AN ABSTRACT OF THE THESIS OF

Isaac B. Daniel for the degree of Master of Science in Geography presented on June 3, 2005.

Title: Historical Alterations to the Columbia River Gorge as a Result of Transportation Infrastructure, 1850-1900.

Abstract Approved:

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Featuring high waterfalls and forested cliffs, and displaying a remarkable transition between the Pacific and Interior west, the Columbia River Gorge reveals the grandeur of western landscapes. Yet the landscape that one sees today is an amalgamation of the Gorge's natural setting *and* its unique human history. Historical research on the Gorge is deficient, as few studies have addressed landscape change that occurred *prior* to the twentieth century. This research explores a significant yet underrepresented chapter in the Gorge's history, focusing on the second half of the nineteenth century. Specifically, this research examines changes in the land that resulted from building transportation infrastructure during this era, namely the development of portage, wagon, and military roads and in-stream navigational aids. Utilizing methods drawn from historical geography, this research employs a wide range of primary source materials, including journals, photographs, surveys, and construction records, to assess landscape change. Results from this study indicate a high spatial extent of landscape impacts resulting from transportation infrastructure put in place between 1850 and 1900. The clearing of floodplain forests, coupled with changes in the hydrography of the river channel brought about by the construction of the Cascade canal and lock, led to significant changes in ecological functions, including nutrient cycling and sediment retention. These results provide suggestions for restoration efforts in the Gorge and also hold important applications for historical interpretation in the contemporary National Scenic Area. There are also broad implications for researchers seeking a broader understanding of changes in western riparian landscapes during this period.

# Historical Alterations to the Columbia River Gorge as a Result of Transportation Infrastructure, 1850-1900

by

Isaac B. Daniel

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Presented June 3, 2005
Commencement June 2006

Master of Science thesis of Isaac B. Daniel presented on June 3, 2005

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Chair of the Department of Geosciences

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Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Isaac B. Daniel, Author

ACKNOWLEDGEMENTS

I would like to thank the many people who helped me in the research process for this thesis. Many individuals were extremely helpful including Susan Seyl (Oregon Historical Society), Kirsten Lahlum and Barbara Boyd (USACE Portland Office), and the staff of the National Archives and the OSU library. A big thanks to Tony Morse for his help with Gorge photographs. I would also like to thank my graduate committee and the professors who I had the pleasure to TA for, Larry Becker, Bruce Coblentz, Steve Cook, and Bruce Shindler. The biggest thanks goes to my graduate advisor, Ron Doel. Without his guidance, perseverance and great attitude this thesis could not have happened.

All of my wonderful friends in and around the university have been a wonderful influence on this project and my graduate school life. Thank you all for giving me the push I needed to complete this thesis and for the many good times spent around and away from the office. Also thank you Gabe and Jenn for providing the perfect pre-defense getaway and for being so wonderful.

Lastly, thank you to my wonderful family. You have been a fantastic guiding force and have been wonderful at letting me discover my own path in life. I could not be where I am without your love and support.

L'Chaim.

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# Historical Alterations to the Columbia River Gorge as a Result of Transportation Infrastructure, 1850-1900

## Chapter 1- INTRODUCTION

The juxtaposition of the Columbia River Gorge's physical attributes and its importance to human settlement in the Pacific Northwest creates a landscape that is unparalleled in the United States. Its unique character stems not only from its picture-perfect example of the grandeur of western landscapes, but also from its central position in the history of settlement and development of the northwest.

For multiple generations, scholars have been assessing the impact of humankind on the face of the earth. Beginning with the writings of George Perkins Marsh (1864), possibly the first individual to show causal links between human action, manipulation of resources, and environmental consequences, the impacts of humans on the land has been a fecund topic of discussion. In more recent times, the disciplines of historical geography, environmental history, and human ecology have flourished as arenas for such discussion and research. The causal relationships existing between humans and the landscape have been well established. As environmental historian William Cronon has declared:

> All human groups consciously change their environments to some extent—one might argue that this, in combination with language, is the crucial trait distinguishing people from other animals—and the best measure of a culture's ecological stability may well be how successfully its environmental changes maintain its ability to reproduce itself… (Cronon 1983: 13)

Assessing environmental change over time cannot be achieved by studying isolated transformations. Rather through a holistic perspective, cultural, social, and economic changes must all be studied in consort to understand substantive landscape impacts. Contemporary examinations of the environmental dimensions of human history must therefore take into account historic social processes, or else the environmental consequences of resource exploitation and utilization cannot be properly identified or assessed.

Historical research on the Columbia River Gorge is deficient in two ways. First, there are surprisingly few studies of the environmental history of this region. Second, few studies address the significant changes in this landscape that occurred *prior* to the twentieth century. Most historical research on the Gorge focuses on twentieth century developments. In particular, studies have addressed the development of large-scale hydropower projects (White 1995), economic differentiation between north and south (Washington and Oregon) banks of the river after 1900 (McLaughlin 1994), and the mandated federal land-use protection measures enacted in the 1980s (Abbott et al 1997). Studies completed on the Gorge before the turn of the twentieth century are primarily concerned with the socio-cultural circumstances of native peoples, the history of early overland explorers (such as Lewis and Clark and John Fremont), and the history of the Oregon Trail. Thus, despite a burgeoning literature on native and early Euro-American population and settlements in the Gorge, these works pay little attention to environmental history, and largely ignore the landscape alterations and environmental impacts that occurred as local resources were identified and exploited. Indeed, the current literature on the history of settlement in the Gorge largely fails to elucidate how this landscape evolved over time.

This study seeks to remedy this situation by answering fundamental questions not yet addressed about the environmental history of the Gorge. Readers will not find here a social or political history of the Gorge region of Oregon and Washington, or a historical account of larger changes in the United States and the greater west in the second half of the nineteenth century, including the Gold Rush, the Civil War, the rapid growth of industry, or the nation's military and economic interest in gaining dominion over the regions west of the 100$^{th}$ Meridian, though all occurred during the time frame of this study and informed it. Instead, this study focuses on understanding environmental changes in the Gorge by careful inspection of surviving historical records. The largest guiding questions are: first, what were the historical processes that led up to, and subsequently continued, as transportation infrastructure was developed after the mid-nineteenth century? Second, how did the addition of transportation infrastructure impact the existing landscape of the Gorge? Finally, what was the degree of landscape alterations and environmental impacts during this time period, both in spatial extent and intensity?

These questions highlight other significant issues that merit review. Particularly important is understanding the environmental character of the landscape in earlier times (here, prior to the arrival of European settlers). Assessing earlier 'baseline' conditions is an essential aspect of reconstructing historical landscapes. Baseline studies enable researchers to better understand landscape change over time, and extending baselines further back in time, beyond the range of modern data sets, is important for many branches of the environmental sciences. The final questions of importance for this research relate to the extent of landscape impacts. Were certain areas impacted more than others? If they were, is there a geographic explanation as to why? Answering these questions may provide insight into the process of landscape change.

The primary goal of this research is to uncover and understand the historical process of riparian alteration in the western Columbia River Gorge from 1850 to 1900. This includes a detailed exploration of the development of transportation infrastructure in the riparian zone of the Columbia River over this time. The main topical areas are the construction of portage and mainline railroads, cattle driving and military wagon roads, and in-stream canal and lock construction. Physical changes in the land are particularly emphasized. These will be interpreted against the larger driving forces – including the importance of this unique Pacific Northwest corridor in aiding the growth of Portland, Seattle, and other coastal metropolitan areas in Oregon and Washington states – that contributed to the physical changes on the landscape. While a comprehensive assessment of the ecological ramifications that occurred in relation to, or as a result of, alterations made to the riparian zone of the Columbia River lies beyond the scope of this thesis, insights into likely changes are offered.

