copies of field notes.

Uses of Collections

The FCRPS museum collection may be used for exhibits, interpretive programs, or other interpretive media, research, and publications. The primary considerations for the use of museum objects are their preservation, research, and interpretative purposes.

Collections of material culture from previously collected or excavated sites should be of particular value to FCRPS Program researchers. Researchers and other specialists who wish to pursue research objectives of sites under the authorities of the FCRPS Program are encouraged to examine objects and archival materials. Outside researchers must submit a research proposal to the Federal agency for review by the appropriate Agency official. If applicable, the research proposal may be discussed with appropriate FCRPS Cooperating Groups before access to the collection is granted by the responsible agency.

Objects may be loaned out to qualified institutions for approved purposes. These institutions must meet accepted museum standards for security, handling, and exhibition of museum objects. Sensitive materials may require additional conditions prior to a loan commitment. Expenses related to loans of museum objects, including shipping and insurance, will normally be assumed by the borrower.

Curation Facilities

Each land managing agency maintains administrative control of the archaeological collections associated with FCRPS activities even though collections are maintained at academic or tribal repositories. The SWRD puts a firm emphasis on using existing materials and information in support of NRHP evaluation of properties that are candidates for treatment.

FCRPS currently has collections housed at the following repositories:

<table>
<tr><th>Project</th><th>Repositories w/ Curation Agreements</th><th>Temporary Curation Facilities or Facilities w/ no Curation Agreement</th></tr>
<tr><td>Bonneville</td><td>Burke Museum, Seattle, Washington;
Yakama Museum, Toppenish, Washington</td><td rowspan="3">Collections from all Portland District Projects curated at Oregon State Museum of Natural and Cultural History, at no charge</td></tr>
<tr><td>The Dalles</td><td></td></tr>
<tr><td>John Day</td><td>Tamastslikt Cultural Institute, Pendleton, Oregon</td></tr>
</table>

Project	**Repositories w/ Curation Agreements**	**Temporary Curation Facilities or Facilities w/ no Curation Agreement**
McNary[14]		
Ice Harbor	Washington State University, Pullman, Washington	
Lower Monumental		
Lower Granite		
Little Goose		
Dworshak		University of Idaho
Chief Joseph	Confederated Tribes of the Colville Reservation Curation Facility, Nespelem, Washington	
Albeni Falls	N/A	Eastern Washington University; NIRAC; Kalispel Tribe
Libby	Confederated Salish and Kootenai Tribal Curation Facility	
Grand Coulee	Spokane Tribe of Indians Curation Facility, Wellpinit, Washington; Confederated Tribes of the Colville Reservation Curation Facility, Nespelem, Washington	
Hungry Horse	Confederated Salish and Kootenai Tribal Curation Facility	

Types of Collections

Cultural Collection

The purpose of these collections is to guarantee preservation and protection of the material culture of past generations whose *in-situ* preservation cannot be assured. To that end, the collections provide opportunities to increase knowledge and inspiration among present and future generations through research, interpretive programs, and exhibits. The following list identifies, by discipline, object types appropriate to the FCRPS's museum collection and, as needed, notes current representation.

[14] Collections from McNary, Ice Harbor, Lower Monumental, Lower Granite, and Little Goose administered by the USACE Walla Walla District are curated as a single collection at Washington State University.

Archaeology

Archaeological collections are generated in response to CRM requirements related to legal mandates, development of FCRPS facilities, preservation-related activities, research requirements, and interpretive needs. According to 43 CFR Part 7.13 - Custody of Archaeological Resources:

> (a) Archaeological resources excavated or removed from the public lands remain the property of the United States. The exception to this is inalienable and communal property, as defined by NAGPRA, and (b) Archaeological resources excavated or removed from Indian lands remain the property of the Indian or Indian tribe having rights of ownership over such resources.

The archaeological collection includes artifacts, human remains, and other materials obtained using archeological methods.

Archive Materials - The FCRPS library is housed in the program offices of the FCRPS cultural program of BPA. This collection includes books, administrative documents, technical references and contract deliverable reports (otherwise known as “grey literature”) documenting compliance activities by the Federal agencies and their contractors. Books and manuscripts having direct association with the FCRPS CRP will continue to be included in the museum collection.

Archaeological Field Records - All records associated with archaeological collections are retained as part of the field collections. These records include field notes and catalogs, daily journals, drawings and maps, photographs and negatives, slides, sound recordings, raw data sheets, instrument charts, remote sensing materials, collection inventories, analytical study data, conservation treatment records, computer documentation and data, and any other documents generated.

Artifacts and Specimens - Archaeological research projects within the FCRPS may result in the collection of artifacts (both prehistoric and historic), ecofacts, or other data as a result of FCRPS funded activities. Materials from both Native American sites and historic Euroamerican sites are included in this category. If materials are collected, their precise provenience information must be recorded.

Confiscated Archaeological Objects - These are objects recovered from unauthorized and illegal activities. They might include unearthed artifacts, ecofacts, and human remains illegally excavated or uncontrolled surface collecting by unauthorized individuals within the boundaries of the FCRPS Project Areas. Such objects might be held temporarily as evidence if legal action is to be taken. If provenience is known, artifacts go back to the landowner once legal questions are resolved. Native American human remains may be subject to the NAGPRA process.

Ethnology

The FCRPS has important ties to Native American tribes within the system. The ethnology collection is a limited component of the FCRPS's curation activities, as few ethnographic items have been recovered in the past, and there is little expectation that this will change. Items that have been acquired in the past are curated at several facilities.

Objects – Ethnographic material in the FCRPS collections were acquired primarily through gifts between 1928 and 1976. There is no active solicitation of the ethnographic objects aside from oral histories and photographs used to document the history of the region and the program.

Future Collections Activity - The FCRPS may continue to acquire ethnographic material from the Native American groups that have aboriginal, historic, or religious ties to FCRPS lands, if collection and curation of such collections are acceptable to the associated tribe. All such future collections activities will proceed in close cooperation with tribal councils, THPOs, and Elders.

Ethnographic Records - All records associated with ethnographic collections are retained as part of the museum collection. These records may include field notes; interview schedules, tapes (video and audio), interview transcripts; negatives, prints and slides; data sheets (all subject to restrictions of confidentiality, if any); artifact inventories; analytical study data; computer documentation and data; reports generated by ethnographic investigations; and any other documents generated.

Future Collections Activity

Future collections activity will concentrate on the curation of objects and documentation directly associated with FCRPS funded fieldwork and research.

Appendix B – Monitoring Methods, Documentation, and Reporting

Information collected from monitoring is essential to the FCRPS Cultural Resource Program in that is serves as the basis for NHPA section 106 effects determiniations and damage assessments for Archaeological Resource Protection Act violations. Monitoring methods in the following sections were developed by Steven A. Jenevein, of Warm Springs Geo Visions, in 2014 (Jenevein 2014) for the Wana Pa Koot Koot Cooperating Group, which provides advice and assistance to the Corps and BPA for the Bonneville, The Dalles, and the John Day multipurpose projects. That document is included here in its entirety, and is intended to provide users with an example of monitoring protocols that could be applied to all projects addressed by the FCRPS Cultural Resource Program.

Archaeological Site Condition Monitoring Plan for the Bonneville, The Dalles, and John Day Projects of the Federal Columbia River Power System (FCRPS)

FINAL REPORT

Prepared by

Steven A. Jenevein
Warm Springs Geo Visions

Prepared for

U.S. Army Corps of Engineers Portland District
CENWP-CT-C, 333 SW 1st Street
Portland, OR 97024

December 22, 2014

Work jointly funded by the U.S. Army Corps of Engineers and Bonneville Power Administration under the FCRPS Cultural Resources Program.

U.S. Army Corps of Engineers Contract No. W9127N-14-P-0032

WSGV Report No. 14-16

Warm Springs Geo Visions PO Box 460
Warm Springs, Oregon 97761

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List of Tables

List of Acronyms

Agencies	Bonneville Power Administration, U.S. Army Corps of Engineers
APE	Area of Potential Effect
ARPA	Archaeological Resource Protection Act
BIA	Bureau of Indian Affairs
BPA	Bonneville Power Administration
BN	Bonneville Lock and Dam Project
COR	Contracting Officer's Representative
CRG	Cultural Resources Group
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CTWSRO	Confederated Tribes of the Warm Springs Reservation of Oregon
DAHP	State Department of Archaeology and Historic Preservation
FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
GIS	Geographic Information System
GPS	Global Positioning System
HPRCSIT	Historic Properties of Religious and Cultural Significance to Indian Tribes
JD	John Day Lock and Dam Project
MSL	Mean Sea Level
NAD83	North American Datum of 1983
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NPS	U. S. National Park Service
OHV	Off-Highway Vehicles
PDOP	Positional Dilution of Precision
PI	Principal Investigator
PWS	Performance Work Statement
SHPO	State Historic Preservation Office
SOP	Standard Operating Procedures
SOW	Scope of Work
TCP	Traditional Cultural Property
TDA	The Dalles Lock and Dam Project
USACE	U.S. Army Corps of Engineers, Portland District
USGS	United States Geographical Survey
UTM	Universal Transverse Mercator
WPKK	Wana Pa Koot Koot
WSGV	Warm Springs Geo Visions
Yakama	Confederated Tribes and Bands of the Yakama Nation

Introduction

This archaeological site condition monitoring plan (Plan) outlines standards and protocol for monitoring of archaeological resources within the Area of Potential Effects (APE) for the Bonneville, The Dalles, and John Day Projects of the Federal Columbia River Power System (FCRPS), Cultural Resources Program (Project). Archaeological monitoring is required to identify effects from the operation of the FCRPS on historic properties eligible for listing on the National Register of Historic Places (NRHP). Currently, no consistent data collection methods or procedures exist for the Bonneville, The Dalles, and John Day Projects managed by the U.S. Army Corps of Engineers (USACE), Portland District, making changes to a site's condition over time difficult to evaluate. The USACE and Bonneville Power Administration (BPA), in coordination with the Wana Pa Koot Koot (WPKK) Cooperating Group, have determined that a monitoring plan comprised of standard monitoring objectives, operating procedures, data collection methods, and documentation forms is necessary to facilitate determination of effects from the FCRPS (Study). This Study was conducted by the Warm Springs Geo Visions (WSGV) Cultural Resources Group (CRG), on behalf of the USACE, Portland District under Contract Number W9127N-14-P-0032.

The USACE, Portland District and BPA (Agencies) are jointly responsible for compliance with Section 106 of the National Historic Preservation Act (NHPA) under the terms of the 2009 Systemwide Programmatic Agreement for management of Historic Properties affected by operations of the FCRPS (BPA, Bureau of Reclamation, USACE 2009). Federal agencies are required to resolve adverse effects to National Register eligible historic properties under NHPA. The Agencies have worked closely with interested and affected Tribes, the Washington State Department of Archaeology and Historic Preservation (DAHP), the Oregon State Historic Preservation Office (SHPO), and other agencies for cultural resource management in compliance with Section 106 of the NHPA. This Study represents one part of the Agencies responsibility under Section 106 and 110 of NHPA, the Native American Graves Protection and Repatriation Act (NAGPRA), and the Archaeological Resources Protection Act (ARPA) to take into account the effects of operation and management of the FCRPS on historic properties.

Overview of Archaeological Site Monitoring

Archaeological site condition monitoring includes repeated site documentation and measurement of changes to a site's physical condition through time (Dierker and Leap 2005; Hargrave 2009; Walton 2003). Archaeological site monitoring is commonly associated with opportunistic site visitation that documents and describes the general site condition at the time. Opportunistic monitoring may occur as a result of a planned management activity such as replacement of buried utilities or other similar projects. It is usually a onetime event with no formal schedule set for when the site may be revisited. The types of information recorded about the site may also vary depending on the goals of the project, the conditions observed, and the experience of the recorder working with no formal site monitoring instructions or guidelines.

Archaeological monitoring is also commonly associated with a proposed construction project. Monitoring for construction activities is often more structured then opportunistic monitoring and usually has well defined goals and methods that are outlined in a project specific monitoring plan (Hargrave 2009). Archaeological site condition monitoring as described in this plan is different to these two types of monitoring because the monitoring field protocol, data analysis, and reporting are standardized to ensure the repeated collection of specific data meet defined standards set specifically for the needs of the FCRPS Cultural Resource Program. Collecting accurate and comparable data is critical for land managers to identify processes that could potentially affect a sites condition and is necessary for making informed management decisions or for prioritizing and formulating management recommendations for site treatment (Nickens 2005 ;Walton 2003). Site monitoring can identify potential threats, impacts or changes to a site's condition, and report on the effectiveness of previous management or treatment actions.

This cultural resource monitoring plan provides guidance on condition monitoring of historic properties located within the Project. The Plan and associated documentation was developed in consultation with technical representatives of the WPKK Cultural Resource Cooperating Group. Input and comments provided by WPKK members have been incorporated into both the Plan and associated forms, and have helped greatly to identify needs and priorities specific to the Project. Group members submitted comments either by mail or as part of a WPKK monitoring plan technical workshop that was held specifically as part of this study on April 23, 2014. The Plan is designed to address specific site condition monitoring needs and goals unique to cultural site types and impact agents present within the Project.

Report Organization

The Plan is divided into seven sections and four appendixes. The first section provides an introduction to the Study, regulatory framework, archaeological site monitoring, and report organization. The second section covers the Project setting and background, potential site types within the Project, and provides a summary of previous monitoring efforts. The third section discusses potential impacts and threats with a detail discussion of natural and cultural site impacts. The fourth section covers the monitoring plan design including goals, site selection and priority, frequency and timing and a schedule for when the Plan will be reviewed. The fifth section details monitoring protocol including forms, field preparation, baseline, repeat, and walkthrough monitoring, and photographic documentation. The sixth section covers data analysis and reporting and the seventh section covers administration aspects of the Plan including personnel requirements and training.

Appendix A includes Standard Operating Procedures (SOP) for baseline and repeat site monitoring (SOP 1), walkthrough monitoring (SOP 2), photographic documentation (SOP 3), and collecting monitoring related Global Positioning Systems (GPS) data (SOP 4). Appendix B includes examples of the FCRPS Archaeological Site Monitoring Form, FCRPS Walkthrough Site Monitoring Form, FCRPS Photographic Record, the FCRPS Photo Point Record, and the FCRPS Monitoring Continuation Sheet. Appendix C includes an example of a Project Management Summary Table and Appendix D includes an example of a Walkthrough Monitoring Visitation spreadsheet.

Study Setting and Background

The Study was conducted within FCRPS APE for the Bonneville, The Dalles, and John Day Lock and Dam Projects. The three run-of-river projects are located along a 252 kilometer (km) stretch of the Columbia River beginning roughly at the Bonneville Dam and ending upstream at the John Day Dam. The FCRPS APE includes all geographic areas potentially affected by on-going operation of the FCRPS that could alter the character or use of historic properties (BPA, Bureau of Reclamation, USACE 2009). The APE for the Bonneville, The Dalles, and John Day Projects can be generally described as all USACE, Portland District fee-owned lands and easements to include a 500 meter (m) buffer. In areas where fee-owned lands do not extend beyond the ordinary high- water shoreline, the APE is defined as extending 500 m inland from the ordinary high-water level.

Study Setting

Bonneville Lock and Dam Project

The Bonneville Lock and Dam Project (BN) was constructed in the 1930s to improve navigation along the Columbia River and provide hydropower to the Pacific Northwest (USACE 2014a). The Bonneville Dam was completed in 1937 creating Lake Bonneville that extends 77 km upstream to The Dalles Dam. A second powerhouse was added to the facility in 1981 and a larger navigation lock in 1993. The average pool elevation is 23.3 m above mean sea level (MSL). Maximum pool elevation is 25 MSL and minimum is 21.3 m MSL. The BN is moderately developed with major impacts from reservoir inundation, BN facilities, highway, road, railway, public recreation, and both commercial and residential development.

The BN is located within the deep and narrow Columbia River Gorge that is relativity narrow until widening at The Dalles Basin (Orr and Orr 2012). Shoreline morphology varies widely from vertical bedrock cliffs to low gradient sand and gravel beaches. Shorelines and surrounding slopes are generally thickly vegetated but transition into more arid plant communities towards the eastern end of the Project. Strong westerly gap flow winds are common and are the result of large temperature gradients between the east and the west ends of the Columbia River Gorge (Sharp and Mass 2004).

The Dalles Lock and Dam Project

The Dalles Lock and Dam Project (TDA) was completed in 1957 and includes a dam structure, navigation lock, spillway, powerhouse, and fish passage facilities (USACE 2014b). The construction of the dam created Lake Celilo that extends approximately 39 km upstream to the John Day Dam. The average pool elevation is 48 m above MSL. Maximum pool elevation is 49 m MSL and minimum is 47 m MSL. The TDA is light to moderately developed compared to the BN with major impacts from reservoir inundation, TDA facilities, highway, road, railway, public recreation, and some commercial and residential development.