It is important to differentiate between the overall forces that *lead* to landscape change and the manifestations that o*ccur* on the landscape. Turner and Meyer (1993) use 'driving forces' and 'proximal effects' to underscore this important distinction. They assert that driving forces are the larger social, cultural, and economic conditions that exist as part of a regional or national idealism. Proximal effects are the on-the-ground manifestations (or *impacts*, in this research) that result from the driving force conditions. Examples of driving forces include population growth, a free market system, and technological innovation, while proximal *effects* can include such results as a larger housing stock, a larger housing market, and a spatial pattern of housing development that reflects transportation technology. The events that transpired in the Gorge during the era of study of interest, and the proximal effects that occurred on the landscape, are inextricably linked to driving forces behind them. Driving forces for the Gorge during this time period certainly include the desire to build a transcontinental railroad across the western territories, the large droves of overland immigrants from the east, and the U.S. government's desire to settle western regions, leading to General Land Office surveying and subsequent land claims. These caused general proximal effects in the Gorge region such as the introduction of livestock and water diversions for irrigation; more specifically, it led to intensified efforts to build new transportation infrastructure in the Gorge itself, causing changes in the river channel and adjoining riparian zones. In this sense, the current thesis follows a pathway suggested by William Cronon in *Nature's Metropolis*, where he examined how the growth of Chicago and the burgeoning railroad networks led to significant clear-cutting of forests to the north and west of Chicago, particularly in Wisconsin, Iowa and Minnesota (Cronon 1991). This study similarly seeks to examine not the growth of new urban regions, but rather the impact this growth had on transportation corridors themselves—in this case the Gorge.

To accomplish a study of this kind, a wide range of historical resources are required. Indeed, the need for a broad array of interdisciplinary knowledge and source materials cannot be underestimated. Sisk (1998) asserts that this approach is a seminal component to historical landscape studies:

> Rather than weaving together a historical narrative to 'paint a picture' of environmental change, a science-based history of land use will provide a means for placing current conditions and recent trends into a broader temporal context. Compilation of historical trends will allow us to begin to associate cause and effect, exploring the relationship between human activities and environmental change.

Altogether this research aims to achieve a better understanding of how the introduction of technological transportation systems influenced the historical and ecological landscape of the Columbia River Gorge. By drawing on a diverse character of source materials, this study should help eliminate certain missing links in the environmental history of the Gorge. Above all, it makes clear that human activity in the Gorge caused significant landscape change long before the better-known effects resulting from the construction of major Columbia River dams in the twentieth century. The impacts described and analyzed in this thesis all took place in the pre-dam era.

## Chapter 2- LANDSCAPE STUDIES: LINKING HISTORY WITH THE LANDSCAPE

Voluminous studies now address historical landscape change. Much of this research uses the historical record to explain social processes, which are then translated into landscape characteristics. Its focus is predominately social history. Landscapes become manifestations of the dynamic conditions producing them. Much of historical geography has taken this approach, especially that of work done in the mid to late twentieth century, generally before the 1980's (see Meinig (1979) for an example). The dominant tradition at the time involved working within a discipline: historians focused on humans and the human condition, while ecologists focused on ecological distribution and variations on the landscape. (Christensen 1989) This approach limited the role of humans in ecosystem change, ultimately ignoring complex relationships that had broad and profound impact on landscapes.

Increased concern by the late twentieth century to understand physical alterations by humans to ecosystems was a catalyst in a significant growth of research in historical geography and environmental history. Interest in ecological systems dramatically increased, and scholarly research on it flourished. Ecologists and historians alike noted the "new dimension[s] provided by the combination of ecological expertise and effective use of documentary history." (Hooke and Kain 1982: 131) This new effort led to an integration of historical geography, environmental history and principles derived from human ecology. This new variety of interdisciplinary study has generally been referred to as landscape studies. The most overt call for landscape studies has come from McDonnell (1993), who assembled scholars from geography, environmental history, (traditional) ecology, and human ecology who articulated a vision of landscape studies as a means to holistically understand changes in the land. McDonnell asserted that "history, geography, and anthropology, among other fields, have documented many kinds of intentional and unintentional environmental effects of humans that ecologists must come to account for in their studies of natural, modified, and managed environments." (7) Furthermore, cross-disciplinary studies allow researchers to achieve a more accurate understanding of history and ecology as a set of interrelated processes. Russell (1997) capitalizes on this fact in her evaluation of the tools that anthropologists, historians, ecologists, and geographers have developed to assess historical landscapes. The rationale behind landscape studies therefore may be summarized as one of integration. It requires understanding of historical and ecological processes *as well as* their overarching contextual atmosphere.

Russell's (1997) work on reconstructing historical landscapes thoroughly examines the tools that historians and ecologists have used in evaluating historical landscapes. She highlights three types of analysis: 1) *archeological,* including pollen studies and sedimentology, 2) *landscape ecology*, including dendrochronology, vegetation sampling, and soil analysis, and 3) *environmental history and historical geography*, making use of such sources as land survey records, diaries and journals, and public records. Egan and Howell (2001) use a similar categorization of the possible tools/analyses to be used for these types of studies. They assert that there are two primary kinds of evidence available: cultural evidence like the written record, maps, photographs, and early land surveys, and biological evidence such as dendrochronology, hydrology/geomorphology, and palynology (the study of spores and pollen). Each of the methodologies presented by these scholars may be used to infer changes in a given landscape over a particular period of time.

Multi-layer, multi-source approaches to landscape studies, these scholars have argued, are the most rewarding and the most likely to yield accurate results. (Bickford and Mackey 2004, Egan and Howell 2001) It is through this multi-layer approach that reliability, through cross-referencing, may be established. While the most dependable, this approach is not always practical. This is especially true for historical studies in places where the historical record is fragmented, unavailable, and/or requires a large commitment of resources for acquisition. For example, archeological methodology requires a high degree of specific training and expertise, as well as considerable resources to collect field data and analyze them. Ecological methods are often not practicable for the same reasons, particularly when little reliable data exist for the time period of interest. Traditional ecological metrics—including vegetation cover, vegetation type, and soil composition—are often broadly not documented for landscapes at periods before ecology emerged as an academic discipline in the twentieth century. When these metrics do exist for a particular place, their accuracy often remains uncertain due to lack of standards in taxonomy and data collection techniques.

Methods relying more heavily on traditional historical approaches are frequently the most accessible and comprehensive set of tools that geographers, historians, and ecologists have in understanding past landscapes. Virtually all scholars cite traditional historical methodology as a primary means of assessment for historical landscapes. Indeed, early scholars on the subject, notably Hooke and Kain (1982), assert that historical sources provide the backbone for further research in other fields such as archeology, geomorphology, and traditional ecology.

The methods used for this research project are those central to historical geography and environmental history. This approach was chosen to study the changing nineteenth century landscape of the Columbia River Gorge for precisely the reasons outlined above. Archeological and ecological data for this period are not readily accessible. Only a few, limited archeological studies have been completed for the Washington side of the Cascade Rapids (Minor and Beckham 1984) and for scattered cultural sites around Celilo Falls (Thomison 1987). These studies have focused predominately on indigenous culture, trading, and subsistence patterns prior to the white settlement of the west. They prove useful in assessing existing ('baseline') conditions, but are of limited utility for assessing nineteenth century changes. While some ecological research has been completed on the Gorge, these studies are fairly narrow, focusing on very particular aspects of geology, botany, and climate that allow few larger generalizations. What might be termed "holistic" ecological research, where multiple physical elements like soil, climate, and vegetation are integrated into one study, is relatively lacking for the Gorge. Moreover, historical ecological data, especially for the period before the turn of the twentieth century, are exceedingly lacking. Vegetation types, vegetation cover, soil types, and fire history for the time period are all poorly known. Only the traditional historical records for the Gorge in the latter half of the nineteenth century are rich in extent and content.

Fortunately, numerous diaries and journals were kept by explorers and overland travelers to the northwest. Journals from explorers are often more descriptive of landscape features and more accurate of place-names. Explorers, especially those sponsored by the federal government, were trained in scientific fields and hence were more systematic and purposeful in their recordings. Journals kept by settlers are often more anecdotal, with descriptions of landscape features being secondary. But both settler and explorer primary source materials are invaluable in assessing on-the-ground characteristics, especially those that were most striking or unique (such as the physical and social environment of the Cascade Rapids). Memoirs and letters are similarly useful. Contemporary newspapers also proved useful for this research. While journals are particularly good at providing background information, newspapers excel at providing information on large social and environmental events, like the opening of a road or a disastrous flood. (Hooke and Kain 1982)

Particularly relevant to this research were the written documents that resulted from government-sponsored surveys. Three surveys rise above all others in importance: 1) the homesteading and cadastral surveys made by the General Land Office (GLO), 2) the transcontinental railroad surveys produced by the U.S. Department of War, and 3) the navigation and river surveys made by the U.S. Army Corps of Engineers (USACE). All of these surveys contain vital information, systematically collected by trained individuals, on existing characteristics of the landscape. They document both the physical characteristics of the land and the societies and communities that inhabited them. Cadastral survey notes pay close attention to human habitation of the landscape, while the railroad and navigation surveys respectively highlight the physical characteristics of the shorelines and the river. By layering these sources together, both temporally and spatially, it is possible to learn a great deal about the geology, hydrology, vegetation, and climate of the Gorge, as well as discern patterns of landscape settlement and development by both the indigenous and white populations. Each of these surveys also produced a number of maps and diagrams that are highly useful, some of which are reproduced here.