Within the TDA, the Columbia River valley is relatively wide and deep only narrowing slightly towards the eastern end near the John Day Dam (Orr and Orr 2012). Shoreline morphology varies from vertical bedrock cliffs to low gradient sand and gravel beaches. The TDA also contains areas of deep aeolian and fluvial deposited sediment that are susceptible to erosion leaving large vertical scarps along the shoreline. Vegetation within the TDA is typical of the shrub-steppe zone that is arid to semi-arid with low precipitation with common strong westerly winds (Franklin and Dryness 1988; Sharp and Mass 2004).

John Day Lock and Dam Project

The John Day Lock and Dam Project (JD) was completed in 1971 providing flood control, hydroelectric power generation, and improved navigation along the Columbia River (USACE 2014c). Completion of the John Day Dam created Lake Umatilla that extends 123 km to the McNary Dam located just upstream from the town of Umatilla, Oregon. The JD includes the John Day Dam structure, navigation lock, spillway, powerhouse, and fish passage facilities. The average pool elevation is 79.9 m MSL. Maximum pool elevation is 81.7 m above MSL and minimum is 47.2 m MSL. The JD is light to moderately developed compared to both the BN and TDA with major impacts from reservoir inundation, JD facilities, highway, road, railway, public recreation, and both commercial and residential development.

The Columbia River valley throughout the JD is largely open and wide only narrowing towards the western end near the John Day Dam (Orr and Orr 2012). Shoreline morphology varies from vertical bedrock cliffs to low gradient sand and gravel beaches. The JD also contains areas with deep aeolian and fluvial deposited sediment that are susceptible to erosion leaving large vertical scarps along the shoreline. Vegetation is typical of the shrub-steppe zone that is arid to semi-arid with low precipitation (Franklin and Dryness 1988; Sharp and Mass 2004).

Site Types within the Project

This Plan outlines standards and protocol for monitoring the condition of historic properties located within the Project. The NHPA defines a historic property as “any prehistoric or historic district, site, building, structure, or object included in or eligible for inclusion in the NRHP” [36 C.F.R. § 800.16(l)(1)]. This Plan is not intended to provide guidance for monitoring other cultural resources such as sacred sites, Traditional Cultural Properties (TCP) not determined eligible for inclusion to the NRHP, or Historic Properties of Religious and Cultural Significance to Indian Tribes (HPRCSIT). Although many potential impacts and threats to sacred sites, TCPs or HPRCSITs would be the same for historic properties, other factors unique to monitoring sacred sites, TCPs and HPRCSIT are not included in the current Plan and would have to be included or considered if the Plan was to be effective in monitoring the condition of these special areas. Monitoring special areas such as TCPs also requires specialized training and is usually conducted by both trained Cultural Specialists and Tribal Elders.

Different types of archaeological sites can be threatened or impacted in different ways. For example, deeply buried sites may be unaffected by surface disturbance but damaged by bioturbation or caving caused by shoreline erosion. It is important for monitors to understand what types of sites will be monitored and consider the potential threats or impacts that each site may be subjected to based on the sites location and past and present conditions. Many sites within the Project are complex, oftentimes with multiple components that may require special consideration when planning monitoring fieldwork (Solimano et al. 2013; Wernz and Bird 2005; Wernz et al. 2006).

Numerous documents have summarized the Project's rich cultural history including summarizing the types of sites present within the Project area. Significant works include *The Prehistory and History of the Columbia River Gorge National Scenic Area* (Beckham et al. 1988), the *Historic Properties Management Plan for the Bonneville Lock and Dam Project* (Wernz et al. 2006), the *Preliminary Cultural Resources Evaluation for the City of The Dalles, Oregon, Proposed Urban Growth Boundary Expansion* (Ellis et al. 2011), the *Historic Properties Management Plan for The Dalles Lock and Dam Project* (Wernz and Bird 2005), *Miimá Taymúr: A Historic Properties Management Plan for the John Day Reservoir* (Dickson 2002) and *the John Day Project Historic Properties Management Plan* (Solimano et al. 2013). Precontact site types found within the Project include both long and short term residential locations, specialized use areas, and ceremonial sites (Beckham et al. 1988; Ellis et al. 2011; Solimano et al. 2013). Archaeological remains associated with these site types can include lithic scatters of various sizes, habitation sites with and without houses, quarry's, various pit features, caves, rock shelters, pictographs, petroglyphs, stacked rock features, and burials. Historic period resources can be grouped into a number of broad themes relating to agriculture, homesteading, transportation, fishing and canning, logging, townsite development, tourism, and Federal development (Beckham et al. 1988; Ellis et al. 2011; Solimano et al. 2013). Archaeological remains associated with these broad themes can include Project facilities, structures, roads, trails, debris scatters, structural remains, and various other historic features associated to both Euroamerican and historic Native use of the Project.

Summary of Previous Monitoring Efforts within the Project

Archaeological monitoring began within the Project in 1999 and has continued since on a relatively annual basis (Table 1). Monitoring was completed under contract by members of the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO), and the Confederated Tribes and Bands of the Yakama Nation (Yakama) cultural resource programs. Traditionally, sites located on the north shoreline of the Bonneville and The Dalles Projects were monitored by the Yakama and sites located on the south shoreline of the reservoirs were monitored by the CTWSRO. The CTUIR traditionally monitored both shorelines within the John Day Project. More recently in 2012, the Yakama were awarded a contract to monitor both the north and south shorelines of the Bonneville and The Dalles Projects (Shellenberger and Kiona 2014). In some cases, Tribes would coordinate fieldwork sessions and meet in the field to monitor sensitive areas as a group and or share monitoring related information. Sites located on islands within the Bonneville and The Dalles Project were often monitored jointly by members of both the CTWSRO and Yakama, with the Tribe working under contract for that area acting as the lead in the field.

In the early years of the monitoring program, there was no standardized protocol for identifying or recording site impacts. Project scopes were limited and did not specify the number or which sites should be monitored. General instructions included to monitor the shoreline either one or multiple times a year and document all areas affected by Project operations and vandalism (Bird and Jenevein 2003a, 2003b; Miller 2002; Scott 2003c, 2003d). Each Tribal cultural resource program used different forms and methods for collecting and reporting field data. Monitoring

Table 1. Previous archaeological site monitoring within the Project.

Project	Year Monitored	No. Sites Visited	Contractor	Reporting (form type)	Reference
Bonneville	2001	6	CTWSRO	SA	Jenevein and Bird 2004
Bonneville	2002	10	CTWSRO	MF, SA	Bird and Jenevein 2003a
Bonneville	2003	9	CTWSRO	MF, SA	Bird and Jenevein 2003c
Bonneville	2004	11	CTWSRO	MF, SA	Jenevein and Bird 2005a
Bonneville	2005	12	WSGV	MF, SA	Jenevein and Bird 2005c
Bonneville	2006	12	WSGV	MF, SA	Jenevein and Bird 2007a
Bonneville	2007	12	WSGV	MF, SA	Jenevein and Bird 2008a
Bonneville	2008	12	WSGV	MF, SA	Jenevein and Bird 2009a
Bonneville	2009	11	WSGV	MF, SA	Jenevein and Bird 2010a
Bonneville	2011	7	WSGV	MF, SA	Jenevein 2013
Bonneville	2012	20	WSGV	MF. SA	Jenevein and Liebert 2013
Bonneville	2014	7	WSGV	MF	Jenevein 2014
Bonneville	2002	32	Yakama	SA	Scott 2003a
Bonneville	2003	32	Yakama	SA	Scott 2003c
Bonneville	2004	32	Yakama	SA	Scott 2004a
Bonneville	2005	34	Yakama	SA	Scott 2005a
Bonneville	2006	33	Yakama	SA	Scott and Kiona 2006a
Bonneville	2012	10	Yakama	MF, SA	Shellenberger and Kiona 2013
Bonneville	2013-2014	3	Yakama	MF, SA, N	Shellenberger and Kiona 2014
The Dalles	2001	10	CTWSRO	SA	Jenevein and Bird 2004
The Dalles	2002	34	CTWSRO	MF, SA	Bird and Jenevein 2003b
The Dalles	2003	35	CTWSRO	MF, SA	Bird and Jenevein 2004
The Dalles	2004	35	CTWSRO	MF, SA	Jenevein and Bird 2005b
The Dalles	2005	34	CTWSRO	MF, SA	Jenevein and Bird 2005d
The Dalles	2006	32	WSGV	MF, SA	Jenevein and Bird 2007b
The Dalles	2007	11	WSGV	MF, SA	Jenevein and Bird 2008b
The Dalles	2008	29	WSGV	MF, SA	Jenevein and Bird 2009b
The Dalles	2009	21	WSGV	MF, SA	Jenevein and Bird 2010b
The Dalles	2012	12	WSGV	MF, SA	Jenevein and Liebert 2013
The Dalles	2014	9	WSGV	MF, SA	Jenevein 2014
The Dalles	2002	40	Yakama	SA	Scott 2003b
The Dalles	2003	54	Yakama	SA	Scott 2003d
The Dalles	2004	5	Yakama	SA	Scott 2004b
The Dalles	2005	40	Yakama	SA	Scott 2005b
The Dalles	2006	58	Yakama	SA	Scott and Kiona 2006b
The Dalles	2012	10	Yakama	MF, SA	Shellenberger and Kiona 2013
The Dalles	2013-2014	4	Yakama	MF, SA, N	Shellenberger and Kiona 2014
John Day	1999	6*	CTUIR	MF, SA	Dickson 2000
John Day	2000-2001	55	CTUIR	MF, SA	Miller 2002
John Day	2002	64	CTUIR	MF, SA	Miller 2003
John Day	2003	110	CTUIR	MF, SA	Miller 2004
John Day	2004	180	CTUIR	MF, SA	Miller 2009
John Day	2005-2006	275	CTUIR	MF, N	Steinmetz 2012
John Day	2007-2008	66	CTUIR	MF	Steinmetz 2013
John Day	2013-2014	2	Yakama	MF, SA, N	Shellenberger and Kiona 2014

* The CTUIR monitored most sites on the John Day Reservoir, updating six of the most severely impacted. Reporting form type: MF = monitoring form; N = report narrative; SA = site record addendum.

data was recorded on specially designed monitoring forms as well as on both Oregon SHPO or Washington DAHP site record update forms. The earliest monitoring forms focused primarily on recording impacts from looting and vandalism and have changed over the years to accommodate field observations and contract requirements (Dickson 2000). In most cases, monitoring observations were recorded in the field on a specialized form (Dickson 2000; Miller 2002; Scott 2003c, 2003d). Once back at the office, the in-field form would be used to create a narrative for the final report oftentimes with supporting maps and photographs. Monitoring forms that had check box impact categories were usually supplemented with an additional text narrative, site damage report, and or site record addendum (Bird and Jenevein 2003).

Beginning in 2006, the USACE began including a standardized monitoring form as part of each monitoring contract. The forms were modified versions of forms currently in-use by the CTWSRO/WSGV and CTUIR and included a combination or both check box and narrative data entry. Starting in 2011, the USACE began specifying which site and how often each site should be monitored. The USACE also expanded efforts to standardize reporting by requiring use of a updated specialized USCAE monitoring form. The updated form was modified from the WSGV monitoring form that had been in use by the WSGV since 2006. Since 2012, monitoring contracts issued by the USACE have required use of a further refined draft form developed by the WSGV. The draft form utilized more check box entries and was an attempt to further standardize reporting and reduce to amount or time necessary to complete each form in the field. The early draft of this 2012 form was the predecessor to the current monitoring forms included in this Plan.

In 2012, a monitoring plan was prepared for the Lower Memaloose Island Site (35WS217) located within the Bonneville Lock and Dam Project following a FCRPS stabilization project (Jenevein 2012). The site stabilization was in response to ongoing severe erosion that had exposed human remains and intact cultural materials at multiple locations throughout the island. This Plan included an overview of the monitoring history as well as future recommendations for monitoring personnel, field procedures, treatment of non-native invasive plants, discovery of human remains and or funerary objects, monitoring scheduling, and reporting. The plan's main goal was to provide guidance for gauging the success of the site stabilization and establish protocol for evaluating if the treatment would have any short or long term adverse effects on remaining cultural deposits.

A recent review of condition monitoring in the John Day Project was completed as part the Historic Properties Management Plan update (Solimano et al. 2013). The review highlighted a number of issues with past monitoring in the John Day Project that should be considered prior to developing new standards and procedures as part of this Plan. Although specific for the John Day Project, Solimano's recommendations can also be applied to past monitoring within both the Bonneville and The Dalles Projects and generally summarizes a few of the main issues dealing with monitoring standardization and quality that should be resolved and or considered as part of this Plan. Major issues include (1) the lack of available baseline information for sites; (2) descriptions were often nominal and unique to individual recorders; (3) lack or placing site stability and erosion into a broader geomorphological framework; (4) and the emphasis on looting at the expense of other site impacts. The concerns raised by Solimano are valid and will be addressed as part of the following Plan.

Site Impacts and Threats

Archaeological sites can be subject to a number of potentially damaging impacts that can threaten a sites' integrity possibly altering eligibility in the NRHP. Threats and impacts can vary depending on the type of site and location within the Project. For this Plan, potential site impacts are separated into two general categories of origin to include both natural and cultural impacts.

Natural Site Impacts

Natural site impacts occur from natural occurrences or processes that are the result of the physical environment (Table 2). An example of a natural site impact would be digging from rodents (*Post-depositional Processes; Faunalturbation*) potentially disturbing intact archaeological remains. Potential natural site impacts have been classified into seven general classes to include (1) *Aeolian/Alluvial Deposition*, (2) *Animal – Surface* that includes all above ground effects from birds, insects, wildlife bedding areas, trailing, trampling, wildlife displaced artifacts, and miscellaneous other animal impacts, (3) *Post-Depositional Processes* ([3a] cryoturbation, [3b] faunalturbation, [3c] floralturbation), (4) three classes of *Erosion* ([4a] landslip, [4b] water [sheet, rill, gully, tunnel], and wind), (5) effects from *Wildfire*, (6) and *Weathering*. One additional miscellaneous (7) *Natural Impact - Other* category has been added to include all potential natural impacts not covered under the six main classes. Detail definitions and terminology is provided for each class and subclass within SOP 1: Baseline and Repeat Archaeological Site Monitoring in Appendix A.

Cultural Site Impacts

Cultural site impacts are the result of either direct or indirect human actions (Table 3). An example of a cultural site impact would be damage to a site feature or artifact from vandalism. Shoreline erosion that is associated to the operation of the FCRPS is considered a cultural impact due to the source cause being the managed pool levels by the FCRPS. Potential cultural site impacts have been separated into 13 general classes that include impacts related to (1) *Agricultural and Livestock*, (2) *Land Development*, (3) *Partial or Full Excavation*, (4) *Road Use and Maintenance*, (5) *Utilities*, (6) *Wildfire and Rx Fire*, (7) *Restoration*, (8) *Emergency Event*, (9) *Recreation*, (10) *Reservoir Effects*, (11) *Unauthorized Excavation*, and (12) *Vandalism*. One additional miscellaneous (13) *Other - Cultural Impact*s class has been added to include all potential cultural impacts not covered under the five main classes.

Five of the general impact classes contain multiple subclasses to further identify specific threats or impacts. Subclasses occurring within the *Agricultural and Livestock* category include (1a) *Livestock and Grazing*, (1b) *Plowing, Disking, and Harrowing*, (1c) *Land Leveling*, (1d) *Vegetation Removal*, (1e) *Drainage Ditch Excavation and Maintenance*, and (1f) *Fence Construction*.
Additional subclasses occurring within the *Livestock and Grazing* category include Bank Alteration, Broken Artifacts, Edge Damaged Artifacts, Hoof Shear, Heavy Grazing, Manure, Post Holing, Trailing, Trampling, and Grazing Developments. Subclasses within the *Restoration* category include both (7a) Riparian/In-Stream and (7b) Terrestrial restoration. Subclasses within the *Recreation* category include (9a) Camping, both developed and unmaintained (9b) Trail Use,

Table 2. Potential natural impact agents to archaeological sites within the Project.