No less helpful were published documents from the legislative branch of the federal government. Published in a *Serial Set*, these documents contain a large amount useful information. Serial set documents were principally of two kinds. The first and most common are short resolutions or notices of appropriations intended to complete surveys or projects. These documents reported the purpose of the resolution or appropriation, often detailing monetary outlays and projected timelines for finishing projects or surveys. Second, and even more helpful, were the actual survey and/or project reports submitted to Congress. These documents typically described in great detail landscape features (both environmental and social), in addition to plans for future developments or reports on the progress of an existing project.

One of the most important sources of historical evidence for this research is the rich photographic record of the Gorge made during the last four decades of the nineteenth century. For instance, Carleton Watkins, a photographer from San Francisco, took many photographs on two trips to the Gorge in the late 1860's and early 1880's. Historians of landscape photography note that Watkins was specifically concerned with both the wilderness landscape as well as the integration of humans (particularly incoming settlers) into it. (Nickel 1999) As Alinder et al (1979) assert, "He seems to have photographed most of the significant geological features [of the Gorge] and documented well the incursion of man in firmly rooted settlements and the growth of transportation and industry." (25) Over 100 very detailed and high-resolution images survive from his photographic expeditions of the Gorge. These images document environmental and social conditions in the Gorge in Watkins' day and thus are invaluable resources which can yield rich insights into the evolution of this historical landscape.

Less helpful, but also significant, was the decadal census. Census data for this time period provides information about the growth and characteristics of settlements in the Gorge. While these data do not explicitly mention physical landscape features, the census may be used as a tool to explore driving forces behind changes in the landscape. Changes in census characteristics can indicate shifts in transportation and settlement patterns on the landscape.

Lastly, secondary source material proved very valuable for this research. Historians and historical geographers have produced a large quantity of literature on the history of the Gorge. Particularly helpful were articles published in journals of northwest history, especially the *Oregon Historical Quarterly*. Many of these articles contained significant bibliographic information. Two previous studies on the Cascades region of the Gorge, those of Beckham (1984) and Minor and Beckham (1984) provided a solid foundation for the current study (although these works focus primarily on the social and cultural histories of the area, treating physical landscape changes in only cursory detail). This research undertakes a similar history but makes a more concerted effort to understand changes in the landscape itself (and thus takes an approach closer to that of environmental history).

Secondary materials of another kind—general histories of Oregon, Washington, the northwest, the Columbia River, and the Gorge—also aided this study. Their strength (for the purpose of this study) lies in their broad coverage of major trends in the region, as well as outlining major events that unfolded in the nineteenth century. Histories of railroad and steamboat travel in the Pacific Northwest similarly cover a wide array of trends and events. All of these secondary source materials provide a firm foundation for this research by establishing temporal and spatial context, allowing a more cross-referenced, layered study. Along with these, secondary literature was examined on geology, climate, geomorphology, vegetation species and communities, limnology, hydrology, riparian processes and functions, and other physical characteristics of the Gorge's landscape. This literature makes it possible to better assess the type and extent of anthropogenic impacts made on the land.

What are the particular strengths of these resources, and what are their weaknesses? As with any methodology, making effective use of historical source materials requires a firm understanding of their potential limitations. Historical methods can yield imprecise results, and historical sources can be skewed or unreliable, as environmental historians and specialists in related fields have repeatedly pointed out. (Cronnon 1983, Russell 1997, Taylor 1996, White 1980) These limitations are generally of two types: contextual issues and problems of interpretation. Contextual issues arise from the limited reliability of the historical data. They include mistakes made by individuals producing records: for instance, a surveyor who gathers data without a consistent protocol for data recording, or uses incorrect nomenclature for geographic or biotic features. Interpretation issues, by contrast, stem from the assumptions and biases of the data producer(s) and from the historians and scholars who make use of their data. The biases of data producers, such as a nineteenth century overland explorer/naturalist, can be difficult to decipher. Descriptions of landscape conditions in written source material such as diaries, letters, newspapers, and journals can be distorted by individual prejudices or ideologies (which sometimes can be discerned by determining what is included or omitted in their accounts). Biases on the part of scholars can be equally subtle. Researchers can misrepresent data, in the form of words, pictures, or maps, to support one's central research arguments. Beyond context and interpretation, there are other limitations of historical source material that arise from their specific character. This is the result of historical records and documents often being incomplete and of variable quality.

Addressing these limitations is vital for studies in historical geography. Researchers must be aware of their own personal biases. Historical material must be sifted through in a relatively indiscriminant way, and each source be treated with equal parts faith and skepticism. The temporal and spatial overlapping of source material helps insure that personal bias is reduced to the greatest extent possible. Moreover, this approach serves to highlight potential problems of source reliability, since comparing texts (or photographs, maps, statistics, and other source materials) often allows the researcher to discover inconsistencies and contradictions. In a chapter on cartographic and photographic source materials, Egan and Howell (2001) affirm that "one can leave no map unread, no photograph unobserved. The researcher must keep in mind, however, that such documents are not all revealing and must be used in conjunction with other sources such as field notes, diaries, travel accounts, guidebooks, and census data." (140) When multiple sources are found to be congruent with one another, there is a greater chance that the data are reliable.

Limitations of any particular source material may also be discerned by analyzing who produced it. In this study, for example, it seems important to know who was employing Carleton Watkins as a landscape photographer. The frame of his photographs might have shifted had he not been employed by the railroad operators in the Gorge. (As a matter of fact, there are differences in the composition and framing of photographs between his first and second expeditions to the Gorge, possibly because his second expedition was partly funded by the Oregon Steam Navigation Company.) Similarly, it is important to search for biases among the General Land Office field officers who took measurements and recorded landscape features. These officers were given specific instructions, standardized from the federal office, on the methods that they were to use in data collection and recording. Despite this, scholars who have worked with these surveys acknowledge that there are many instances of bias and inconsistency. (Cornett 1994, Egan and Howell 2001) Indeed, Galatowitsch (1990) asserts that inconsistent descriptions, bias and error in vegetation descriptions, and fraudulent surveying are the primary sources of GLO survey limitations.

Finally, secondary source material must also be reviewed for bias and consistency. While most scholarly research attempts to minimize bias, it is never completely free of it. Some early accounts of the history of the Gorge and the railroads in the Pacific Northwest are written in an anecdotal form, based primarily on personal contact and experience. For example, P.W. Gillette's (1904) article on the history of the Oregon Steam Navigation Company does not include a single source citation. The author mixes the history of the Company with his own experiences while traveling through the Gorge. Dates are given very broadly, and important chapters in the Company's development are omitted. This source, it is important to note, still proved useful by providing contemporary, on-the-ground perceptions of river and transportation 'improvement' then taking shape in the Gorge. But Gillette's work, like all other forms of historical evidence, must be carefully examined within the context of all available components of the historical record.

The methodology used for this study, while centered in historical geography, is therefore both thorough and integrative. A multitude of source materials, from a diverse set of archives and libraries, was used to ensure cross-referencing both over time and space. (See Appendix 1 for explanations of the archival resources used.) Lastly, all attempts were made to reduce bias, mainly by following Egan and Howell's (2001) advice: leave no source unexamined. It is now time to turn our attention to the Columbia River Gorge itself.

## Chapter 3- ASSESSING THE BASELINE

In undertaking studies of landscape history, a grasp of previous conditions is essential to understand what has changed, as well as how and why. To do this, environmental scientists as well as historical geographers need to determine a reference point in the past – a baseline – where the condition and dynamic of the landscape can be assessed with reasonable confidence. This chapter assesses baseline conditions of the Columbia River Gorge in several ways. First, it explores the physiographic characteristics of the Gorge. Second, it provides a brief overview of human presence in the Gorge prior to 1850. By establishing a comprehensible baseline for the mid-nineteenth century, the impacts of subsequent development in the Gorge can be assessed with greater precision and insight.