Impact Agent Class	Description
Aeolian/Alluvial Deposition	- Deposition of sediment that has been mobilized and transported by either wind (aeolian) or water (alluvial).
Animal - Surface	- Impacts from natural wildlife the occur primarily at or above the ground surface involving minimal to moderate amounts of ground disturbance.
Bird damage	- Nesting activities or excessive guano.
Insect damage	- Chewing or above ground burrowing such as termites or carpenter.
Bedding areas	- Circular areas of trampled vegetation often found in sheltered or shaded areas.
Trailing	- Non-livestock trails where vegetation has been trampled or removed.
Trampling	- Removal of most or all ground vegetation in areas were larger wildlife such as deer or elk congregate.
Displaced artifacts	- Movement of artifacts or other site features by wildlife.
Other	- Category used to note all other above ground animal impacts that cannot be classified into other categories.
Post-depositional Processes	- Natural factors that affect the sediment and soil surrounding archaeological materials.
Cryoturbation	- Mechanical disturbance from periodic freezing and thawing.
Faunalturbation	- Mixing of archaeological remains by burrowing vertebrates and invertebrates.
Floralturbation	- Mechanical disturbance of from trees, shrubs, or other plants.
Erosion	- The process by which particles are picked up and carried by water, wind, or ice.
Landslip	- Mass movement of material that can be the result of either a landslide or flow.
Water	- The movement of material by flowing water.
Sheet	- Uniform removal of material from the ground surface.
Rill	- Shallow (0 - < 10 centimeters [cm]) channels formed from surface runoff.
Gully	- Moderately shallow to deep (>10 - <100 cm) "U" and "V" shaped channels.
Tunnel	- Erosion caused by the subsurface movement of water.
Wind	- The movement and transport of material by wind during dry conditions.
Wildfire	- Direct effects from wildfire that are not cultural in origin.
Weathering	- Natural decay caused by both mechanical disintegration and chemical decomposition.
Natural Impact-Other	- Other unidentified natural impacts.

Table 3. Potential cultural impact agents to archaeological sites within the Project.

Impact Agent Class	Description
Agriculture and Livestock	- Impacts associated with both the commercial and private cultivation of plants and animals.
Livestock Grazing	- Impacts related to livestock grazing.
Bank Alteration	- Eroding stream banks with no supporting vegetation.
Broken Artifacts	- Fresh bending fractures on artifacts.
Edge Damaged Artifacts	- Fresh flake scars on artifact edges.
Hoof Shear	- The shearing of stream channel banks by livestock hoofs.
Heavy Grazing	- Surface vegetation that has a mown appearance.
Manure	- Self-evident, indicates use by livestock.
Post Holing	- Clear, hoof-shaped depressions in the soil caused by livestock walking on wet ground.
Trailing	- Visible livestock trails where all or most vegetation has been removed.
Trampling	- Removal of most or all ground vegetation in areas where livestock congregate.
Grazing Development	- Construction related to livestock including spring development, corrals, holding pens, chutes, and fence construction.
Plowing, disking, harrowing	- The surface preparation of soil usually before sowing.
Land Leveling	- The mechanical surface leveling of fields often times to improve drainage.
Vegetation Removal	- The mechanical removal of surface vegetation prior to cultivation.
Drainage ditch excavation and maintenance	- All construction and subsequent upgrades to drainage ditch system.
Fence construction	- Installation and associated maintenance of gates and fencing.
Land Development	- All physical alterations and improvements related to building construction.
Partial or Full Excavation	- Effects from past archaeological excavation.
Road Use and Maintenance	- Site impacts associated with the use and maintenance of vehicle roads.
Utilities	- Impacts associated with the installation, use, and maintenance of utilities.
Wildfire and Rx Fire	- Both direct and indirect effects from fire.
Restoration	- All restoration improvements conducted within a site area.
Riparian/In-Stream	- Channel alteration, riparian planting and bank stabilization.
Terrestrial	- Dry land surface improvements.
Emergency Event	- Impacts associated with major events such as accidents, spills or floods.
Recreation	- Impacts associated to all recreational activities.
Camping	- Overnight stays in a tent, trailer, or vehicle; to include both camping in un-designated and maintained areas and within maintained campgrounds.
Trails	- All human caused foot trails.

Table 3. Potential cultural impact agents to archaeological sites within the Project (Cont.).

Trail - Developed	- Trails that are built and maintained by the land manager.
Trail - Unmaintained	- Trails that are unmaintained and not managed by the land
Mining	- Recreational and commercial prospecting and extraction of mineral resources.
Refuse Dumping	- Intentional dumping of modern refuse to include un-concentrated surface trash to large piles of discarded waste.
Surface	- Scattered surface litter commonly found in public recreation areas.
Dumping	- Intentional waste dumping.
Stock Use	- Impacts associated with the use of horses, mules, burros, and llamas.
Vehicle - OHV	- Impacts associated with the use of all Off-Highway Vehicles.
Reservoir Effects	- Effects from the operation of the Project.
Caving	- The collapse of a streambank by under-cutting.
Wave-cutting	- Erosion from waves on a streambank.
Beach Lag	- Accumulation of deflated artifacts, cobbles, or boulders found along the shoreline.
Partial Inundation	- Periodic flooding of normally or historically dry land.
Full Inundation	- Permanent flooding of normally or historically dry land.
Unauthorized Excavation	- All Unlawful and intentional excavation, disturbance and theft within a site.
Digging – Intentional	- The unlawful and intentional digging within a site for the purpose of locating artifacts.
Digging - Other	- Digging within a site for the purpose of locating artifacts.
Artifact sorting/Collection Piles	- The unlawful and intentional sorting and collection of artifacts within a site.
Theft	- The unauthorized removal of all archaeological materials from a site.
Vandalism	- The willful or malicious defacement and destruction of artifacts or features.
Other - Cultural Impact	- Other unidentified cultural impacts.

(9c) Mining, (9d) Refuse Dumping of both surface trash and pile dumping, (9e) stock use, and (9f) Off-Highway Vehicles (OHV) use. Subclasses within the *Reservoir Effects* category include (10a) Caving, (10b) Wave-Cutting, (10c) Beach Lag, (10d) Partial Inundation, and (10e) Full Inundation. Subclasses within the Unauthorized Excavation category include (11a) Digging where artifacts are exposed, (11b) Digging – other, (11c) Artifact sorting and collection piles, and (11d) Theft.

Monitoring Plan Design

This Plan provides guidance on how data should be collected, managed, and reported as part of a FCRPS monitoring program. The structure of this plan is modeled after other natural resource monitoring programs developed by the National Park Service (NPS), the United States Geological Survey (USGS), and other agencies for sampling natural resources in national parks (Oakley et al. 2003; Elzinga et al. 1998; NPS 2004; Fancy 2001). Although these plans were developed for measuring long-term changes to natural resources, the basic structure of a natural resource monitoring protocol can be equally as useful for guiding monitoring of cultural resources. One of the common goals for both natural resource and culture resource monitoring programs is the need to detect and measure changes to a resource or an archaeological site's condition over time. It is important that data collected as part of any monitoring program are consistent and comparable between site visits even though visitation may be infrequent or have occurred over a long period of time. Any observed differences to the site condition should be a result of factors other than multiple people collecting measurements in a slightly different way (Oakley et al. 2003).

In addition to plans and protocols developed for monitoring natural resources, several other examples of monitoring plans have been developed that specifically address cultural resources. A number of good examples have been summarized within the 2009 USACE Public Works Technical Bulletin 200-1-60 entitled *Best Practices for Archaeological Site Monitoring* (Hargrave 2009). The three plans reviewed by Hargrave (2009) includes one plan that was developed for the management of historic sites in New Zealand (Walton 2003), one that was developed for the Colorado River Corridor Archaeological Site Monitoring Program (Dierker and Leap 2005), and a third for a monitoring program developed for use by the USACE (2005) Omaha District.

Although each monitoring plan varies slightly depending on project specific factors such as the variability among the types of archaeological sites and the impact agents present in the area being studied, all plans share a number of common characteristics. Monitoring strategy characteristics for each of the plans was reviewed by Hargrave (2009) and summarized as a "best practices" section of the report. Based on the review of the different reports, Hargrave (2009) recommended a number of important sections be included within any monitoring report. Recommendations included; identifying specific goals for monitoring, identify possible site impacts, develop useful field monitoring forms, develop SOPs, conduct and provide guidance for baseline and routine monitoring, collect quality GPS data, collect repeat photography, and recommendations for site treatment and data management. The majority of the sections summarized by Hargrave (2009) mirror guidelines for either complete or partial report sections recommended to be included in natural resource monitoring protocols (Oakley et al. 2003; Fancy 2001; Elzinga et al. 1998; NPS 2004). As a result, the Plan and accompanying SOPs represent a summation of all reviewed plans, associated documentation, and recommendations that have been modified to meet the specific needs of the site types and potential impact agents present within the Project.

Monitoring Goals and Expectations

The primary goals of archaeological condition monitoring is to: detect and measure changes to the condition of archaeological resources over time that could potentially alter a sites eligibility to the NRHP; and to use the data gathered through monitoring to help make recommendations or modify the future management of a site, program, or policy as defined by the FCRPS Cultural Resource Program goals. These goals will be accomplished by collecting data in the field, analyzing the collected data, assessing the need for any necessary management action, followed by program review (Walton 2003).

Methods described within this Plan are designed to be primarily qualitative in nature and focus on identifying and understanding changes to a sites condition over time. In some cases, the cause of change may be obvious such as site effects from a recent flood or vandalism. In other cases, the source of impacts may be complex, such as where erosion from multiple agents may be responsible for site damage that are operating at varying scales of space and time. In certain cases, quantitative tools may be necessary to help go beyond merely identifying change that is occurring at a site by providing useful data to verify and measure the types and rates of change that are occurring. This additional level of quantitative analysis may be necessary for land managers to accurately make both short and long-term mitigation and site management recommendations. Future review of this monitoring Plan may identify the need to include additional SOPs detailing tools and techniques for more detailed quantitative monitoring. For example, two useful quantitative techniques that measure differential rates of erosion include erosion monitoring stakes and cross-section surveys. Erosion monitoring stakes measure the rate of erosion or deposition occurring over a surface (Santucci 2009). A cross-section survey measures the rate of erosion or deposition occurring along a linear transect such as a road, trail, or stream bank (Sampson 2009). These techniques can be easily added to the existing monitoring plan at a later date or completed as needed by either USACE or contract personal in response to specific issue(s) occurring at one or more sites.

Site Selection and Monitoring Priority

Sites eligible for monitoring include all historic properties that are listed, eligible, or unevaluated for inclusion in the NRHP. Site selection should be conducted by the USACE/FCRPS monitoring program manager and based on the most current site information. Factors to consider when selecting sites for monitoring include the site type, potential threats, frequency of past site visits, previous monitoring frequency recommendations, FCRPS Cultural Resource Program priorities, and available funding.

Monitoring priority is assigned based on a combination of the site type, NRHP status, and the potential for or known threats (Table 4). The priority for site type and NRHP status (decreasing in importance) includes burials and rock panels, sites listed, eligible, and unevaluated for the NRHP and unknown resources where very little or no information is known about a resource. The threat category includes in decreasing order of importance; impacted, threatened, stable, and unknown. Based on a combination of the site type and NRHP status and threat category, a determination is made assigning each site as High, Medium, or Low monitoring priority.

Table 4. Site monitoring priority and frequency recommendations.

Site type / NRHP Status	Threat	Priority	Rate of Deterioration		Recommended Monitoring Frequency (Baseline/Repeat) *	Recommended Monitoring Frequency (Walkthrough) †
Burial/ Rock Panel	Impacted	HIGH	Rapid Rapid Periodic Slow Slow Periodic	→ → → →	Monthly - Annual Quarterly - Annual Semiannual - Annual Annual	Frequent
Burial/ Rock Panel	Threatened	MED	Slow Slow Periodic None	→ → →	Quarterly - Annual Semiannual - Annual Annual	Periodic
Burial/ Rock Panel	Stable	MED	None	→	Annual-Biannual	Infrequent
Burial/ Rock Panel	Unknown	MED	Unknown	→	Opportunistic	Opportunistic
Listed, Eligible, Unevaluated	Impacted	HIGH	Rapid Rapid Periodic Slow Slow Periodic	→ → → →	Monthly - Annual Quarterly - Annual Semiannual - Annual Annual	Frequent - Periodic
Listed, Eligible, Unevaluated,	Threatened	MED	Slow Slow Periodic None	→ → →	Quarterly - Annual Semiannual - Annual Annual	Periodic
Listed, Eligible, Unevaluated	Stable	LOW	None	→	3-5 years	Infrequent
Listed, Eligible, Unevaluated	Unknown	MED	Unknown	→	Opportunistic	Opportunistic
Unknown (Submerged)	Unknown	MED	Unknown	→	Opportunistic	Opportunistic

*Baseline/Repeat Monitoring Frequency: Monthly = 12 visits per year; Quarterly = four visits per year, Semiannual = two visits per year; Annual = one visit per year; Biennial = one visit every two years; Three year = one visit every three years; Five year = one visit every five years.

† Walkthrough Monitoring Frequency: Frequent = multiple visits dependent on site conditions; Periodic = regular site visits; Infrequent = occasional site visits; Opportunistic = occasional visit during special circumstances.

Monitoring Frequency and Timing

“Monitoring frequency” is the recommended number of times a site should be revisited in the future. Monitoring frequency is dependent on a number of factors including the type of site being monitored, the number of various documented or expected threats or impacts, and the rate of deterioration or the speed at which the site is expected to be impacted (Crane et al. 2011). A site’s monitoring frequency will likely change over time based on monitoring observations and Project priorities. For sites that have not yet been monitored or where little data is known, monitoring frequency is estimated based on an informed understanding of site type, geomorphological setting, potential threats, and expected rate of deterioration.

For example, shoreline erosion would be an expected impact at sites located at or in close proximity to a reservoir's shoreline. Additional knowledge about the type of geomorphological setting including underlying geologic deposits such as the presence of deep sand and gravel or bedrock will help further prioritize site urgency of visits based on an expectation of the rate of erosion. Also, sites located at or in close proximity to recreation areas or transportation corridors would be more likely threatened by visitor related impacts then sites located far away from any such activity (Crane et al. 2011:17). Sites previously determined as not eligible for the NRHP will not be monitored. Monitoring frequency can be changed for any reason by the USACE/FCRPS Cultural Resource Program manager based on new data and priorities.

Table 4 outlines recommendations for monitoring frequency. Monitoring frequency is determined by considering site type and NRHP status, potential or known threats, and known or expected rate of deterioration. For this Study, both burials and rock panel sites are afforded the highest priority based on the sensitive and sacred nature of the resource. Sites either listed or eligible for inclusion in the NRHP are considered high priority. Sites unevaluated for the NRHP are also considered a high priority and treated as eligible until a formal determination is made. Submerged sites or sites where no information is known are considered to be medium priority.

Known or potential threats are determined either through previous monitoring, site recording, informal observation, or an informed understanding of the site type, location, and expected impacts. Choices include stable, threatened, impacted, or unknown. The rate of deterioration is the speed and frequency at which impacts are occurring. Noting the rate of deterioration is an important factor and helps prioritize an appropriate response by the land manager. For example, slow surface erosion should evoke a different response and urgency than repeated recent digging and looting. Choices for rate of deterioration include, slow, slow periodic, rapid periodic, and rapid.

Monitoring frequency can be determined after considering site type and status, potential or known threats, and the known or expected rate of deterioration. Recommendations can be made for baseline, repeat, or walkthrough monitoring. Baseline monitoring is conducted during the first site visit and details the current site condition, identifies any impacts and potential threats, and provides guidance and recommendations for future site management. Repeat monitoring includes revisiting areas of the site that have been identified during baseline monitoring as being impacted, threatened, or where required photo points and or erosion monitoring stations have been established. Walkthrough monitoring includes quickly revisiting a site, documenting only major impacts or changes to the site condition that may require immediate action by the Project. Complete explanation and procedures for baseline, repeat, and walkthrough monitoring are provided in the following monitoring protocol section of this report.

Monitoring frequency choices includes monthly (12 visits per year), quarterly (four visits per year), semiannual (two visits per year), annual (one visit per year), biennial (one visit every two years), three year (one visit every three years), five year (one visit every five years), discontinue, or other. Walkthrough monitoring may occur at the above intervals or at any other frequency based on special conditions or Project requirements such as reservoir drawdown, seasonal exposure, response to a particular event, or report of nearby threat or damage. The USACE

/FCRPS monitoring lead should coordinate with other USACE staff to avoid timing conflicts such as impacting threatened and endangered species during monitoring activities.

Determining walkthrough monitoring frequency is less structured then determining the frequency for baseline or repeat monitoring. The intent of walkthrough monitoring is to supplement other types of monitoring with a less structures approach allowing more frequent site visits. Increased site visits may help identify site impacts that occur at irregular times or during specific conditions such as a flood or low water. Table 4 suggests four frequency classes to help guide walkthrough site visits based on site type and status, potential or known threats, and known or expected rate of deterioration. The classes include frequent (multiple visits dependent on site conditions), periodic (regular site visits), infrequent (occasional site visits), and opportunistic (occasional visit during special circumstances).

One of the primary goals of monitoring is to use the data collected to make informed decisions regarding the short and long term treatment and management of a site. Monitoring goals should be clear for sites that have been monitored repeatedly to avoid collecting redundant data. Impact thresholds that trigger an agencies response should be defined at sites where impacts are likely or have occurred in the past. Monitoring can supplement the Agencies goal of identification, evaluation, and treatment of historic properties affected by the FCRPS, but is not intended to continue indefinitely at the same frequency recommended during initial assessment or as a replacement for determining a site's eligibility to in the NRHP.

Scheduled Plan Review

This monitoring plan should be informally reviewed following each field season. Field workers and USACE/FCRPS Cultural Resource Program managers should annually assess the usefulness of the data collected and make recommendations for improving the Plan as necessary to meet the current needs of the FCRPS Cultural Resource Program. It is recommended that a formal review of the Plan take place at the same time the Project Historic Properties Management Plan is review and or revised.

Monitoring Protocols

Developing standardized methods for collecting and reporting data is a critical part of a monitoring program. Standardized reporting insures comparability of observations between site visits is important not just for comparing changes occurring at a site or Project level, but important for identifying and reacting to larger issues occurring throughout the entire FCRPS.

General procedures for site monitoring include: (1) a complete an initial survey and assessment of the site area, (2) a check of existing site administrative data for completeness, (3) identify any threatened or impacted site areas, (4) establish photo points if necessary, (5) complete an FCRPS Archaeological Site Monitoring Form, and (6) create or update a site monitoring map. Outlined below is a general discussion of field methodology required during site monitoring. Standard operating procedures for Baseline and Repeat Archaeological Site Monitoring (SOP 1), Walkthrough Archaeological Site Monitoring (SOP 2), Photographic Documentation (SOP 3), and

GPS Use: Monitoring Data Collection (SOP 4) detail all procedures and are located within Appendix A.

Monitoring Forms

The FCRPS Archaeological Site Monitoring Form is designed to document field data collected during both baseline and repeat site monitoring visits. The Monitoring Form was adapted from monitoring forms currently in use by the NPS, the U.S. Bureau of Reclamation for the Colorado River Corridor Archaeological Site Monitoring Program, FCRPS, and monitoring projects conducted by the WSGV Cultural Resource Group for the Pelton-Round Butte Hydroelectric Project, Federal Energy Regulatory Commission (FERC), (FERC Project No. 2030) (Dierker and Leap 2005; Jenevein and Bird 2007a, 2007b, 2007c). Other forms commonly used during monitoring and included as part of the Plan are the FCRPS Photographic Record, the FCRPS Photo Point Record, and the FCRPS continuations sheet. Examples of all required forms are included within Appendix B of this report.

During the initial site monitoring visit, one monitoring form will be completed and used as the primary record for each subsequent monitoring visit. Monitoring forms are comprised of six major sections to include: (1) site management information, (2) site condition, (3) natural impacts, (4) cultural impacts, (5) monitoring documentation, and (6) recommendations.

Site Management Information

The management section contains site administrative information to include various site number designations, the project name and number (if applicable), the property type description, date and time of the site visit, the current total site area expressed in square meters (m^2), the monitoring session number or designation, and the field recorders name and organization affiliation.

Site Condition

The site condition section provides information about the overall condition of the site and describes the percentage of the site affected by impacts as compared to the total site area, an assessment of the relative speed of site deterioration, information on the sites current land use, vegetation coverage, the presence or absence of invasive plant species, the condition of the sites datum(s), and a listing of site elements that were visited during monitoring.

Natural Impacts

The natural site impacts section records the effects of natural processes such as the aeolian/alluvial deposition, surface animal impacts, post depositional processes, erosion, affects from wildfire, weathering and miscellaneous “other” natural impacts not covered by other classes.

Cultural Impacts

The cultural impact section records both direct and indirect “human caused” impacts that have been subdivided into 12 major categories to include agriculture and livestock, land development, partial and full excavation, road use and maintenance, utilities, wildfire and Rx fire, restoration, emergency events, recreation, reservoir effects, unauthorized excavation, vandalism, and “other” cultural impacts not covered by other classes.

Monitoring Documentation

The Monitoring documentation section identifies the type and amount of documentation completed during each monitoring visit. Required fields include information on whether photo points were installed and or used during monitoring, if other photographs were taken, if erosion monitoring stations were installed and or monitored, and if video, or GPS mapping was used.

Recommendations

The site recommendations section includes fields for the recorded(s) to suggest or update the monitoring visitation schedule and to make preservation comments regarding any necessary required actions that could include possible site treatment or mitigation measures.

The monitoring form is intended to encourage field recorders to collect only meaningful information necessary to detect and measure changes to the site condition. Fields describing site changes are primarily multiple choices with an additional comments section that should be used to provide detail and context to noted changes.

Field Preparations

Prior to field monitoring, all necessary preparations should be made in the office to ensure that each field session is productive and meets the monitoring objectives for each site as defined within the monitoring plan. All required equipment identified within the SOPs should be gathered and checked to ensure that it is in proper working order. All site records, previous monitoring forms, and maps should be gathered and reviewed. Previous monitoring data should be evaluated to provide the field crew a tentative list of potential tasks or issues that may be encountered during monitoring. Site access routes should be determined to limit possible site disturbance as a result of site.

Baseline Monitoring

The purpose of baseline monitoring is to document in detail the current site condition, identify any damage and potential threats, and provide guidance and recommendations for future site management. Baseline monitoring should be conducted once during the initial site visit. Baseline monitoring involves reviewing and updating site location information, such as driving directions and Universal Transverse Mercator (UTM) coordinates. During the initial site visit, a full assessment of the site’s current condition should be conducted to include documenting all site impacts, and potential future threats. Areas of the site that are identified as being impacted or threatened should be documented at a level of detail and scale sufficient to detect changes to the site condition that may occur between future scheduled site visits.

Baseline monitoring should establish guidance for future monitoring as to what areas of the site need to be documented and in what detail. All photo points and any additional erosion measurement documentation such as cross-section surveys or erosion stakes should be established during the baseline visit. All monitoring information will be recorded on specialized FCRPS Archaeological Site Monitoring Forms using standardized terminology and classes unique to each specific site impact noted. Based on the results of monitoring, recommendations should be made as to the frequency and timing of scheduled future site monitoring visits. Required actions or recommendations for any necessary emergency and or long-term site treatment and stabilization should also be made at this time. Detailed baseline monitoring methods and protocol are defined within SOP 1, Baseline and Repeat Archaeological Site Monitoring (see Appendix A).

Repeat Monitoring

Following the initial baseline monitoring visit, repeat site monitoring will occur at sites based on the recommended monitoring schedule. Repeat site monitoring will include revisiting areas of the site that were identified as being impacted, threatened, or where required photo points and or erosion monitoring stations have been established. All required photographs, measurements, or specialized observations specified within the site's baseline monitoring form should be duplicated. Any changes to the site condition compared to the baseline or the previous site monitoring visit should be thoroughly documented. Additional photo points and or erosion monitoring stations should be installed if necessary to document new damage. Based on the monitoring results, recommendations should be made for possible changes to the monitoring schedule or any necessary required actions to include emergency and long-term site treatment and stabilization. Procedures for conducting repeat monitoring visits are covered in SOP 1, Baseline and Repeat Archaeological Site Monitoring (see Appendix A).

Walkthrough Monitoring

Walkthrough monitoring includes quickly revisiting a site, documenting only major impacts or changes to the site condition that require immediate action by the Project. Documentation during walkthrough monitoring is limited to cursory notes and photographs in order to reduce the amount of time required to process and prepare field and office materials. Walkthrough monitoring is recommended for sites that are threatened by impacts that occur at irregular times and frequencies such as looting and vandalism. It is also recommended for sites where little information is currently known or that the existing data is out of date and updated information would help USACE/FCRPS managers prioritize future documentation needs. Walkthrough monitoring is not intended to replace traditional condition monitoring but to be used as tool to quickly gather important information about the condition of multiple sites during times when they are most susceptible to natural and cultural impacts. Procedures for conducting walkthrough monitoring visits are covered in SOP 2, Walkthrough Archaeological Site Monitoring (see Appendix A).

Photographic Documentation

Photographic Documentation is one of the most useful tools to record changes to a sites condition over time. Repeat photography involves taking multiple photographs of the same subject during separate site visits. Repeat photography is often accomplished by using photo points which mark the location of where a photograph was taken with either a permanent marker such as an installed datum or some other preexisting permanent feature. Photo points are specifically established in threatened or disturbed areas of a site to record either current impacts or potential future threats. The location of each photo point should be mapped and described to ensure that the point is relocated during subsequent monitoring visits.

Multiple monitoring photographs can be taken from a single photo point to document multiple subjects in the surrounding area. Information about each photo point is recorded on a FCRPS Photo Point Record (Appendix B) that will record information necessary for the relocation of the point and the duplication of all required photographs. General information about each of the photographs taken from each photo point is also recorded on a FCRPS Photographic Record (Appendix B) that records information such as the photo subject, direction, recorder, date, and time. Each photograph is used to compare the current site condition with photographs that have been taken from the same photo point at an earlier date or will be taken from the same point in the future. Detailed procedures on the installation of photo points, and conducting photographic documentation are included within *SOP 3: Photographic Documentation* (see Appendix A).

Data Analysis and Reporting

Post-field Reporting

Timely reporting of monitoring results to the land manager is essential to ensure that any threatened or damaged sites can receive appropriate treatment before further damage occurs. Result of monitoring will be summarized as part of both a Project Management Summary Table (Appendix C) and within the Project monitoring report. A preliminary Project Management Summary Table will be completed and submitted to USACE immediately following fieldwork. Information contained within the table includes: site number, site type, national register eligibility, monitoring date, pool elevation, identified active site impacts or concerns, site condition rating and rate of site deterioration, and monitoring priority recommendations. Information contained within the table should provide the USACE Project manager with enough information to respond to any threats and impacts identified during monitoring. A finalized version of the table will be supplied as part of a summary technical monitoring report.

Monitoring Forms

Following each baseline or repeat site monitoring visit, paper copies of all field forms, notes, and records will be combined and transferred into a FCRPS Archaeological Monitoring Form in Microsoft Word format. Completed monitoring forms will minimally include field observations, text descriptions, photographs, and measurement data collected during each individual site field visit. Forms will also include an updated site monitoring map as an attachment depicting the location of all mapped datums, photo points, and boundaries of all pertinent site features, noted site impacts, or observations. For repeat site monitoring visits, updated or new monitoring maps are only necessary if changes or additions to the previous monitoring map has been made since the last time the site was visited. A completed hardcopy of the digital form(s) is intended to be carried and used in the field during future monitoring visits for comparing a site's current condition to the past.

Currently, finalized hardcopy forms are prepared as a Microsoft Word document and combined into a single PDF file. It is recommended that the USACE/FCRPS Cultural Resource Program consider converting all required monitoring forms prepared in Microsoft Word format to on-line web-based forms linked to a larger FCRPS monitoring database. Converting to an on-line, web-based format will not replace paper forms for fieldwork but will further help to standardize reporting, reduce time required for reporting, and make data more available for analysis to the FCRPS Culture Resource Program and its partners.

Walkthrough Monitoring Reporting

One of the primary goals of walkthrough monitoring is to increase the number of sites that can be visited within a given year by decreasing the amount of time required to complete field and office tasks per each site visited. To reduce paperwork and processing time required for each monitored site, all new impacts or threats identified during walkthrough monitoring will be documented in the field on a one page Walkthrough Monitoring Form (see Appendix B). Required information includes the date and time when the monitoring occurred and if any impacts or threats were identified. The forms also provide space to quickly document the type of impact(s) or threats found, the speed of deterioration, and recommendations for treatment if necessary.
The Walkthrough Monitoring Form is a field document and is not intended to be modified or converted into a final digital format. Draft field copies of the Walkthrough Monitoring field forms should archived with other project materials.

A Walkthrough Monitoring Visitation Spreadsheet (see Appendix D) will be used to summarize field results from walkthrough monitoring. The Walkthrough Monitoring Visitation spreadsheet includes basic information on the date and time and when the monitoring occurred, as well as what type of impacts or threats were identified, the speed of deterioration, and recommendations for treatment. The field recorder should determine the correct level of documentation necessary based on the type and the nature of the impact. More comprehensive documentation may be required in cases where important time sensitive information such as evidence of looting and vandalism would be lost if not immediately recorded. A Walkthrough Monitoring Spreadsheet should be completed for the project and submitted with the Project Management Summary Table to the USACE Contracting Officers Representative (COR) immediately following fieldwork.

Monitoring Summary Report

A post-field technical monitoring report summarizing the condition of monitoring investigations and results should be completed following each monitoring field season. The monitoring report should minimally include: introduction, project description, purpose, methods, results, impacts summary (general causes, types, degree, and likely outcomes of the ongoing impacts to the site). The report should also contain recommendations for monitoring scheduling, priority, and possible treatment. The previously submitted *Project Management Summary Table* should be updated if necessary and included in the monitoring report. Specific reporting requirements will be detailed within individual monitoring contract performance work statements (PWS).

Appendices should include monitoring forms for each site visited, new photo point records, site record addendums as required, and a project photograph index. Monitoring forms should minimally include the monitoring form body, monitoring map, and photo page(s). If required, photo point records should also be completed or updated as necessary and included as part of the report. Updated site forms should be completed by a professional archaeologist when there is any change in a site's condition or boundaries. Site updates should be prepared in accordance with requirements defined within the monitoring project PWS and survey and reporting guidelines of the Oregon SHPO and Washington DAHP (DAHP 2011; SHPO 2013). Site update forms should be approved by the USACE COR prior to submittal to the Oregon SHPO or Washington DAHP.

Data Management

Site monitoring can generate large amounts of data that need to be processed and organized in a way that allows for efficient future reference and analysis. Previous years' monitoring data should be maintained by the USACE/FCRPS Cultural Resource Program manager and made available when necessary to both agency representative and contractors. Standardized file formats and specifications for reports, forms, photographic, and Geographic Information System (GIS) data should be included within individual monitoring contract PWS. Recommendations for monitoring photographic and GIS standards are included as part of SOP 3 (Photographic Documentation) and SOP 4 (GPS Use: Monitoring Data Collection) located within Appendix A. Monitoring summary data including basic information such as which sites were visited and if impacts were observed should be maintained at a FCRPS program level as part of the FCRPS monitoring database.

Agency Response and Treatment Recommendations

Detecting and measuring change to a site's condition is only the first part in managing sites affected by operation of the FCRPS. Information gathered through monitoring should be used to trigger immediate and long-term corrective actions by the Agencies. Outlined within Table 5 are recommendations for appropriate documentation methodologies for various impacts, impact threshold triggers, and possible corrective actions. Recommendations within Table 5 only provide a basic structure for possible triggers and Agency response. Site specific impact triggers and potential corrective actions should be developed by the USCAE/FCRPS monitoring program manager in consultation with other FCRPS Project partners including the Oregon SHPO and or Washington DAHP.

Administration

Archaeological monitoring represents one aspect of the FCRPS Cultural Resource Program's responsibility and long-term commitment to protecting historic properties within the Project (BPA, Bureau of Reclamation, and USACE 2005). Monitoring programs take time to develop and require a commitment in staffing by both land managers and project partners to ensure the development

Table 5. Impact thresholds and agency response.

Animal - Surface - Area measurement	- Photo comparison	- All new events - Ground disturbance (> 10 cm in depth)	- Evaluate severity of event - Documentation -Temporary protective measures - Long term plan and protective measures
Post-depositional Processes	- Photo comparison - Area measurement	- All new events - Variance from normal use	- Evaluate severity of event - Documentation -Temporary protective measures - Long term plan and protective measures
Erosion (landslip, water, aeolian)	- Photo comparison - Area measurement - Erosion monitoring stakes	- All new events - Ground disturbance (> 10 cm in depth)	- Evaluate severity of event - Determine/ confirm monitoring methodology - Documentation -Temporary protective measures - Long term plan and protective measures
Wildfire	- Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Long term plan and protective
Weathering	- Photo comparison	- All new events - Variance from expectation of normal weathering	- Documentation -Temporary protective measures - Long term plan and protective measures
Cultural Impacts			
Agriculture and Livestock - Erosion monitoring stakes	- Photo comparison - Area measurement	- All new events - Variance from current land use - Ground disturbance	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures
Land Development	- Photo comparison - Area measurement - Remote sensing	- All new events - Measurable encroachment	- Evaluate severity of event - Agency site visit - Documentation - Long term plan and protective measures

Table 5. Impact thresholds and agency response (Cont.).