### 3.1- Physiographic Characteristics

> Then came the fire period with it's [sic] darkening showers of ashes and cinders and it's [sic] vast floods of molten lava… And again while yet the volcanic fires show signs of action in the smoke and flame of the higher mountains, the whole region passes under the dominion of ice, and from the frost and darkness and death of the Glacial Period, Oregon has but recently emerged to the kindly warmth and life of to-day (Muir 1988: 18)

Scholars have extensively studied the physical attributes of the Columbia River Gorge. Entire works have been completed on its geology, climate, and flora. This first part of this chapter will provide background about the physical landscape, or natural history, of the Gorge. It is not meant to be exhaustive; rather, its purpose is to formulate an understanding of how the landscape evolved before the presence of humans.

### 3.1.1- The River

With a length of 1,243 miles, the Columbia River is the seventh longest river in the United States. It drains an area of about 259,000 square miles. (Allen 1979) The river originates in the heights of the northern Rocky Mountains of Montana, Idaho, and British Columbia, and then flows in a generally southward direction through the Columbia Plateau of eastern Washington. After the confluence with the Snake River, which drains parts of Idaho, Wyoming, Utah, and Nevada, the river makes a broad sweep westward at the 'Wallula Gap'. The Columbia River Gorge, where the river cuts through the Cascade Mountain Range, is encountered roughly 200 miles before the river reaches the Pacific Ocean.

The Columbia River Gorge is usually considered to be 75 miles long, as the crow flies, or 85 miles as measured along the river. Typically the Gorge's limits are the Deschutes River on the east and the Sandy River on the west. The river runs nearly sea level in a generally east-west trend, forming the border of Oregon and

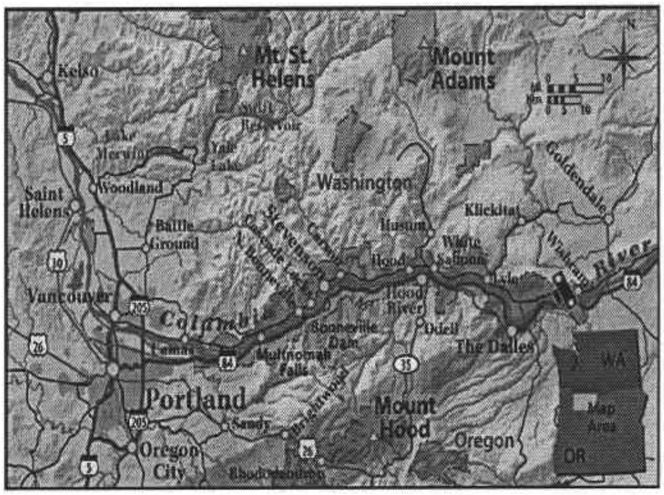



**Figure 1**: Overview Map of the Columbia River Gorge (from U.S. Forest Service Air Quality Website)

Washington. The mountains bordering the river, of volcanic origins, rise to heights on average of 1500-3000 feet, and up to 5000 feet at Mount Defiance. (Allen 1979) These form a generally V-shaped valley, their steep walls often coming in contact with the river's surface. The Gorge is the only sea level passage through the Cascade Mountains from the Fraser River of British Columbia to the Klamath River of California. (Franklin and Dyrness 1988)

### 3.1.2- Geology

A brief geologic history is difficult to achieve for the Gorge, due to the length and diversity of events. However, a brief sketch will be given here. (Overviews are provided in Baldwin (1966) or Williams (1980); for more detailed accounts consult Allen (1979) or Williams (1991).) Volcanic uplift of the Cascade Range generally began around 50 million years (my) ago. Studies of the Eocene period (53.5-37.5 my) have concluded that the Cascade Range was uplifting beside the Pacific shoreline. Explosive volcanoes were common and the shoreline pressed westward as material was added. (Allen 1979) Volcanism continued unabated throughout the Oligocene (37.5-22.5 my), forming a thick mountain range, now slightly inland. Great basalt floods occured in the Miocene epoch (22.5-5.0 my) that highly altered the characteristics of the Gorge. Some 7 or 8 highly viscous and extensive basalt flows poured over the landscape originating from fissures in eastern Oregon. (Some earth scientists believe that these basalt flows came from the hotspot that is now located under Yellowstone National Park in Wyoming.) The viscous lava repeatedly went through the Gorge, since the Columbia River was the primary drainage.

Successive basalt flows can still be seen throughout the entire Gorge, especially on the steep bluffs around Multnomah Falls on the Oregon side of the river. (Williams 1991)

The modern river emerged predominately in the Pliocene epoch (5.0-1.8 my). Allen (1979) outlines three processes that shaped the river during this time period. First was the increased level of localized volcanism. Volcanic vents around the Gorge, including Larch Mountain and Mount Defiance, went through a period of increased activity. Concurrently, up-arching of the Coast and Cascade Mountain Ranges caused increased diastrophism, wherein numerous synclines and anticlines were formed through faulting. Lastly erosion continually cut a deep V-shaped canyon through which the river flowed.

The most recent epoch, the Pleistocene, shaped the river that can be seen today. The most significant events during this time period was a series of catastrophic floods, commonly referred to as the Missoula or Spokane floods. During the peak of the ice age, about 40,000 years ago, glacial dams formed somewhere around Missoula, Montana. These ice dams pooled nearly 16,000 square miles of water into temporary lakes. (Allen 1979) As the ice sheet retreated northward numerous breaches occurred in these ice dams, causing catastrophic amounts of water to rush down the upper Columbia River Valley, through the Wallula Gap, and directly into the Columbia River Gorge. These floods carried enormous amounts of sediment, taken from the now aptly called ‘scablands’ of eastern Washington. They also carried massive glacial erratics. Sediment and glacial erratics, often of granitic origins, can be found throughout the middle elevations of the Gorge. In some places, boulders can be found as high as 1100 feet, indicating how deep the floodwaters must have been. (Baldwin 1966) The floods also highly scoured the southern mountains of the Gorge, increasing the steepness of the canyon walls and creating a multitude of high waterfalls.

In the recent geologic past, the Gorge has been subject to a number of landslides. This is the result of soils being on top of unstable bedrock (consisting mainly of mudflows and ash), and the oversteepening of many of the Gorge walls from the Pleistocene floods. The majority of the landslides are on the north bank, where the mountains are slightly more set back from the river channel. The most significant landslide occurred somewhere about 700 years ago (labeled as the Cascade slide on Figure 2). (Strong 1992) This landslide effectively dammed the river and blocked salmon passage. It also was responsible for creating the Cascade Rapids, which later figured significantly in the development of transportation infrastructure in the Gorge. Many slides still take place on both shores of the river.

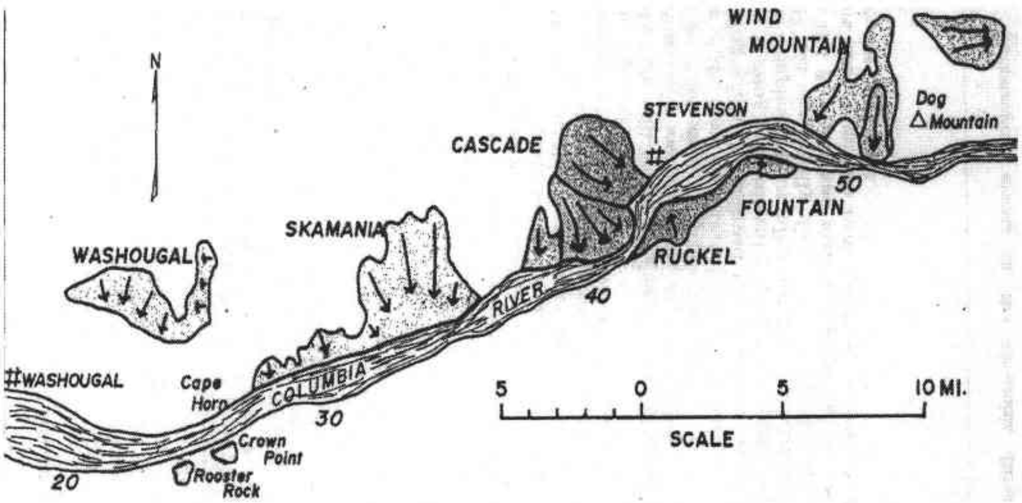



**Figure 2**: Sketch of Columbia River Gorge Landslides. (from Allen 1979)

**3.1.3- Climate**

Climate varies dramatically over the 75-mile stretch of the Columbia River Gorge. It is host to two distinct climatic regimes, with a remarkable sea-level transition from a marine type climate to a continental type of climate, in a region where these differing climates are otherwise separated by significant mountain barriers. (Franklin and Dyrness 1988) The area to the west side of the Cascade Mountains is dominated by Pacific moisture-laden air. As the moist air moves over the mountain range, orographic lifting results in high amounts of precipitation. Peak precipitation occurs at the western crest of the range. The land area to the east of the mountains is sheltered from marine influences, thus lying in a rain shadow. The gradient between the wet, marine climate and the dry, continental climate is very abrupt. As shown in Figure 3, precipitation drops significantly between Cascade Locks and Hood River (a distance of just 18 miles) and again between Hood River and The Dalles (a distance of 19 miles). The abrupt decline in

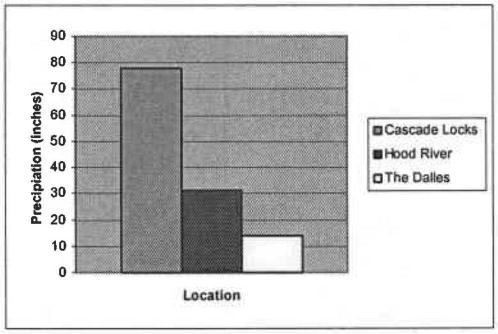



**Figure 3**: Annual Precipitation (Statistics from the Oregon Climate Service)

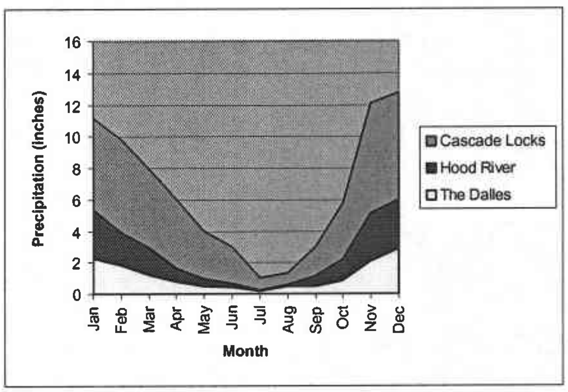



**Figure 4**: Monthly Precipitation (Statistics from the Oregon Climate Service)

precipitation between Hood River and The Dalles creates a small belt of Mediterranean-type climate, similar to that of central California. It is also important to note the seasonal changes in precipitation displayed in Figure 4. Regardless of precipitation quantities, the vast majority of precipitation occurs in the winter months, as summer months are predominantly dry. Most precipitation falls in the form of rain throughout the Gorge. Snowstorms at river level occur a few times per year, often producing higher amounts of snow on the east side due to colder, continental air. Snow can often been seen on ridge tops throughout the winter both on the eastern and western side of the Gorge. Sometimes cold air will filter through the Gorge and cause large quantities of freezing rain to occur on the western end.

Temperatures in the Gorge follow a similar west to east pattern. The marine-influenced west side is generally more temperate, encountering few extremes during both winter and summer. The east side has a typical continental climate, experiencing a large range of temperature variation. Winters are often cold and summers are often exceedingly hot.

The Gorge is subject to very high winds at multiple times during the year. All winds are due to pressure differences between air masses. During the winter, low-pressure systems come on shore from the Pacific Ocean often producing strong west winds as the front moves over the mountain range. Occasionally one of these fronts will draw in air from high pressure sitting over eastern Oregon and Washington. This causes gale force east winds, some of which, as noted above, cause the ice storms in the western Gorge. During the summer months high pressure dominates eastern Oregon and Washington, causing hot and dry conditions, while a semi-permanent low forms at the Oregon and Washington coastlines. This condition leads to very strong, very arid east winds. Recorded winds have reached over 100 mph at ridge tops in the Gorge during these conditions. (Lynott 1966) Thus the Gorge can essentially be seen as a giant wind funnel between pressure systems on the east and west sides of the Cascade Mountains.

### 3.1.4- Vegetation

The diversity of climatic features, resulting from both the east-west climate gradient and the mix of elevations, has profound effects on the vegetational communities of the Gorge. There are thus differences in vegetation as one moves both east to west and up and down. This complex gradient of vegetation communities in such a small area makes the Gorge a very rich area for botanical study. (Spranger 1984) The western lowland forest of the Gorge is typical of western Oregon's vegetation. It is primarily composed of Douglas Fir (*Pseudotsuga menziesii*), Western Hemlock (*Tsuga heterophylla*), and Western Red Cedar (*Thuja plicata*), with an understory of Vine Maple (*Acer circinatum*) and huckleberry (*Vaccinium*). Typical plants found on the forest floor include sword fern (*Polystichum munitum*), miner's lettuce (*Montia perfoliata*), wild ginger (*Asarum caudatum*), and western bleedingheart (*Dicentra formosa*). Higher elevation forests (over 2,500 feet) on the west side, and partly onto the east side, are composed of Noble Fir (*Abies procera*), Silver Fir (*Abies amabilis*), Western White Pine (*Pinus monticola*), and Mountain Hemlock (*Tsuga mertensiana*). Between Hood River and The Dalles, where precipitation rapidly declines, drier forests of Oregon White Oak

(*Quercus garryana*) and Ponderosa Pine (*Pinus ponderosa*) prevail. These forests contain a wide array of wildflowers including multiple species of penstemon (*Penstemon* sp.), desert parsley (*Lomatium* sp.), and balsamroot (*Balsamorhiza* sp.). On the east side of The Dalles a prairie ecosystem dominates, usually characterized as a bunchgrass steppe. (Franklin and Dyrness 1988) Sagebrush (*Artemisia* sp.), bitterbrush (*Purshia tridentate*) and rabbit brush (*Chrysothamnus nauseosus*) are common in this area.

Extensive riparian forests exist on the floor of the Gorge and in places where tributary steams converge with the Columbia River. These areas are poorly drained and often face annual flooding. (Spranger 1984) Common tree species include Black Cottonwood (*Populus trichocarpa*), Oregon Ash (*Fraxinus latifolia*), Red Alder (*Alnus rubra*), a variety of willows (*Salix* sp.) and an occasional Big-leaf Maple (*Acer macrophyllum*).

In addition, the Gorge has two vegetational environments that are very unique and hence do not fit well into the previous discussion. First is a boreal-type vegetation community found on the western portion of the Gorge, solely on the south bank of the river. This type of community exists only on moist, shady cliffs and cool, narrow canyons, often near waterfalls. Jolley (1988) theorizes that these boreal communities are remnants from the last ice age. He asserts that species from higher latitudes migrated southward during the cold period, and then retreated during the ensuing warm period that followed. This left a limited number of species that could only exist in cool, moist niches in the Gorge. Some of these species include Sitka alder (*Alnus sinuate*), Rocky Mountain Maple (*Acer glabrum douglasii*), and variety of herbs, wildflowers, and succulents. The other unique vegetational feature of the Gorge is its abundance of endemic plant species. Fifteen plant species are found nowhere else besides the Gorge. Of these fifteen plants, seven are cliff dwellers, five live on slopes and flats, two are found in grasslands, and one lives solely on an island in the river. (Jolley 1988) Most of these plant species have limited habitat. For example, The Dalles Mountain Buttercup (*Ranunculus reconditis*) can only be found on dry open grasslands at the top of hills in the eastern Gorge, while the Oregon Sullivantia (*Sullivantia oregana*) may only be found on wet cliffs near waterfalls in the western Gorge. As of 1990, both of these species are listed as endangered in Oregon and threatened in Washington. (Eastman 1990) The 15 endemic species are prime representations of the diversity of habitat that exists throughout the Gorge. Their diversity, along with the broad range of climate, elevation, and geologic history make the Gorge a unique natural landscape unparalleled in the United States.

### 3.2- Human Habitation Prior to 1850

> From the international boundary line on the north, as far south as the Sacramento River, in California, the only important low break in the barrier formed by the Cascade Range is the Columbia River Valley. This valley offers the only natural line of communication between the Pacific coast and the country to the east of the Cascade Range where there is not involved a lift of several thousands of feet over these mountains. It thus affords an outlet for the products of the interior, which outlet will unquestionably always be the 'line of least resistance'. (U.S. House of Representatives 1900)

The human history of the Gorge goes back centuries, even millennia, before the scope of this research. Since this study seeks to understand changes in the land during the second half of the nineteenth century, it is imperative to understand human impacts on the landscape in the era leading up to this time, before Native Americans had extensive contact with European-American explorers and settlers arriving from the east. Indeed, the 1850s marked the start of a new era of settlement, land use change, and commercial development both in the Gorge and the greater northwest. Once again, it is crucial to assess the baseline conditions at the start of this period in order to appreciate the extent and magnitude of subsequent change.