Impact	Documentation Methodology	Threshold Trigger	Corrective Action
Partial or Full Excavation	- Photo comparison - Area measurement	- All new events - Observable evidence of past excavations	- Documentation -Temporary protective measures - Long term plan and protective measures
Road Use and Maintenance	- Photo comparison - Area measurement - Erosion monitoring stakes - Erosion transects - Remote sensing	- All new events or construction - Road deflation (> 10 cm in depth)	- Evaluate severity of event - Agency site visit - Determine/ confirm monitoring methodology - Documentation -Temporary protective measures - Long term plan and protective measures
Utilities	- Photo comparison - Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Long term plan and protective
Wildfire and Rx Fire	- Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Long term plan and protective measures
Restoration	- Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Long term plan and protective
Emergency Event	- Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Long term plan and protective measures
Recreation	- Photo comparison - Area measurement - Erosion monitoring stakes	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Long term plan and protective
Reservoir Effects	- Photo comparison - Area measurement - Erosion monitoring stakes - Erosion transects - Remote sensing	- Caving or new scarps - Measurable bank loss - Exposed features or artifact conc.	- Agency site visit - Determine/ confirm monitoring methodology - Documentation - Emergency stabilization - Emergency data recovery - Long term treatment

Table 5. Impact thresholds and agency response (Cont.).

Impact	Documentation Methodology	Threshold Trigger	Corrective Action
Unauthorized Excavation	- Photo comparison - Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Damage assessment - Criminal Investigation - Long term plan and protective measures
Vandalism	- Photo comparison - Area measurement	- All new events	- Evaluate severity of event - Agency site visit - Documentation -Temporary protective measures - Damage assessment - Criminal Investigation - Long term plan and protective measures

and implementation of a successful program. Personnel requirements by the USACE include designating a monitoring project manager who will be responsible for overall project administration, planning, site selection, and compiling and summarizing yearly data. The project manager is also responsible for summarizing multi-year data, coordinating with project partners, scheduling updates, and ensuring that the program continues to meet the overall goals of the long-term management of historic properties within the Project.

Personnel Requirements

Personnel requirements for archaeological site monitoring include a Project lead or Principal Investigator (PI), a monitoring crew leader, and monitoring crew technicians. Responsibilities of the project PI include project planning, coordinating field visits, post-field data analysis, reporting, archiving project data, and the lead in training Project personnel. The monitoring crew leader will be responsible for planning and managing field monitoring visits. The crew leader should ensure that consistent and accurate data is collected in accordance with specifications outlined within the Monitoring Plan and SOP’s. The monitoring crew leader should aid the project lead in compiling field data, reporting, and training Project personnel. Monitoring technicians will aid the monitoring crew leader in collecting and recording field data associated with the project.

The project lead/PI should meet the Secretary of the Interior's Professional Qualifications Standards outlined in 36 CFR Part 61 for a professional archaeologist. The PI should have adequate experience and training necessary to identify, evaluate, and measure site impacts as defined within the monitoring plan SOP’s. The PI should be in the field no less than 25 percent of the total field time. Valuable training for the project lead could include ARPA Training for Law Enforcement Officers and Cultural Resource Professionals. Monitoring crew leaders should minimally have a Bachelors Degree in Anthropology or equivalent, and have adequate experience to identify, evaluate, and measure site impacts identified in the field as defined within the monitoring plan SOP's. Minimal experience should include the use of hand held GPS units, site sketch mapping, and photo documentation and ARPA Training for Law Enforcement Officers and Cultural Resource staff. Monitoring technicians should be proficient in assisting with general field archaeological site documentation tasks. Additional beneficial experience could include the use of hand held GPS units, site sketch mapping, and photo documentation.

Currently, all baseline and repeat site monitoring is conducted by either USACE or contract archaeologists that meet professional standards. Similar monitoring programs managed by other Federal agencies rely heavily on volunteer staff (Crane et al. 2011; Kelly 2007). Benefits of using volunteer staff include more eyes on the ground and potential reduced program costs. Challenges faced by using volunteer staff include using simplified forms, inconsistency in recording between visits as a result of adequate training, catering to specific interests of the monitors who may have an interest in a particular site or resource area, confidentially, and safety (Crane et al. 2011). Within the Project, USACE Natural Resource staff have conducted limited non-formalized site monitoring at specific sensitive areas. In these instances, sites were visited by USACE Rangers both while conducting non-cultural work in the area and as part of trips made specifically for revisiting known sites or sensitive areas. Past USACE site visits by non-professional staff have contributed to the overall protection of sensitive areas in the Project and is encouraged to continue in the future.

Monitoring Training

Monitoring training is essential to ensure that observations and measurements are recorded in a consistent manner over the duration of the program. Periodic training will help maintain consistency in data collection and reporting among multiple recorders throughout the FCRPS Cultural Resource Program. A project training session led by the PI should be conducted prior to the start of fieldwork. Formalized training is recommended for USACE staff involved in FCRPS monitoring and potential contractors and other project partners. Formalized training may include an overview of the program goals, procedures, forms, scope of work (SOW), and field methods. The training should also include review of data reporting with an explanation of how monitoring data will be used and managed by the Agencies. Supplemental training may be necessary as crews and procedures change throughout the duration of the project.

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Appendix A: Standard Operating Procedures (SOP)

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FCRPS Archaeological Site Monitoring Plan

Standard Operating Procedures (SOP) 1:
Baseline and Repeat Archaeological Site Monitoring

December 22, 2014

Introduction

This SOP describes procedures for baseline and repeat archaeological site monitoring. Baseline monitoring should be conducted once during the initial site visit for each of the sites included in the monitoring program. Repeat site monitoring occurs during subsequent site visits based on the recommended monitoring schedule. During the initial site visit, a full assessment of the site's current condition should be conducted to include the documentation of all site impacts and potential future threats. Repeat site monitoring will include revisiting areas of the site that have been identified as being impacted, threatened, or where required photo points and or erosion monitoring stations have been established.

Field Preparation

Prior to monitoring, all relevant site documentation should be gathered to include site records, sections of reports, and any past monitoring information. Monitoring crews should evaluate the quality of the available reference materials prior to entering the field and if necessary, supplemental data such as air photos or GIS data should be gathered and used as an aid during site monitoring. All previous monitoring forms should be thoroughly reviewed by the field team prior to field monitoring.

Equipment:

Personal Equipment:
-Compass
-Field notebook
-Pencils, permanent marker
-3 m tape measure
-Calculator
-Clipboard

Group Equipment:
m roll tape measure(s)
-Flagging
-Wire stake flags
-Digital Camera, spare batteries
-Photo Scale
-GPS, spare batteries
-Graph paper

-Field Forms:
FCRPS Archaeological Monitoring Form FCRPS Photographic Record
FCRPS Photo Point Record
SOP 1: Baseline and Repeat Archaeological Site Monitoring SOP 3: Photographic Documentation
SOP 4: GPS Use: Monitoring Data Collection
Copies of site maps and forms (to be written on in the field)

Note: Baseline monitoring also requires all necessary field equipment required under SOP 3: Photographic Documentation.

Monitoring Overview

Field crews should consider how the site will be accessed and the when the visit will occur. Choosing site access areas and timing should be ideal for both conducting effective monitoring while attempting to attract the least amount of attention to the site and monitoring activities. Special consideration to site visit timing should be given to sites that are located in public areas such as popular recreation sites or along major transportation routes. In these areas, visiting sites either in the early morning or late in the day could significantly limit attracting unnecessary attention to the site and monitoring activities. For undeveloped sites, enter the site away from access points that could encourage further visitation from the public. Avoid walking within sensitive areas, and if possible, walk on rocks or grassy areas to limit leaving unnecessary footprints. It is necessary to walk through a site area to evaluate the condition, but excessive or prolonged visitation can damage fragile vegetation, soil, and surface artifacts causing unintended damage.

Be aware of any signs of recent looting or vandalism when visiting a site as you may be unintentionally entering a crime scene. Look for fresh footprints, heavily used turnouts, or visible churned soil that can be seen from a distance. If you notice any possible signs of looting or vandalism, proceed with caution to avoid disturbing possible evidence. Once you have determined that a violation has occurred, protect the area by limiting access by your crew or others until law enforcement has arrived. In ARPA cases, law enforcement officers are the lead on site during an investigation. Archaeologists and or cultural resource specialists provide technical support to the officer and the investigation. Signs of looting may include moved rocks, broken or cut vegetation, piled soil, or other obvious signs such as overturned, disturbed, or piled artifacts and or features. Follow established notification procedures and protocol defined in the monitoring contract Performance Work Statement or by the USACE, Portland District Archaeologist.

Baseline Monitoring Procedures

1. Check site administrative data for completeness, relocate site datum(s), and familiarize crew with the layout of the site area.
2. Conduct a pedestrian survey the entire site area as defined by previous site recordings using transects spaced < 5 m apart. For extremely large sites (landscapes), consult with the COR prior to the field visit to develop an appropriate monitoring survey strategy.
3. Identify areas that exhibit or are threatened from natural or cultural impacts.
4. Depending on the results of the initial survey, determine the number and location of photo points necessary to document all observed impacts. Baseline monitoring will guide future monitoring at the site so be as complete as possible during the initial site visit recording.
5. Use the *FCRPS Archaeological Site Monitoring Form* to record site observations.
6. Establish and document required photo points using the both the *FCRPS Photo Point* and *FCRPS Photographic Records*. Each site should minimally have one photo point established.
7. Update or create a site monitoring map, recording the location of all pertinent datums, photo points and observations noted during site monitoring.
8. Calculate the area of the site that is currently being adversely impacted (see site monitoring form for classes).
9. Before leaving the site area, collect all stake flags, and or flagging that was used during monitoring from the site area.

10. Confirm that all recorded features have adequate descriptions, photographs, and mapping completed at a scale useful for measuring the rates of changes that are occurring at that particular area.

Monitoring Form

The following section describes step by step procedures for completing the *FCRPS Archaeological Site Monitoring Form*. The monitoring form is designed to document field data collected during both baseline and repeat site monitoring visits. The form structure is designed to encourage field recorders to collect only meaningful information required to detect and measure changes to the site condition. Fields describing site changes are primarily multiple choices with comment sections that should be used to provide a detail narrative and context to noted changes.

Management Section

Smithsonian Number:
Permanent Smithsonian number assigned by the DAHP/SHPO.

Other Number:
Any other number assigned to the site including all temporary numbers.

River Mile:
River mile is the distance from the mouth the Columbia River to the site center. River miles are reported in one mile increments on U.S.G.S. 7.5' topographic maps. Provide the site river mile measurement to the nearest tenth of a mile. The sides of a stream are named (right or left or both) relative to a view downstream. In the Project, the right side is generally the Washington shoreline and the left is Oregon.

Project Name / Number:
List the project name and number unique to the organization conducting the monitoring.

Property Name / Number:
Common site name if assigned.

Property Type:
Taken from the original site record, this field describes the general type of site found.

Date / Time of Visit:
Enter the date and time the site was monitored. Format should be noted in (MM/DD/YYYY) and (00:00 hours (24 hrs).

Site Area (m^2):
Enter the site area in meters squared. Use the most up-to-date site record or GIS data to determine site area. Including site dimensions as part of baseline recording provides an indication of how much time baseline and future repeat or walkthrough monitoring visits may take (Crane et al. 2011). To convert acres to square meters, multiply acres by 4046.85 (acres x 4046.85 = m^2). The site area value is used in conjunction with the total area of the site that is adversely impacted to calculate an estimated overall site condition.

Monitoring Session:
The monitoring session field can be ether a number or name that is unique to the recording organization. Fieldwork sessions can range from a single day to multiple days in length and are numbered consecutively throughout the projects field season. Sessions are often separated between when field data such as photographs and GPS data are downloaded and processed.

Field Monitor(s):
Enter the first name initial and last name of the field recorder(s) participating in monitoring.

Organization(s):
Enter the affiliation of the field recorder(s) that are conducting the site monitoring.

Site Condition Section

Overall Site Condition:
The overall site condition field identifies the site condition following each monitoring visit. The field is calculated by adding the sum of all site impacts observed during the present site monitoring visit; this value is then used to calculate a percentage of the total site area affected (impacted area (m^2) / total site area (m^2) = % of site affected). The value is classified into one of six site condition classes to include; Excellent (< 5% site impacts), Good (≥ 5% and < 40 % site impacts), Fair (≥ 40% - < 60% site impacts), Poor (≥ 60 % - < 95% site impacts), Destroyed (≥ 95% site impacts), or Unknown (no data or condition unknown).

Speed of Site Deterioration:
Speed of site deterioration expresses the relative urgency of impacts currently operating at the site. This field is designed to help managers prioritize site treatment measures and respond accordingly to site impacts noted during monitoring. Classes include; Rapid periodic (rapid, periodic site impacts occurring), Rapid (rapid site impacts occurring), Slow (slow site impacts occurring), Slow periodic (Slow, periodic site impacts occurring), and None (no impacts noted since last monitoring visit).

Current Land Use:
The current land use field describes the general land use of the site area observed during monitoring. Classes include Developed, Un-developed / natural, and Other.

Vegetation Coverage:
The vegetation coverage field describes the overall coverage of vegetation found throughout the entire site area. The vegetation coverage should be estimated by the percent of area covered to include all grass and herbaceous cover, shrubs, and trees. Classes include Excellent (≥ 50% coverage, vegetation is abundant), Good (≥ 20% - <50 % vegetation), Fair (≥ 10% - <20 % vegetation), Poor (< 10% coverage, vegetation is absent or uncommon), and NA (un-relocated or no information).

Invasive Plant Species:
Common invasive and noxious plant species found at the site should be noted as part of each site monitoring visit. Monitors should refer to available county or state weed lists for reference on plant identification and level of concern. If invasive plant species are noted, list the name and estimate in meters squared the total area of the site that is affected.

Datum(s) Condition:
The datum condition field describes the condition of each site datum(s) located during monitoring. An attempt should be made to relocate and assess the condition of all site datums during the initial site monitoring visit. Subsequent visits may only require revisiting datums that are threatened or located near features that are included as part of monitoring. Condition values include; Good (intact, not threatened), Fair (intact, threatened), Poor (disturbed or destroyed), or NA (no information).

Features / Artifact Concentrations Visited:
List all of the site features, artifact concentrations, and site elements that are visited during monitoring. Monitoring efforts should focus on portions of the site that contribute or could potentially contribute to a sites NRHP status.

Natural Impacts Section

Aeolian / Alluvial Deposition:
Aeolian and or alluvial deposition occurs when sediment that has been mobilized and transported by either wind or water is deposited on the surface of the site. This process can occur at varying rates depending on the sediment source and the energy available for transport. Depending on the source of the sediment, the deposited material may or may not contain cultural materials. Evidence of deposition can include loose unconsolidated material overlying a surface soil that is often found along toe or foot slopes, within drainages, or occupying lower lying areas of the landscape.

Animal – Surface:
Impacts classified within the Animal - Surface category includes impacts from natural wildlife. Impacts listed in this category occur primarily at or above the ground surface involving minimal to moderate amounts of ground disturbance. Animal impacts that cause substantial subsurface disturbance and mixing to archaeological materials such as burrowing are classified within the Post-Depositional Processes, Faunalturbation category. The Animal – Surface category includes seven sub-classes: (1) Bird Damage, (2) Insect Damage, (3) Bedding Areas, (4) Trailing, (5) Trampling, (6) Displaced Artifacts, and (7) Other.

1. ***Bird damage***; includes impacts from nesting activities or excessive guano.

2. ***Insect damage***; includes chewing or above ground burrowing such as termites or carpenter ants.

3. ***Bedding areas***; include circular areas of trampled vegetation often found in sheltered or shaded areas.

4. ***Trailing***; includes visible non-livestock trails where vegetation has been trampled or removed. Trailing can be usually quantified as moderate (some vegetation remaining), or heavy (no vegetation remaining).

5. ***Trampling***; includes the removal of most or all ground vegetation in areas were larger wildlife such as deer or elk congregate (often associated with water sources, shaded areas, or bedding areas). Can be loosely quantified as moderate (some vegetation remaining), or heavy (no vegetation remaining).

6. ***Displaced artifacts***; category includes the movement of artifacts or site features by wildlife. Examples may include overturned wood or timbers, toppled walls, or hoof scuffed areas.

7. ***Other***; category should be used to note all other above ground animal impacts that cannot be classified into other categories.

Post-Depositional Processes:
Post depositional processes are ongoing natural factors that affect the sediment surrounding archaeological materials (Waters 1992). These processes begin when the site was first occupied and continue indefinitely to disturb a sites systemic context often making it difficult to distinguish between what site elements are the result of human activity vs. natural processes. Three major physical post depositional processes should be identified during monitoring that have the potential to significantly alter a sites subsurface composition. The three kinds include (1) cryoturbation, (2) faunalturbation, and (3) floralturbation.