Human habitation in the Columbia River Gorge has been dated as far back as 10,000 to 11,000 before present. (Williams 1980) The archeological record from this time period indicates that humans had lived near what is now The Dalles since the end of the Missoula Flood era. Numerous artifacts have been unearthed, including animal bones and tools. Fish bones are predominately absent from these early sites, indicating that the first inhabitants were more likely hunters rather than fishers. Artifacts from later periods (closer to the present) indicate a fairly consistent increase in the quantity of fish bones. (Cressman 1977) As a result of increasing dependence on fish coming out of the Columbia River, a large trading center evolved near The Dalles and Celilo Falls over the last 1,000 years. The people of the Gorge are grouped together in a general categorization as Upper Chinookan. Included in this group for the Gorge are the Chilluckittequaw (Hood River), Wasco, Watlala (Cascade), and Wishram tribes. (Ruby and Brown 1992)

Before further examining the natives of the Gorge, a quick overview of the early travels of English and the American explorers is necessary, for their accounts provide much information about them, as well as the early nineteenth century environment of the Gorge. Robert Gray, an American trader, is often cited as the first explorer to enter the Columbia River (in 1792) and establish contact with the Chinookan people. Over the next decade numerous maritime traders, most of which were part of the British-run Hudson Bay Company and the American-run Northwest Company, traveled through the Gorge, setting up a primitive fur trade. Sent on a mission to find a connection route between the Missouri River and the Pacific Ocean, Meriwether Lewis and William Clark are considered to be the first U.S.-sponsored overland explorers to the northwest. Their successful expedition from 1804 to 1806 spurred increasing overland exploration of areas west of the Rocky Mountains. Ultimately scores of explorers would enter the Gorge during the first three decades of the nineteenth century, including Alexander Henry, David Douglas and Ross Cox. The Northwest Company became entrenched in the northwest focusing almost wholly on the fur trade. Coupled with border settlements between the British and the Americans, the Hudson

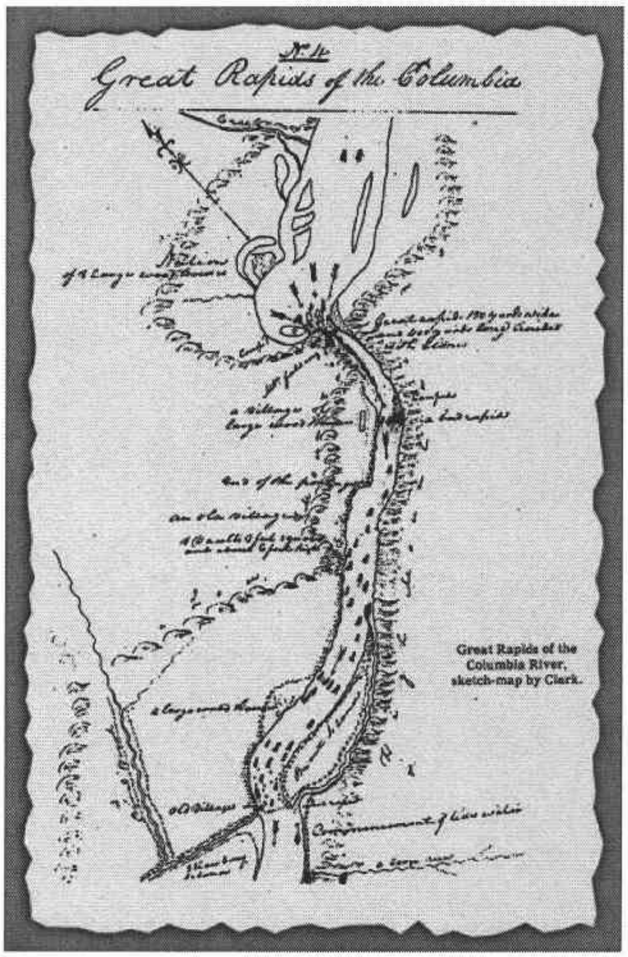



**Figure 5**: Lewis and Clark Map of the Cascade Rapids, 1804-1806 (from Thwaits 1905)

Bay Company was eventually pushed out of Oregon and Washington. (Robbins 1994)

Interactions between the early explorers and the native inhabitants of the Gorge were fairly frequent. The necessity to portage at The Dalles and the Cascade Rapids forced a great deal of interaction between the groups. The natives controlled the portages, enabling them to limit who could pass and at what cost. It was predominantly through the portages and general trade with the natives that explorers wrote down descriptions of their culture, including language, hunting and fishing practices, gender roles, and usage of the environment. These are the only written accounts on the indigenous populations in the Gorge during the early nineteenth century.

Most explorers noted with surprise the cycle of subsistence that the natives exhibited, dominated by high volumes of trade at sites around the Cascades and The Dalles. (Douglas 1972, Thwaites 1905) Extensive trade networks and hierarchies existed between various tribes that descended on the Gorge during the main salmon harvest. Natives from areas as far away as current-day Nevada would gather at The Dalles/Celilo and at the Cascades during harvest times (though The Dalles trading center was significantly larger). Through trade the Gorge acted as a meeting place for separated native tribes from east and west of the Cascade Mountains. Since this elaborate trade network brought a wide variety of goods to the Gorge, including tools, obsidian, and foodstuffs, many artifacts of all kinds have been unearthed at points throughout the Gorge. (Cressman 1977) Besides being traders, the natives of the Gorge were not agriculturalists, subsisting predominately on berries and roots (especially that of Camas [*Camassia quamash*]) in addition to salmon.

The first few decades of exploration, from 1800 to 1830, were times of trade and tension. Permanent white settlement had not yet occurred in the area. This was to change in the coming decades. By 1850 a missionary had been built in The Dalles, the U.S. military had acquired Fort Vancouver (at the western terminus of the Gorge) from the British, a fort at The Dalles was under construction, and the native population suffered drastic population declines from disease epidemics. New patterns of residency were beginning to take shape. The native Chinookans around the Cascades now numbered in the hundreds, and fishing grounds around The Dalles and Celilo Falls saw consistently fewer people during peak harvest times than in decades past. (Ruby and Brown 1992) Nathaniel Wyeth, a naturalist explorer and a pioneering entrepreneur during the 1830's, noted a malarial-type of fever that had decimated the natives around the Cascades, noting only two women left in a village and "scores of half buried dead." (Wyeth 1969: 30)

**Figure 6**: Map of the Northwest, 1844 (Lee and Frost, reprinted in Dicken and Dicken 1979)

The onslaught of overland emigrants to the 'Oregon Country' began to take hold in the 1840's. Trains of emigrants became an annual event, arriving in the fall after a treacherous 3,000-mile trek from Missouri. Statistics on the number of travelers are not very well recorded, but it is known that there was a 'trickle' of people moving on the trail as early as 1841, and that more than 3,000 people made the journey in 1845. (Beckham 1984) Williams (1980) asserts that the number of emigrants swelled to over 5,000 in 1847. During this time period the overland travelers had only one option to reach the fertile lands to the west of the mountains: to float the Columbia River from The Dalles westward through the Gorge. The float was interrupted by the Cascades, which forced exhausted families to portage on poor trails around the rapids. The portage—largely under the control of white explorers and the military by the 1840's—while the last of the major obstacles on the Oregon Trail, remained a dreadful and treacherous experience. The 1847 journal of Elizabeth Geer stands testimony to this:

> It rains and snows… I carry my babe and lead… through snow, mud and water, almost to my knees. It is the worst road that a team could possibly travel. I went ahead with my children and I was afraid to look behind me for fear of seeing the wagons turn over in the mud and water with everything in them… I was so cold and numb that I could not tell by the feeling that I had any feet at all. (Geer 1908: 171-172)

As emigrants were beginning to settle in the northwest, exploring expeditions continued throughout the Gorge and the greater northwest. Expeditions by David Douglas, Thomas Nuttall, and John Kirk Townsend focused on cataloging native plants and animal species in the Gorge, the latter two being part of Nathaniel Wyeth's expedition crew. Many of these efforts to explore and catalogue the Gorge's landscape during this time period provide the first detailed descriptions of the physical attributes of the Gorge.

The landscape that took shape as a result of the native populations and the subsequent influx of settlers into the Gorge is one that is difficult to assess. Both native and white settlement impacts proved significant. Some landscape changes can be connected directly to one group, while others are not easily attributable, as the two groups came into increasing and sustained contact. Thus this period of integration ultimately produced a landscape shaped by individual and aggregate impacts of the native population as well as the white settlers. Impacts were generally widespread but not very intensive.

Most of the existing human imprint on the landscape in 1850 was on the banks of the river. This was especially true for the portage areas on the north and south banks around the Cascade Rapids. Portage trails were already well established when Lewis and Clark traveled through the Gorge in the first decade of the nineteenth century. Virtually all overland travelers, from Lewis and Clark's 1804-1806 explorations to the emigrant settlers on the Oregon Trail in 1850, noted the portage trail at the Cascades. Some of these individuals noted the potential superior position the natives had in controlling the portage, while others noted the exceedingly poor quality of the road (as Elizabeth Geer's diary entry above attests). The American explorer John Townsend noted the necessity to portage around the rapids either by the portage trail or by wading in the water near the shore. Most, he noted, chose the trail. (Townsend 1839)

It is uncertain whether a crude trail ran the entire length of the Gorge on either bank. The Lewis and Clark expedition identified six village sites in the vicinity of the Cascade Rapids as well as an aboriginal trail running between them on the north bank (Thwaites 1905), but did not mention any trail linking the Cascades and The Dalles areas. Strong (1967) also contends that there were well-worn paths between the villages from Beacon Rock upstream to the top of the upper Cascade rapids, also on the north bank. Since archeologists have unearthed many settlements around both The Dalles and the Cascades, this evidence also suggests that communication, travel, and trade between the settlements were very common. The likely means of transportation would be by canoe, but that does not preclude a primitive trail. Furthermore, Strong (1967) asserts that the trail below Beacon Rock was likely non-existent, or if it did exist at all, it was much cruder, due to the precipitous mountains and rocks hugging the shores of the river.

Native villages in the Gorge were almost wholly located near good fishing spots, since salmon were a primary food source. Shelters, canoes, poles for dip-nets, arrows, and bowls were constructed out of cedar. (Beckhan 1984; Minor 1986) The wood used was usually western Red Cedar (*Thuja plicata*) since it grows well in moist lowland forests on the western side of the Gorge. Quantities of wood used by natives is difficult, if not impossible, to determine. Archeologists have noted the native practice of manipulating rocks in fishing locations to encourage salmon to group together. (Cressman 1977) This practice enabled the natives to get more fish at one time by crowding them into one location. Strong (1967) contends that this was more common near the Cascade Rapids where basalt rock was relatively scattered throughout the river's floodplain (as opposed to The Dalles and Celilo, where the river cut thin channels through basalt thus naturally grouping the salmon).

The onslaught of white settlement didn't fully begin until the 1840s. Prior to this, white explorers and travelers were relatively transitory populations in the Gorge. Similar to the natives, they used the Gorge primarily as a transportation corridor. Travelers would utilize the portages, trade goods with the natives, and camp on the banks of river on their way to explore or trap game in other areas east or west. Settlers moving to the Willamette Valley and Puget lowlands became more prevalent in the 1840's. With them came cattle, oxen, and other domesticated animals. Most abundant were a variety of breeds of shorthorn or Durham cattle, which have been traced as the ancestral roots of twentieth century Willamette Valley cattle. Many of the domestic animals had to be herded over the mountains during the summer since they could not float on the makeshift rafts made by the settlers. (Stewart 1949)

The settlers also caused other disturbances that led to drastic changes in the landscape of the Gorge. They introduced a wide array of diseases to the native populations in this region. The drastic decline in the population of natives from these diseases led to vast amounts of land being abandoned and a consolidation of many nearby villages, especially of those around the Cascades. For instance, the Watlala (Cascade) tribe joined together with the upstream Wasco tribe in the 1830's after they suffered great losses from disease. (Ruby and Brown 1992) Some subsistence patterns changed for the natives as a result. There was now competition for food supplies and land, and the extensive trade network that had thrived in the Gorge diminished in importance. The presence of settlers also brought along Christian belief systems, and a small yet important military contingent, most of who resided at the nearby Fort Vancouver. Settlers and the military alike thought it highly desirable to control the portage around the Cascade Rapids. Through disease epidemics and the persistence of the settlers, the portage was essentially removed from native control by 1850. With their numbers so low, the natives essentially did not have the manpower to be arbiters of the portage. (Beckham 1984)

The landscape of the Gorge in 1850 was going though numerous changes that would increase in rapidity and extent over the next 50 years. From a native standpoint the future looked excessively bleak. Their population was decimated, their land was taken, and their control of the vital transportation link at the Cascades was lost. British and American explorers who traveled though the Gorge just decades earlier had come and gone, now replaced by droves of weary but hopeful settlers moving over the Oregon Trail to settle in the fertile lands west of the mountains. The Gorge had already been established as the vital transportation link between these fertile lands and the vast 'inland empire' of the northwest. The coming 50 years would capitalize on this fact, turning the Gorge into a source of wealth for the Territory and future State of Oregon.

## Chapter 4- LANDSCAPE TRANSFORMATION: THE GORGE FROM 1850 TO 1900

> Where mountains squeeze the river, a series of rapids and falls, called the *Cascades*, interrupt the channel. The Cascade Railroad on the Washington shore carried us through the forest and around the barrier. Occasionally the falls showed themselves very near, in breathtaking glimpses.... The vista at the upper end of the Cascade Railroad is wondrous: the river spreads wide and its green waters mirror superb forests on surrounding mountainsides. In the Cascades downstream, the green turns suddenly to silvery foam. (Trautmann 1987: 15-16)

A cornerstone in the environmental transformation of the Pacific Northwest was laid on September 27, 1850, with the passage of the Donation Land Claim Act (DLCA). This act by the federal government created a structure for land disposal and land surveying, as well as a claims process for the Territory of Oregon (established two years prior on August 14, 1848). The territory covered land in what are now the states of Idaho, Montana, Oregon, Washington, and Wyoming. The passage of the act was the first in a series of federal government actions that evinced dedication to the settlement and development of the

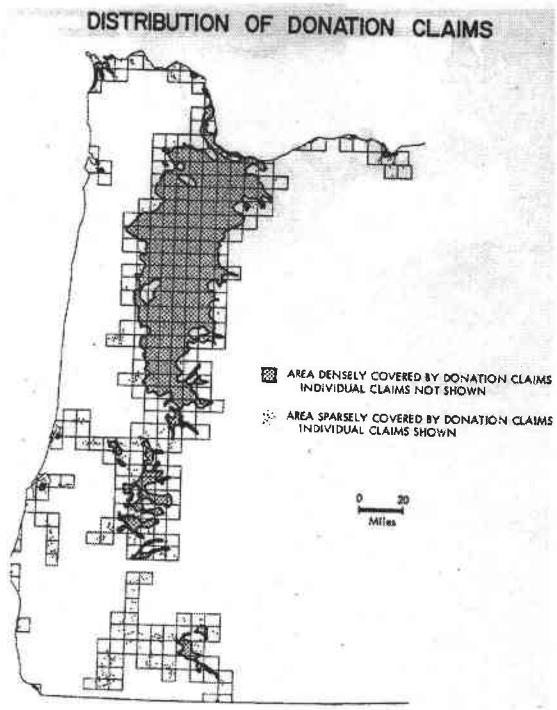



**Figure 7**: Oregon Donation Land Claims (from Head 1971)

northwest for decades to come. This act set the stage for an increasingly vibrant and productive landscape: one of American agrarian culture, rich mineral wealth, and transportation linkages.

An estimated 5,000 people moved westward on the Oregon Trail in 1850, and 6000 in 1852. (Minor 1986, Williams 1980) The Gorge functioned as a means to get to the Willamette Valley and Puget lowlands. By 1850 the most fertile lands in the westward valleys were claimed. As the only sea-level corridor to the northwest, it was largely out of necessity that the Gorge was settled. Virtually all land around the Cascades was claimed between 1850 and 1855, most of which was secured by filing claims under the DLCA. Figure 8 (on the following page) displays a map made by the General Land Office detailing the claims made during this time period. Charles Stevens noted while passing through the Cascades area in 1853 that "every place down the river where a claim can be made, you will find it ocupied [sic]…" (Rockwood 1936: 158).