1. ***Cryoturbation***; is the disturbance of archaeological remains through the process of the periodic freezing and thawing of soil. Mixing occurs when moisture penetrates the surface forming cracks and voids that then freezes, expanding or heaving soil towards the surface. This process allows both particles and artifacts to shift and move within the soil. Voids created by this process can become in filled with new sediment adding to the material being circulated. Evidence of cryoturbation can include heaved or “lifted” sediment or visible cracks left in the soil surface following colder periods of weather. The resulting cracks or voids may become infilled with new sediment shortly after the ground thaws making them difficult to identify.

3. ***Faunalturbation***; results from the mixing of archaeological remains by burrowing vertebrates (mammals, amphibians, birds, and reptiles) and invertebrates (insects, earthworms, and crustaceans) (Waters 1992). The extent of the potential site disturbance is dependent on both the physical limitations of the subsoil (soil texture, compaction, depth, and moisture content) and on the type and number of animals present. Some of the effects of faunalturbation can only be observed during subsurface investigation but other types of burrowing can be easily observed on the ground surface during monitoring. Examples of burrowing include rodent and other animal burrows and dens. Note the total area in meters squared of the site affected by faunalturbation and include the number, size, and type of the burrowing evidence you observe.

2. ***Floralturbation***; is the disturbance of archaeological remains by the effects of trees, shrubs or other plants. Floralturbation can occur in a number of ways to include tree-throw where soil surrounding a trees roots and trunk are displaced when a tree is overturned. Another process of floralturbation includes the displacement of soil from the growing root system and the infilling of voids left following the root decay. The final process includes tree-sway where the sediments surrounding the base of a tree are loosened and compacted as the result the movement by wind. Effects of floralturbation can be identified by obvious overturned trees exhibiting exposed root balls (tree-throw) to visible cracks in the surface of the soil surrounding a trees trunk (tree-sway). Identifying the displacement by roots and the infilling of roots voids may only be identified during subsurface investigation with the exception of available subsurface exposures such as found in exposed stream or road cut banks. Note that the effects of floralturbation can be found in combination with other impacts such as shoreline

erosion. In some cases, relatively slow shoreline erosion can be significantly accelerated by toppling of trees and other vegetation.

Erosion:
Erosion is the process where soil or sediment particles are picked up and carried by water wind or ice. Erosion can be the result of both natural and cultural agents and can occur at a slow or very rapid rate (Soil Survey Division Staff 1993; Schoeneberger et al. 2002). Three kinds of erosion can be identified during monitoring; (1) landslip, (2) water, and (3) wind.

1. ***Landslip erosion***; the mass movement of sediment or soil that can be the result of either a slide or flow. Evidence of landslip erosion can range from obvious scarps and slumps to more discrete movement that can be identified only by tree trunks that are slightly curved at the base or a visibly bent fencepost, utility pole or other features.

2. ***Water erosion***; the result of the movement of material by flowing water. Four kinds of accelerated water erosion can be identified during monitoring as (a) sheet, (b) rill, (c) gully, and (d) tunnel.

   A. Sheet erosion; the generally uniform removal of sediment from the surface of the site without the presence of channels. As the slope gradient increases, the severity of sheet erosion often increases in proportion. Indicators of sheet erosion may include ponded loose sediment, twigs and leaves that are contained within piles or deposited on the backsides of other features that trap sediment.

   B. Rill erosion; shallow (0 - < 10 cm) channels that are formed from surface runoff. Rill erosion can be identified as shallow dendritic shaped channels that often form in line with the slope.

   C. Gully erosion; moderately shallow to deep (>10 - <100 cm) "U" and "V" shaped channels that form from surface runoff. Gullies can develop within natural drainages, trails, or vehicle ruts. Gully erosion can be identified as shallow to deep gullies that often form in line with the slope.

   D. Tunnel erosion; occurs when water moves freely within the subsurface soil layers. Water can enter the ground and initially move subsurface by way of cracks, worm and rodent burrows, and root casts. As water moves within these voids, sediment is eroded, enlarging the voids creating tunnels that often result in a "jug" shaped feature at the entrance and exit.

3. ***Wind erosion***; occurs during dry conditions and depending on the particle size can pick up and transport material either short or long distances. Evidence of wind erosion could include areas that exhibit a scoured like surface such as a dune blowout and may be associated with areas of deposition that often exhibit excess loose sediment.

Wildfire:
This field identifies effects from wildfire that are not cultural (human caused) in origin. Effects from fire on archaeological remains can be both direct and indirect and vary depending on a fires temperature and duration of exposure to heat (Winthrop 2004). Some examples of direct effects include burning of historic structures and debris (aesthetic damage to glass, metal and ceramics), spalling of rock panels (petroglyphs or pictographs), or bedrock mortar features, and the

modification or destruction of obsidian hydration rinds on lithic artifacts (Winthrop 2004). Indirect effects can include the loss of vegetation that increases erosion and surface visibility of artifacts and features leaving the sites materials susceptible to looting and vandalism.

Weathering:
Weathering is the process of natural decay caused by both mechanical disintegration and chemical decomposition (Waters 1992). The effects of weathering on archaeological materials within a site increases proportionally with the rise in both temperature and precipitation. Exposed organic materials such as wood, shell, and bone are most vulnerable to weathering but many other materials such as brick, metal, and masonry are also susceptible to the effect of weathering.

Other – Natural Impacts:
This field should be used to note all other natural impacts that cannot be classified into other categories.

Cultural Site Impacts Section

Agriculture and Livestock:
The agriculture and livestock category refers to site impacts associated with both the commercial and private cultivation of plants and animals. Six common categories divide the agriculture and livestock category: (1) Livestock grazing, (2) Plowing, disking, harrowing (3) Land leveling, (4) Vegetation removal, (5) Drainage ditch excavation and maintenance, (6) and Fence construction.

1. ***Livestock grazing***; category includes all impacts associated with grazing cattle and or horses. Terminology used to describe livestock grazing impacts is taken from the National Forest Service grazing documentation the existing National Forest Service, Region 6, Grazing Allotment Review Strategy for Section 106 Compliance (Hann 2010). Grazing impacts should be thoroughly photographed by taking both overview and detail close-up photos of the affected site areas. All impacts should be mapped and areas added to the monitoring site sketch map showing impacted areas in relation to affected site concentrations and features. GPS data should be collected for the boundaries of all affected areas. Sub categories to consider when recording grazing impacts include:

    A. Bank alteration; stream banks with no supporting vegetation and which appear to be eroding and are associated with other signs of cattle grazing.

    B. Broken artifacts; fresh bending fractures on artifacts. Two or more fragments of an artifact found together (in trail or in trampled area).

    C. Edge damaged artifacts; fresh flake scars on artifact edges. Explain why damage is likely related to grazing (in trail or in trampled area).

    D. Hoof shear; shearing of stream channel banks by cattle hoofs. Hoof shear is an aspect of bank alteration.

    E. Heavy grazing; vegetation has a mown appearance. No evidence of flowers or seed stocks on plants. Manure is a useful indicator of cattle versus wild ungulate use.

F. Manure; self-evident. Distinctive composition and shape useful as indicator of the presence of cattle also referred to as cow pies, scat, sign etc. Attention should be given to the type of the manure as either cattle or horse.

G. Post holing, clear; hoof-shaped depressions in the soil caused by cattle walking on wet ground. Size of hoof print can differentiate cattle from wild ungulate use. Also referred to as hammering (as when a hammer misses a nail causes a hole in soft wood), soil displacement, hummocking, and pedestalling.

H. Trailing; visible cattle trails where all or most vegetation has been removed in mineral soils are often exposed. Manure and hoof print size are useful indicators of cattle versus wild ungulate trailing. Can be usually quantified as moderate (some vegetation remaining), or heavy (no vegetation remaining).

I. Trampling; removal of most or all ground vegetation in areas were cattle congregate (often associated with water sources, salt blocks, shading areas, and bedding areas). Trampling is often associated with significant amounts of manure. Can be loosely quantified as moderate (some vegetation remaining), or heavy (no vegetation remaining).

J. Grazing Development; to include the construction and maintenance of all spring developments, corrals, holding pens, chutes, fence construction, or any other features constructed for livestock use.

2. ***Plowing, disking, harrowing***; includes the surface preparation of soil usually before sowing. The depth of surface disturbance varies depending on the method of preparation.

3. ***Land leveling***; includes the mechanical surface leveling of fields often times to improve drainage.

4. ***Vegetation removal***; includes the mechanical removal of surface vegetation prior to cultivation.

5. ***Drainage ditch excavation and maintenance***; includes all construction and subsequent upgrades to drainage ditch system.

6. ***Fence construction***; includes the installation and associated maintenance of gates and fencing.

Land Development:
Note all site impacts related to past or ongoing land development that is un-associated with other listed categories. Land Development impacts could be associated with the maintenance or construction of either permanent or temporary structures related to Project, private operations, or other activities.

Partial or Full Excavation:
Partial or full excavation identifies whether a site has been the subject of past archaeological excavations. If the site is known to have had previous excavations, monitors should attempt to relocate excavation units and evaluate the current condition. Note if excavation units are visible and if any of the units have slumped in.

Road Use and Maintenance:
This field should be used to document the effects associated with road use and maintenance. Possible direct impacts to sites could include disturbance from road construction, culvert installation and repair, sign placement, or shoulder repair. Secondary impacts may include deflation of site areas within road corridors or erosion related to surface runoff.

Utilities:
Refers to impacts associated with the installation, use, and maintenance of utilities. Utilities may include above or below ground power, water, sewer, or communication lines. Potential impacts could include vegetation removal, grading of associated areas for repair, and associated access road use.

Wildfire and Rx Fire:
Effects from human caused fire on archaeological remains can be both direct and indirect and vary depending on a fires temperature and duration of exposure to heat (Winthrop 2004). Some examples of direct effects include burning of historic structures and debris (aesthetic damage to glass, metal and ceramics), spalling of rock panels or bedrock mortar features, and the alteration or destruction of obsidian hydration rings on lithic artifacts. Indirect effects can include a loss of vegetation that increases erosion and surface visibility of surface artifacts and features leaving the sites materials susceptible to looting and vandalism. Fire suppression activities such as hand and dozer line construction, mop up activities, and fire support operations to include fire camps, helispots, and spike camps can all inadvertently affect known and unknown cultural resources. Although not common, both intentional and unintentional looting and vandalism has occurred at archaeological sites by fire suppression crews. It is possible that because of a fire, remote sites that commonly experience little or no human visitation may be located near various fire support operations increasing the sites potential to be impacted in the future.

Restoration:
Restoration field categories include all site impacts associated to environmental restoration and enhancement projects. Two general classes of projects are covered under the restoration category to include (1) Riparian/In-Stream, and (2) Terrestrial type projects.

1. ***Riparian/In-Stream***; includes all work conducted in the riparian zone, channel enhancement and modifications, wetland, and fish passage work.

2. ***Terrestrial***; category includes all dry-land restoration work that may involve stabilization, invasive plant species eradication, and all non-riparian habitat improvement projects.

Emergency Event:
The result of any unexpected large scale event that could directly or indirectly threaten or impact a site. Examples of emergency situations within the Project may include highway or road vehicle accidents, railway derailments, spills, flooding, landslide, and structure or dam failure.

Recreation:
The recreation category includes impacts associated to all leisure activities and user visitation within the Project. Categories include (1) Camping, (2) Trails, (3) Mining, (4) Refuse dumping, (5) Stock use, and (6) Vehicle – OHV.

1. ***Camping***; category included all camping related impacts within both dispersed and developed campsites. Developed campsites are areas designated and maintained as a campground by

the land manager. Dispersed campsites are any other location used for camping. Camping related impacts may include fire ring construction, the moving of rocks and other obstructions, site leveling, entrenching and clearing for tent spaces, latrine excavation, heavy trampling and the inadvertent or purposeful destruction of cultural features or artifact concentrations. All impacts should be described, photographed, and mapped by both GPS and plotting the impacted area on the site monitoring sketch map.

2. ***Trails***; field refers to the effects from all human caused foot trails that can be categorized into two types of developed and unmaintained trails. All trails located within a site should be described, noting the width and depth of the trail tread. Trail photographs should minimally include overviews and detail photos of representative sections and or heavy use areas. The trail should be mapped and plotted on the site monitoring map and recorded with GPS.

   A. Developed, foot trails that are built and maintained by the land manager.

   B. Unmaintained, trails are unmanaged and often develop from periodic or prolonged use of an area by the public

3. ***Mining***; field refers to all recreational and commercial prospecting and extraction of mineral resources. All impacts should be described, photographed, and mapped by both GPS and by plotting the impacted area on the site monitoring sketch map.

4. ***Refuse Dumping***; field refers to the intentional dumping of modern refuse over the site surface. Categories include (1) surface trash and (2) dumping. Recent dumping events should be immediately reported to USACE Rangers or other appropriate land manager.

   A. Surface trash; includes scattered surface litter commonly found in public recreation areas. Note the general location, amount, and source if possible of surface trash found at the site.

   B. Dumping; includes all intentional waste dumping. For refuse dumping, describe the type and amount of garbage observed and if the discarded waste is the result of a single or multiple dumping events. Dumping piles should be described, photographed, and mapped by both GPS and plotted on the site monitoring sketch map.

5. ***Stock Use***; field refers to impacts associated with the recreational use of horses, mules, burros, and llamas. Potential impacts include overgrazing, pawed-up or churned surface soil, trampled vegetation, manure, and trail and stream bank erosion. All impacts should be described, photographed, and mapped by both GPS and plotted on the site monitoring sketch map.

6. ***Vehicle – OHV***; field refers to site impacts associated with the use of Off-Highway Vehicles (OHV). Impacts may be the result of both motorized and non-motorized vehicles such as bicycles. Site impacts can include reduced or total loss of surface vegetation, surface soil disruption and or compaction, accelerated erosions and deflation, and inadvertent or purposeful destruction of cultural features or artifact concentrations (Sampson 2009). All impacts should be described, photographed, and mapped by both GPS and plotted on the site monitoring sketch map.

Reservoir Effects:
The reservoir effects category includes all potential site impacts related to inundation or fluctuating water levels of the Project. The primary reservoir related impact is mechanical erosion that can occur underwater, along the active shoreline, or from backshore runoff and stream inflow (Ware 1989). Shoreline erosion is not uniform within the different Projects and varies largely depending on an areas surficial geology, geomorphology, slope and profile, wind direction, the amount of fetch as well human and other processes. Reservoir effects categories include: (1) caving, (2) wave-cutting, (3) beach lag, (4) partial inundation, and (5) full inundation.

1. ***Caving***; the collapse of a streambank by under-cutting due to erosion at the toe or erodible soil layer above the toe of slope. Evidence of caving may include masses of sediment found at the base of a vertical cut bank that has fallen as a cohesive. Sediment blocks may or may not be partially covered with surface vegetation.

2. ***Wave-cutting***; visible erosion impacts from waves on a streambank. Effects from wave-cutting include distressed streambanks, cut banks, strandlines, reduced or removed shoreline vegetation, and or a gravel beach berm.

3. ***Beach lag***; the accumulation of deflated artifacts, cobbles, or boulders found along the shoreline.

4. **Partial inundation**; the periodic flooding of normally or historically dry land. Partially inundated sites may be affected by multiple reservoir related impacts such as caving, wave-cutting and beach lag as well as other inundation specific impacts such as chemical weathering, sedimentation, and the displacement and weathering of features.

5. ***Full inundation***; permanent flooding of normally or historically dry land. As with partial inundation, full inundation may include multiple other potential impacts including chemical weathering, sedimentation, subaqueous erosion, and the displacement of site elements by currents and wave action. Impacts related to full inundation are largely unknown for most sites.

Unauthorized Excavation:
Unauthorized excavation field includes the effects from any excavation, removal, damage, and or alteration of any archaeological artifact, features, or site without a permit. Four general types of unauthorized excavation are covered under this category to include (1) Digging – intentional, (2) Digging – other, (3) Artifact sorting or collection piles, and (4) Theft.

1. ***Digging – Intentional***; category includes intentional human digging within a site for the purpose of locating artifacts or site features.

2. ***Digging – Other***; category includes human excavation within a site without the intent of locating or removing artifacts or site features.

3. ***Artifact sorting or collection piles***; Artifact sorting or collection piles that contain several to many small artifacts are common examples of unauthorized excavation. Artifact sorting and collection piles are created from a person(s) that has illegally gathered, sorted, piled, and likely removed selected artifacts from a site. Artifact sorting or collection piles are a likely indication that theft has occurred.

4. ***Theft***; artifact theft includes the removal of any archaeological artifact or all or part of a feature from within the site boundaries. Theft of non-cultural items found on site such as signs, gate, or other interpretative items should be listed within the vandalism category.

Vandalism:
Vandalism is the willful or malicious defacement and destruction of archaeological artifacts, features or other on-site elements. Vandalism can occur at both precontact and historic sites and can range in severity from acts that are hardly noticeable to acts that could change a site's NRHP eligibility. Although acts of vandalism most often occur at site areas that are easily accessible and are in close proximity to public areas, any site may be vulnerable regardless of location or lack of a past visitation history. Acts of vandalism should be thoroughly documented through detailed description, drawings, photographs, and plotting the affected area on the site monitoring map. Documentation should include enough detail to differentiate between any past, current, or future acts of vandalism. All acts of vandalism should be immediately reported to the USACE Portland District Archaeologist and USACE Project Rangers. Evidence of recent acts to site elements should be reported as an ARPA violation and protected undisturbed until directed by the USACE Portland District Archaeologist and Law Enforcement.

Other – Cultural Impacts:
This field should be used to note all other cultural impacts that cannot be classified into other categories. Possible examples include site effects related to geocaching, paintball, or the recent construction of shrines or cairns.

Monitoring Documentation Section

Required Photographs:
Note if required photographs were taken during monitoring. Required photographs are taken from established photo points. Choices include "yes" or "no".

Video:
Note if video was used during monitoring. Choices include "yes" or "no".

Other Photos:
Note if other photographs were taken during monitoring. Choices include "yes" or "no".

GPS:
Note if GPS was used during monitoring. Choices include "yes" or "no".

Monitoring Station Measurements:
Note if erosion station measurements were taken during monitoring. Choices include "yes" or "no".

GPS File name:
If GPS was used for mapping, list file name.

Attachments:
Note if additional forms were used during monitoring. Choices include Monitoring Sketch map, Photographic Record, Photo Point Record, Continuation Sheet, or None.

Recommendations Section

Monitoring Schedule:

Based on the current monitoring results, list the recommended monitoring schedule for repeat. Refer to the Project Recommended Monitoring Frequency Table (Table 4) for scheduling recommendations. If recommendations differ from the criteria listed in the Project Recommended Monitoring Frequency Table or of the "Other" category is used, provide justification in the recommended management actions section. Scheduling choices include:

- Monthly *(12 visits per year)*;
- Quarterly *(four visits per year)*;
- Semiannual *(two visits per year);*
- Annual *(one visit per year);*
- Biennial *(one visit every two years);*
- Three year *(one visit every three years);*
- Five year *(one visit every five years);*
- Discontinue *(end archaeological monitoring);*
- Other. If other, describe schedule in the recommended management actions section.

Walkthrough Monitoring Schedule:

Based on the current monitoring results, list the recommended walkthrough monitoring schedule. Walkthrough monitoring can be the only type of monitoring recommended for a site or in combination with one or multiple repeat site visits. Provide specific recommendations for monitoring frequency, season, date range, or time of day. Note if special conditions would contribute to monitoring success such as during periods of low water, windows of limited access such as during a reservoir drawdown, or during a scheduled event.

Recommended Management Actions:

Describe possible management actions for the site. Possible options could include suggestions for emergency or long-term stabilization, mitigation, or site protection measures. Use this section to also make suggestions regarding changes to the sites visitation schedule or documentation needs. Possible options include: Revegetation, stabilization, testing, fencing/closure, additional documentation, damage assessment, and or increased law enforcement visits. Provide justification and explanation of each recommended management options.

Recommended By:

Enter the first initial and last name of the person making the recommendations.

Date:

Enter the date the recommendations are made. Format should be noted in (MM/DD/YYYY).

FCRPS Archaeological Site Monitoring Plan

Standard Operating Procedures (SOP) 2: Walkthrough Archaeological Site Monitoring

December 22, 2014

Introduction

This SOP describes procedures for walkthrough archaeological site monitoring. Walkthrough monitoring includes quickly identifying major impacts or changes to the condition of a site that requires immediate action by the Project. Walkthrough monitoring is not intended to replace baseline or repeat monitoring, but supplement traditional monitoring activities by visiting threatened sites more frequently. Walkthrough monitoring is recommended for sites that are threatened by impacts that occur irregularly such as looting and vandalism. Walkthrough Monitoring is also recommended for sites where little information is known about a resource or that the existing data is out of date and updated information would help to prioritize future needs. The primary goal is to increase the number of sites that can be visited in a given year by reducing the amount of time required to complete field and office tasks for each site visited.

Field Preparation

As with baseline or repeat monitoring, all relevant site documentation including site records, sections of past reports and monitoring information should be reviewed by the field team prior to fieldwork. Monitoring crews should evaluate the quality of the available reference materials, and if necessary, gather supplemental resources such as air photos or GIS data to aid in site relocation and monitoring.

Equipment:

Personal Equipment:
-Compass
-Field notebook
-Pencils, permanent marker
-3 m tape measure

Group Equipment:
-Digital Camera, spare batteries
-Photo Scale
-GPS, spare batteries

-Field Forms:
-*FCRPS Walkthrough Site Monitoring Form*
-*Copies of site maps and forms (to be written on in the field)*

Monitoring Overview

Field crews should consider how the site will be accessed and when to schedule the field visit. Baseline and repeat monitoring is generally conducted during seasons and times of day that will attract the least amount of attention to the site and monitoring activities. The more intensive level of documentation required by baseline and repeat monitoring increases the time required on site by the monitoring crew. The extra time on site often attracts unwanted attention to sensitive site areas that are located in public areas such as in campgrounds or along major transportation routes. Walkthrough monitoring requires little formal documentation decreasing the amount of field time. As a result, monitoring visits can be done quickly and during times when the site is heavily used without the worry of attracting unnecessary attention.

As with baseline or repeat monitoring, be aware of any signs of recent looting or vandalism when entering a site area. Look for fresh footprints, heavily used turnouts, or visibly churned soil that can be seen from a distance. If you notice any possible signs of looting or vandalism, proceed with caution to avoid disturbing possible evidence. Once you have determined that a violation has occurred, protect the area by limiting access by your crew or others until law enforcement has arrived. In ARPA cases, law enforcement officers are the lead on site during an investigation. Archaeologists and or cultural resource specialists provide technical support to the officer and the investigation. Signs of looting may include moved rocks, broken or cut vegetation, piled soil, or other obvious signs such as overturned, disturbed, or piled artifacts and/or features. Follow established notification procedures and protocol defined in the monitoring contract Performance Work Statement or by the USACE, Portland District.

Walkthrough Monitoring Procedures

1. Identify site areas that are threatened or impacted by natural or cultural impacts.
2. Use the *FCRPS Walkthrough Site Monitoring Form* to record site observations.
3. If site impacts are identified, briefly describe, photograph, and record the location of each major impact.
4. The field archaeologist should determine the correct level of documentation necessary based on the type (erosion vs. vandalism) and the nature of the impact (new or ongoing). More comprehensive documentation may be necessary in cases where important time sensitive information such as evidence of looting and vandalism would be lost if not immediately recorded.
5. Following each field visit, add the monitoring results to the project *Walkthrough Monitoring Visitation spreadsheet*.

Monitoring Documentation

The following section describes procedures for completing the *Walkthrough Monitoring Visitation spreadsheet (Appendix B)*. The spreadsheet is designed to log basic management and scheduling data about the site visit as well as monitoring observations and recommendations.

Spreadsheet Fields:

1. **Smithsonian Number**: Permanent Smithsonian number assigned by the SHPO.

2. **Other Number**: Any other number assigned to the site including all temporary numbers.

3. **Date / Time of Visit**: Enter the date and time the site was monitored. Format should be noted in (MM/DD/YYYY) and (00:00 hours (24 hrs).

4. **Field Monitor(s)**: Enter the first name initial and last name of the field recorder(s) participating in monitoring.

5. **Impact Observed**: Record if any site impact(s) were located during monitoring. Enter (Y) for yes and (N) for no.

6. **Site Impact/Threat**: List all natural and cultural site impacts. Provide general impacts categories only.

7. **Impact Description**: Provide a brief supportive narrative for each impact.

8. **Speed of Deterioration**: Speed of deterioration expresses the relative urgency of each impact. The field is designed to help managers prioritize site treatment measures and respond accordingly to impacts noted during monitoring. Classes include; Rapid periodic (rapid, periodic impacts occurring), Rapid (rapid impacts occurring), Slow (slow impacts occurring), and Slow Periodic (slow periodic impacts occurring).

9. **Recommended Management Actions**: Describe possible management actions for the site. Options may include suggestions for emergency or long-term stabilization, mitigation, or site protection measures. Possible options include: Revegetation, stabilization, testing, fencing, closure, additional documentation, damage assessment. Provide a brief explanation of recommended management options. Use this section to make suggestions regarding changes to the sites visitation schedule.

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FCRPS Archaeological Site Monitoring Plan

Standard Operating Procedures (SOP) 3: Photographic Documentation

December 22, 2014

Introduction

This SOP describes procedures for taking photographs and establishing photo points as part of archaeological site monitoring. Photographic documentation provides an efficient way of identifying changes to a site's condition over time (Hall 2001). There are two general types of photographs that are taken during monitoring to include repeat and general subject photography (Hall 2001; Santucci 2009). Repeat photographs are pictures taken of the same subject from the same location over multiple site visits that are then compared and used to detect change to the site condition over time. General subject photographs are taken to record particular events such as isolated erosion or a single looting event that may have been observed during a single site visit. General subject photographs are not usually intended to be duplicated during subsequent site visits but can be chosen in the future to be duplicated depending on the needs of the recorder. All photographs should be taken at a scale (overview vs. close-up) that is most useful for measuring or recording the intended subject. For a more detailed review of monitoring photography applications and techniques, please see the previous work by Hall (2001) and Santucci (2009).

Using Repeat Photography

Repeat photography utilizes multiple photographs taken of the same subject during separate site visits which are used to compare changes to the site condition over time. Repeat photography is accomplished by using photo points which mark the location of where a photograph was taken by either a permanent marker such as an installed datum or some other preexisting permanent feature. Photo points are specifically established in threatened or disturbed areas of a site to record either current impacts and or potential future threats. The location of each photo point should be mapped and described to ensure that the point is relocated during future monitoring visits. Information about each photo point will be recorded on a FCRPS Photo Point Record. Multiple monitoring photographs can be taken from a single photo point to document multiple subjects in the area surrounding the photo point. Information about each of the photographs taken from a photo point is recorded on a FCRPS Photographic Record to include the photo subject, direction, recorder, date, and time. Each photograph is then used to compare the current site condition with photographs taken from the same photo point at an earlier date.

Taking General photographs

General photographs are used to record specific impacts or conditions that are not necessarily intended to be duplicated in the future. General photographs do not require establishing photo points but do require inclusion in the monitoring session's Photographic Record. If necessary, general photographs may be later used as required photographs. For example, a general photograph showing a collection pile may be later chosen to be duplicated during a subsequent monitoring visit if additional damage is noted. Field recorders should consider the potential need for future duplicate photographs, and if necessary, record enough information about each image to allow for the duplication in the future if necessary.

Field preparation

Prior to fieldwork, all cameras should be checked to make sure they are in proper working order. The camera and all extra batteries should be fully charged. If necessary, extra digital storage cards should be cleared of any stored data and included as a backup for use in the field. Although only one camera is necessary for site monitoring, multiple cameras can be useful for increasing efficiency during field recording.

Equipment:

General Photo Equipment	**For Establishing Photo points**
-Digital camera(s)	-Compass
-Extra batteries	-Pencil, permanent marker
-Extra data storage cards	-3 m tape measure
-Battery Charger/ AC adapter for car charging	m roll tape measure(s)
-Photo Scale (small and large), meter scale	-Hammer (2 - 4 lb.)
-Clipboard	-Approved permanent photo point monument(s)
-Field Forms	-Monument datum tags or caps (if used)
FCRPS Photographic Record	
FCRPS Photo Point Record	

Establishing Photo points

Photo points are permanently marked camera locations that are used as reference to take duplicate photographs of the same subject over an extended period of time. Each image that is taken from a photo point represents a different time when a site was visited and can be used to compare changes to the site between visits. Photo points should be established in areas of a site that are currently impacted or are threatened by future damage. Photo points can also be recreated from previous site or monitoring photographs to compare a sites current condition with conditions that existed at a site prior to site monitoring. At a minimum, one photo point will be established for each site that is monitored.

1. Select the photo point location. A photo point can be a monument that is specifically installed for the purpose of monitoring or any other permanent feature such as a fence post, road intersection, or distinct bedrock boulder. Multiple monitoring photographs can be taken from a single photo point to document multiple subjects at different angles of view. Recorders should consider how visible the subject will be in the current lighting conditions and shadows. If you are duplicating a previous photograph, attempt to duplicate as many variables in the photograph as possible such as the time of year, day, and lighting to emphasize changes to the site condition that would be the result of natural and cultural factors and not of natural seasonal changes.

2. Record the location and descriptive information about the photo point on the FCRPS Photo Point Record. Required information includes a description of the photo point itself (*½ " capped re-bar exposed 10 cm above the ground surface, or split rail cedar fence post measuring 1.5 m in height by 15 cm in diameter),* the bearing and distance from the

photo point to minimally two permanent points or reference datums that are plotted on the site monitoring map.

3. Although not required, overview photographs showing the photo point and the surrounding area including the reference datum(s) may be helpful to aid in future relocation of the photo point. Photographs documenting the placement of photo points can be useful in relocating or determining if damage has occurred to photo points placed in an area with an elevated threat of disturbance or vandalism. Additional overview photographs taken of a photo point would be considered general photographs.

4. Letter each photo point in consecutive order as (A, B, C...). Multiple monitoring photographs can be taken from a single photo point. Each photograph that is taken from each photo point should be sequentially numbered beginning at one (1). For example, three photos taken from the same photo point would be labeled (Photo Point A, Photo 1, Photo 2, Photo 3, or a shortened listing of PPA-1, PPA-2, PPA-3).

5. For new photographs taken from photo points, record pertinent photographic information on both the FCRPS Photo Point Record and on the FCRPS Photographic Record.

Using the FCRPS Photographic Record

The FCRPS Photographic Record is used to record and track information about each photograph taken during site monitoring. Use a separate form to record information collected from each camera that is used. Photographic records commonly document all photographs taken in a single day or multiple days that are worked within a single field session until the pictures are downloaded. Administrative information recorded for each photo includes; the project number, project name, monitoring session, year, camera model, lens size, and the location of the digital file archive.

Required information for each individual picture includes:

1. Date. Enter the date when the photograph was taken (MM/DD). Year is recorded as part of the main Photographic Record information.

2. Time. Enter the time when the photograph was taken. Use the exact time the image was taken or round to the nearest quarter hour interval.

3. Exposure number. Pictures are numbered in consecutive order on each Photographic Record beginning with one (1) and can be used to record pictures taken at a single or multiple sites depending on the needs of the project. For cases when multiple shots of the same subject are taken (a situation often encountered during errors) pictures can be numbered in groups (1-4) with the preferred shot noted in the subject description (ie. shot 1-3 bad lighting, use shot 4).

4. Subject description. Clearly describe the subject of the photograph you are taking. Note the site number, feature number, photo point letter or any other formal designation of the subject. Note if the photograph is a detail or overview shot and include reference information such as if a scale was used and the names of workers shown in the image.

5. View toward. Enter the true north compass bearing from the location of the photographer to the subject (0 - 360°).

6. Recorder. Enter the first initial and last name of the photographer.

Using the FCRPS Photo Point Record

The Photo Point Record is used to record information about each photo point and all required photographs to be duplicated during future monitoring visits. One Photo Point Record is completed for each photo point and is completed when the photo point is first established. The completed Photo Point Record should be used as reference to aid in the future relocation, duplication, and comparison of site photographs. Each form has room to record up to three photos from a single photo point. Additional forms may be used if necessary to document additional photos.

Required information for each photo point:

1. Photo Point. Label each photo point with a unique letter designation in consecutive alphabetic order as (A, B, C...).

2. Date Established. Enter the date when the photo point was established (MM/DD/YYYY).

3. Photo Point Description. Clearly describe the photo point and surrounding setting. Include details on relocating the photo point such as the bearing and distances to multiple known site datums or features. Describe the condition of the photo point, height above ground surface, and physical characteristics. Include dimensions and any other relevant information to describe the point if a natural object such as if a boulder or other object is used. Provide enough information about the photo point to allow for the relocation by monitors that have never been to the site.

Required information for each individual picture:

1. Photo Number. Number each photograph sequentially from each photo point beginning with one (1). For example, three photos taken from the same photo point would be labeled (Photo point A, Photo 1, Photo 2, Photo 3, or a shortened listing of PPA-1, PPA-2, PPA-3).

2. View toward. Enter the true north compass bearing from the location of the photographer to the subject (0 - 360°).

3. Distance to subject. Enter the distance in meters (m) from the photo point to the subject.

4. Subject description. Clearly describe the subject and purpose of the photograph you are taking. Note the site number, feature number, or any other formal designation of the subject. Include reference information such as if a scale was used and the names of workers that may be shown in the image.

5. Recorder. Enter the first initial and last name of the photographer.

6. Date. Enter the date when the photograph was taken (MM/DD/YYYY).

Managing and storing photographic data

Photographs taken as part of site monitoring should be in digital format and recorded at a minimum resolution of 1600 x 1200 pixels and saved in 24-bit or larger format for best detail. Images should be printed or displayed in full color but gray scale may be used in situations where gray scale is the preferred format to depict a particular subject. Electronic image files should be saved using the highest-quality settings for JPEG format. Use an appropriate file naming system designated by the contract or a similar type system that includes consecutive image numbers.

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FCRPS Archaeological Site Monitoring Plan

Standard Operating Procedures (SOP) 4: Global Positioning System (GPS) Use: Monitoring Data Collection

December 22, 2014

Introduction

This SOP describes methods for collecting spatial data using a handheld Global Positioning System (GPS) receiver during archaeological site monitoring. Information covered in this SOP is specific to archaeological site monitoring and is not intended to replace owner or user manuals supplied by the GPS manufacturer. This SOP should supplement any USACE Geographical Information System (GIS)/GPS guidelines provided as part of an individual project performance work statement (PWS). Questions regarding clarification on procedures or reporting should be directed to the FCRPS Cultural Resource Program GIS/GPS lead. GPS operators should become familiar with the use and operation of the specific GPS receiver and accompanying software that will be used before conducting site monitoring.

GPS Specifications

GPS receivers should be capable of collecting sub-meter data, are simple to operate, require little training, and provide repeatable results. Currently, the recommended and approved GPS unit to be used for collecting spatial data during site monitoring is the Trimble© Geo or Juno series handheld GPS unit. The Geo or Juno series is capable of collecting data with sub-meter accuracy while using a project specific data dictionary. A data dictionary is a customizable list of features and attributes for field data collection that both standardizes and maximizes data collection efficiency while monitoring. Recreational GPS receivers may be useful for relocating sites but do not possess the required accuracy and repeatable results necessary to map site impacts observed between site visits.

General GPS Operation and Data Collection

All spatial data collected during monitoring will be projected in the Universal Transverse Mercator (UTM) coordinate system and North American Datum of 1983 (NAD83). If necessary, existing data, imagery, or maps should be loaded on the GPS receiver and used to aid in the relocation of the site or related datums or features. When logging spatial coordinates in a Trimble GPS unit, a minimum of three (3) positions should be collected for each point feature. Line features should have a minimum of three (3) positions collected for each line section mapped. Polygon features should have enough positions collected around the perimeter of the feature to depict the intended shape of the subject. To ensure consistency in the data, the GPS receiver Positional Dilution of Precision (PDOP) mask should be adjusted to collect points with a value no higher than 7 (PDOP of 6 is preferred). Increasing the PDOP mask will allow the collection of positions with decreased accuracy and may be necessary in situations where collecting a position overrides accuracy concerns. If poor GPS satellite reception is expected, planning software supplied with the GPS unit can be used to determine the times of day when satellite availability and geometry will be the best.

Data to be collected during baseline monitoring:

- Site datums [*Point Feature*].
- Photo points [*Point Feature*].
- Point – other, specific points of interest such as collection piles, single or small areas of disturbance, or other reference point information [*Point Feature*].
- Lines depicting linear site impact features (roads or trails) [*Line Feature*].
- Boundaries for areas of noted site impacts (erosion, rodent disturbance, unauthorized excavation and vandalism) [*Polygon Feature*].

Data to be collected during repeat site monitoring:

- New or newly located site datums [*Point Feature*].
- New photo points [*Point Feature*].
- Changes to existing spatial data (expanded site boundaries) that have not been previously recorded, linear site impacts such as new roads or trails [*Line Feature*].
- Boundaries of current noted site impacts (erosion, camping areas, unauthorized excavation, vandalism, site disturbance) [*Polygon Feature*].

Downloading and Processing Data

GPS units should be downloaded immediately after returning from the field. All data files should be transferred to the appropriate project directory and backed up per Agency or contractor protocol. Data should be immediately evaluated for quality and if necessary, adjustments should be made in the field collection procedures or with the individual unit settings to correct any problems. Unacceptable data should be identified as such, separated from acceptable Project spatial data, and recollected.

GPS Data dictionary

The FCRPS Cultural Resource Program GIS/GPS lead will provide the monitoring database schema in XML format. All procedures and protocol specified by the FCRPS Cultural Resource Program GIS/GPS lead should be followed by Agency staff and contractors.

Appendix B Example of Monitoring Forms

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Example of the FCRPS Archaeological Site Monitoring Form

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ARCHAEOLOGICAL SITE MONITORING FORM
Federal Columbia River Power System, Cultural Resource Program

MANAGEMENT

Smithsonian No.:	Other No.:
River Mile: Bank (L / R / B):	Project Name / No.:
Property Type:	Date / Time of Visit:
Site Area (m^2):	Monitoring Session:
Field Monitor(s):	Organization(s):

SITE CONDITION

Overall Site Condition: *(results of current monitoring, expressed in m^2 of total site impacts observed)*	
☐ Unknown *(no data or condition unknown)*	Fair *(> 40% - < 60% site impacts)*
☐ Excellent *(< 5% site impacts)*	Poor *(> 60 % - < 95% site impacts)*
☐ Good *(> 5% and < 40 % site impacts)*	Destroyed *(> 95% site impacts)*
Speed of Site Deterioration:	
☐ None *(no impacts noted since last monitoring visit)*	Rapid *(rapid site impacts occurring)*
☐ Slow *(slow site impacts occurring)*	Rapid periodic *(rapid, periodic site impacts occurring)*
☐ Slow periodic *(slow, periodic site impacts occurring)*	

Current Land Use: ☐ Developed, ☐ Un-developed /Natural, ☐ Other	
Vegetation Coverage: *(Coverage of vegetation over the entire site area)*	
☐ Excellent *(> 50% coverage, vegetation is abundant)*	☐ Poor *(< 10% coverage, vegetation is absent or uncommon)*
☐ Good *(> 20% - <50 % vegetation)*	
☐ Fair *(> 10% - <20 % vegetation)*	☐ NA *(no information)*
Invasive Plant Species: ☐ Absent, ☐ Present (*if present, list species and estimate % of site affected*)	
Comments:	

Datum(s) Condition:
☐ Good *(intact, not threatened)*, ☐ Fair *(intact, threatened)*, ☐ Poor *(disturbed or destroyed)*, ☐ NA *(no information)*
Comments
Features / Artifact Concentrations Visited: (*revisit all site elements that contribute or could potentially contribute to a sites NRHP status, list below)*
Comments:

ARCHAEOLOGICAL SITE MONITORING FORM
Federal Columbia River Power System, Cultural Resource Program

NATURAL IMPACTS

Natural Impacts Coding

0 = Absent (no evidence of impacts) *2 = Inactive (no new impacts since site was last visited) 1 = Active (evidence of impacts since site was last visited)* *3 = NA (not enough information to make a determination)*

	Code	Site Area Affected (m^2)			Code	Site Area Affected (m^2)
Aeolian/Alluvial Deposition				**Erosion**		
Animal - Surface				Landslip		
Bird damage				Water		
Insect damage				*Sheet*		
Bedding areas				*Rill (0 - < 10 cm)*		
Trailing				*Gully (>10 - <100 cm)*		
Trampling				*Tunnel*		
Displaced Artifacts				Wind		
Animal - Other				**Wildfire**		
Post-Depositional Processes				**Weathering**		
Cryoturbation				**Other – Natural Impacts**		
Faunalturbation						
Floralturbation						

Do any of the above impacts appear to have occurred since the last monitoring session? ☐ Yes, ☐ No
If yes, explain in comments.

Comments:

Continuation Sheet ☐ Yes, ☐ No

ARCHAEOLOGICAL SITE MONITORING FORM
Federal Columbia River Power System, Cultural Resource Program

CULTURAL IMPACTS

Cultural Impacts Coding

0 = Absent *(no evidence of impacts)*
1 = Active (evidence of impacts since site was last visited)
2 = Inactive (no new impacts since site was last visited) 3 = NA (not enough information to make a determination)

	Code	Site Area Affected (m^2)		Code	Site Area Affected (m^2)
Agriculture and Livestock	-	-	**Emergency Event**		
Livestock Grazing			**Recreation**	-	-
Bank alteration			Camping		
Broken artifacts			Trails		
Edge damaged artifacts			Trail - developed		
Hoof shear			Trail - unmaintained		
Heavy grazing			Mining		
Manure			Refuse Dumping		
Post holing			Refuse Dumping - Surface		
Trailing			Refuse Dumping - Dumping		
Trampling			Stock Use		
Grazing development			Vehicle - OHV		
Plowing, disking, harrowing			**Reservoir Effects**	-	-
Land leveling			Caving		
Vegetation Removal			Wave-cutting		
Drainage ditch Excavation & Maint.			Beach Lag		
Fence Construction			Partial Inundation		
Land Development			Full Inundation		
Partial or Full Excavation			**Unauthorized Excavation**	-	-
Road Use and Maintenance			Digging - Intentional		
Utilities			Digging - Other		
Wildfire and Rx Fire			Artifact sorting or collection piles		
Restoration	-	-	Theft		
Riparian/In-Stream			**Vandalism**		
Terrestrial			**Other – Cultural Impacts**		

Do any of the above impacts appear to have occurred since the last monitoring session? ☐ Yes, ☐ No
If yes, explain in comments.

Comments:

Continuation Sheet ☐ Yes, ☐ No

ARCHAEOLOGICAL SITE MONITORING FORM
Federal Columbia River Power System, Cultural Resource Program

MONITORING DOCUMENTATION

Required Photographs:	☐ Yes, ☐ No	Video:	☐ Yes, ☐ No
Other Photos:	Yes, ☐ No	GPS *(If yes, list file name)*:	Yes, ☐ No
Monitoring Station Measurements:	Yes, ☐ No	GPS File Name:	
Attachments: ☐ None, ☐ Monitoring Sketch Map, ☐ Photographic Record, ☐ Photo Point Record, ☐ Continuation Sheet,			
Other (list):			

RECOMMENDATIONS

Monitoring Schedule:
☐ Monthly *(12 visits per year)*, ☐ Quarterly *(four visits per year)*, ☐ Semiannual *(two visits per year)*
☐ Annual *(one visit per year)*, ☐ Biennial *(one visit every two years)*, ☐ Three year *(one visit every three years)*
☐ Five year *(one visit every five years)*, ☐ Discontinue, ☐ Other *(list)*:

☐ Walkthrough Monitoring *(list frequency and special conditions)*

Recommended management actions:
☐ Revegetation, ☐ Stabilization, ☐ Testing ☐ Fencing/Closure, ☐ Additional Documentation, ☐ Damage Assessment,
☐ Other *(list)*:

Recommended management actions description:

Continuation Sheet ☐ Yes, ☐ No

Recommended by:	Date:

Has any recommended management actions been undertaken since the site was last visited? ☐ Yes, ☐ No

Example of the FCRPS Walkthrough Site Monitoring Form

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WALKTHROUGH SITE MONITORING FORM
Federal Columbia River Power System, Cultural Resource Program

MANAGEMENT

Smithsonian No.:	Other No.: Page	of
Project Name / No.:	Date / Time of Visit:	
Field Monitor(s):	Organization(s):	

SITE CONDITION

Speed of Site Deterioration:	
None *(no impacts noted since last monitoring visit)*	Rapid *(rapid site impacts occurring)*
Slow *(slow site impacts occurring)*	Rapid periodic *(rapid, periodic site impacts occurring)*
Slow periodic *(slow, periodic site impacts occurring)*	

SITE IMPACT/THREAT

Natural Site Impacts:	Cultural Site Impacts:	
Aeolian/Alluvial Deposition	Agriculture and Livestock	Emergency Event
Animal - Surface	Land Development	Recreation
Post-Depositional Processes	Partial or Full Excavation	Reservoir Effects
Erosion	Road Use and Maintenance	Unauthorized Excavation
Wildfire	Utilities	Vandalism
Weathering	Wildfire and Rx Fire	Other – Cultural Impacts
Other – Natural Impacts	Restoration	

Impact Description(s):

RECOMMENDATIONS

Recommended management action(s):

Example of the FCRPS Photographic Record

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Federal Columbia River Power System Page of
Cultural Resource Program

PHOTOGRAPHIC RECORD

Camera Model: Roll/ lot No.
Download Date:
Downloader Name:

Project No.: Year:
Project Name:
Monitoring Session:

Mo.	Day	Time	Exp.	Subject Description	View Toward *(TN)*	Recorder

Example of the FCRPS Photo Point Record

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Federal Columbia River Power System Cultural Resource Program **PHOTO POINT RECORD**	Page	of

Smithsonian No: Temp No.: Other No.:	Project No.: Project Name: Monitoring Session: GPS File Name:

Photo Point: *(letter designation A, B, C…)*	Date Established:	UTM Coordinates: Northing: Datum: Zone: Easting:
Photo Point Description: *(Thoroughly describe the photo point; include distance and bearing to two or more permanent datums or site features; plot on site monitoring sketch map).*		

Photo Number:	View Toward:	Distance to subject:
Subject Description:		
Recorder:		Date:

Photo Number:	View Toward:	Distance to subject:
Subject Description:		
Recorder:		Date:

Photo Number:	View Toward:	Distance to subject:
Subject Description:		
Recorder:		Date:

Example of the FCRPS Continuation Sheet

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Federal Columbia River Power System Cultural Resource Program **CONTINUATION SHEET**	Page of
Smithsonian No.: Temp No.: Other No.:	Project No.: Project Name: Monitoring Session: Date:

Appendix C

Example of Project Management Summary Table

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Appendix C: Site Monitoring and Management Summary Table (example).

Site Number	Site Type	National Register Eligibility	Monitoring Date	Pool/ Elev. (Feet)*	Identified Active Site Impact/Concern	Site Condition Rating/ Rate of deterioration	Monitoring Priority Recommendation
35SH####	Camp/Lithic Scatter	Unevaluated, Potentially Eligible (Name 2002)	6/25/2014	TD/ 158.52	-Aeolian Deposition -Recreation; Trail use -Reservoir Effects; Bank Slump, Partial Inundation -Digging	Fair/ Slow	2 (Moderate)
35SH####	Lithic Scatter/ Ferry Landing	Unevaluated, Potentially Eligible (Name 2002)	6/23/2014	TD/ 158.43	-Alluvial Deposition -Faunalturbation; Tunneling, Dens -Reservoir Effects; Wave-cutting	Fair/ Slow (inundation) and Rapid Periodic (shoreline)	2 (Moderate)

* Hourly pool forebay elevation data was obtained online from the USACE, Northwestern Division data query for the Bonneville Dam & Lake On Columbia River (HFIRXZZAZD) and The Dalles Dam & Lake Celilo On Columbia River (HFIRXZZAZD) (http://www.nwd-wc.usace.army.mil), accessed June 30, 2014.

Abbreviations: BN = Bonneville Lock and Dam Project; TDA = The Dalles lock and Dam Projects

Note: The actual pool elevation at each site will vary from the forebay elevation depending on the sites location along the River. Forebay elevation is measured immediately upstream from each respective dam. Pool level elevations are provided only for sites affected by fluctuating water levels.

Appendix D

Example of Walkthrough Monitoring Visitation Spreadsheet

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Appendix D: Walkthrough Monitoring Visitation Spreadsheet (example).

Smith Number:	Other Number:	Date / Time of Visit	Field Monitor(s)	Impact Observed (Y/N)	Site Impact/ Threat	Impact Description	Speed of Deterioration	Recommended Management Actions
35WS##1	2014-1	03/24/2014, 07:00	J. Smith B. Fish	N				
35WS##2	2014-2	03/24/2014, 08:00	J. Smith B. Fish	Y	-Caving	-Recent caving found below Feature 1; affected area measures 3 m in length; 1.5 m high exposed face; multiple lithics and FCR found below slump; evidence of recent high water.	-Slow -Rapid Periodic	- Additional documentation; stabilization
					-Vandalism	-Spray paint found on boulder 2 m east of Feature 4.	-Rapid periodic	-Damage Assessment
35WS##3	2014-3	03/24/2014, 10:00	J. Smith B. Fish	N				
35WS##4	2014-4	03/24/2014, 11:00	J. Smith B. Fish	N				
35SH##1	2014-5	03/24/2014, 12:00	J. Smith B. Fish	N				