The General Land Office was authorized under the DLCA to survey all the land that was being distributed to settlers. The surveyors had general instructions on how to establish survey lines and what landscape attributes they should document. This was a means for organized land inventory and disposal. The area around the Cascade Rapids were grouped into Township 7N, Range 7E in the cadastral survey completed over a course of years in the later 1850's. The survey indicated that many of the properties abutting the river had areas of seasonal inundations and well-developed floodplain species including fir, ash, maple, alder, and balm with willow and hazel as the primary underbrush. (Van Vleet and Newsom 1859) There was also mention of broad benches above the river and a few places where there were perpendicular rocks coming directly out of the water.

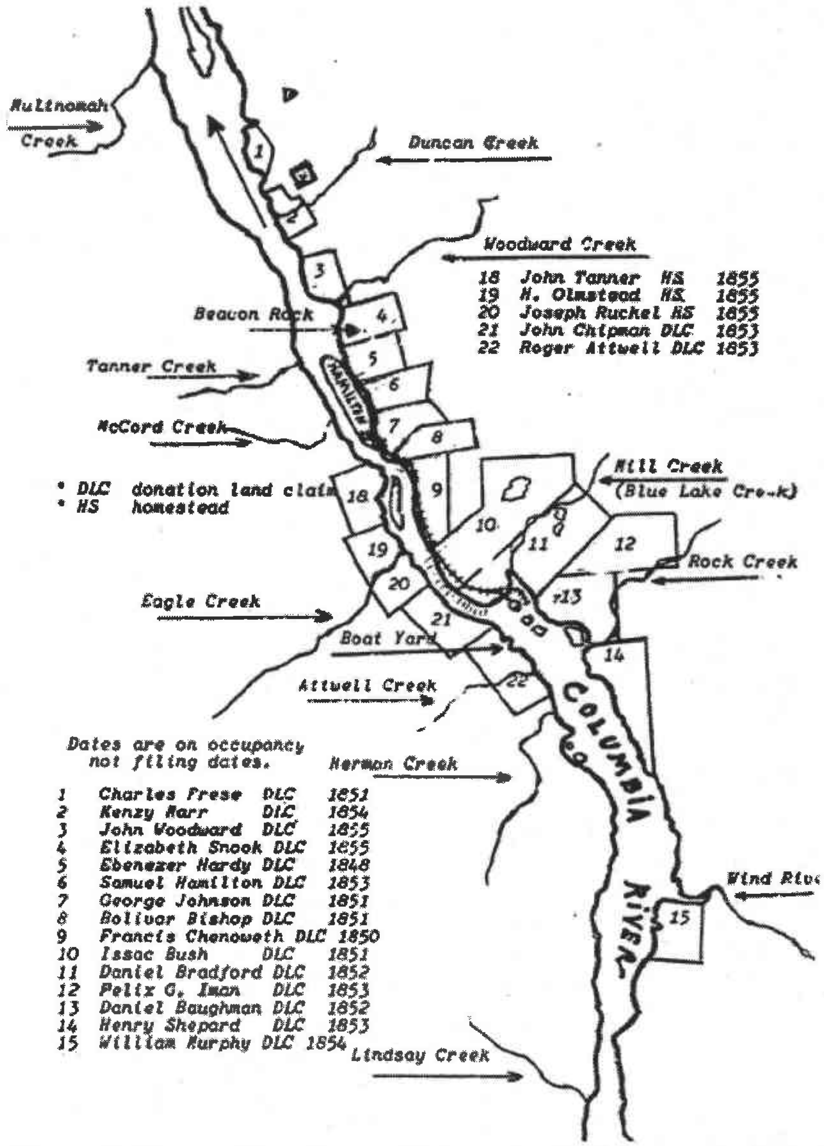



**Figure 8**: Map of Donation and Homestead Claims around the Cascade Rapids (General Land Office, Circa 1858)

Beyond the annual arrival of overland immigrants hungry for land, the growth of Portland as an up-and-coming metropolis spurred growth in the area. (Gill 1924) Low-powered steamboats had plied the lower Columbia River, from its confluence from the Willamette River to the sea, since the early 1840's. Regular trade and travel routes had been established between San Francisco and Portland. The United States military was also becoming established in the northwest at this time. Fort Vancouver was acquired from the British in the 1840's and new posts were being established along the Oregon Trail. Fort Dalles was constructed and in operation by 1850, creating a large need for transporting military personnel and supplies through the Gorge.

The stage was set for innovative transportation infrastructure to move in to the Gorge. Generally there were two main periods of infrastructure development that occurred during this time: the building of roads on the river's floodplain, and the development of in-stream steam navigation. Both of these contributed greatly to landscape changes during the era of interest and will thus be explored individually. While some landscape transformation and environmental engineering will be discussed within this chapter, the following chapter will discuss the individual and cumulative landscape impacts, drawing on contemporary riparian-based ecological science for contextual understanding.

### 4.1- Portage Railroads, Military Roads, and the Mainline

The acquisition of the land around the Cascade Rapids by private interests was the primary impetuous for development of the portages. Francis Chenowith constructed the first road, often referred to as a 'tramway', on the north bank soon after he acquired his claim in 1850. The portage trail that existed at the time was, as a military engineer described it, "in very bad condition, cut up by gullies and canyons and in many places broken away entirely by land slides... It is difficult to travel at the best season of the year, and in the winter is rendered almost impassible by the depth and tenacity of the mud." (Derby 1855b) With help from the Bradford brothers (Daniel and Putnam), who had a neighboring claim to Chenowith, a wooden portage line was constructed on the north bank of the river. The road was first built upon Chenowith's claim, spanning a mere three-quarters of a mile. It was extended over the ensuing year to span from the middle to the upper Cascades, a distance of about one and a half miles. (Derby 1855b; see Figure 8, where it spans claims 9, 10, and 11) This essentially bypassed the worst of the Cascade Rapids and enabled overland travelers to avoid the poor pack trail. The north bank road built by Chenowith and the Bradfords is the first 'railroad' to run on the Pacific coast of America. (Gill 1924) Narrow gauge wooden rails were laid, on which wooden cars would be pulled by mules. Planks were then placed between the rails for the mules to walk on. Freight would be carried in the cars, while passengers would walk the on the road behind them. (Beckham 1984, Gill 1924, Minor 1986) The diary of twin sisters Cecelia Adams and Parthenia Blank describe the portage in 1852 thusly:

> A railroad 3 miles long, made of scantling and plank without iron. On this runs a small car propelled by a mule attached to it by a long rope for an engine, and a pair of thills between which the engineer stations himself and walks and guides the car. On this the charge is 75 cents per 100 pounds, but takes no passengers. (Webber 1990: 79)

The length of the portage road reported by the sisters is questionable. According to other contemporary diaries and surveys, the route likely spanned a little less than 2 miles. (Derby 1855b, Van Vleet and Newsom 1859) During the winter of 1855-56 the Bradfords extended their road on a series of trestles around a precipitous hillside near the middle Cascades. (Derby 1855b)

Previous to the construction of the Bradford road, as it is normally referred to, steamboats were a common sight as they plied the lower part of the Columbia River, from the bottom of the Cascade rapids, through Portland, and out to the Pacific Ocean. With the addition of steamboats between the Cascades and The Dalles (where another portage was necessary), the newly developed portage at the Cascades now enabled through-transportation routes to be established. One of the first such steamers to go on the middle river between the Cascades and The Dalles, the *James P. Flint*, was built and operated by Bradford and Company. This company then entered into an agreement with the owners of the steamboat *Belle* that plied the river below the Cascades, and a full transportation link was established. (Gill 1924) The Bradfords, only a few years after their first investment in the portage, were now able to advertise a full connection service between Portland, The Dalles, and ultimately other points upstream (steamboats had already been placed on the river above The Dalles portage). This connection would prove essential until a full railroad would span the Gorge in the early 1880's.

The Bradford road was the only functioning road around the Cascade Rapids until 1855. Early that year J.S. Ruckel settled a site on the south bank of the river (Claim 20 on Figure 8). He quickly commenced building a portage railway on his settlement to compete with the Bradford road. With no more then general permission for a right of way from neighboring land owners, he built landings at the top of the upper Cascades and at the mouth of Tanner Creek, a wagon road from the upper landing to his settlement and a pack trail from there over 'Tooth Rock' to the lower landing. (Derby 1856b) The Portland *Weekly Oregonian* reported on February 9, 1856 that the Oregon side road was in "complete order" with teams ready to transport "freight, goods wares and merchandise." (Unknown 1856) The newspaper also contains an advertisement for the 'Oregon Transportation Line', a steamship/portage line, similar to Bradfords, that utilizes Ruckel's south bank portage road and a series of steamships on the lower and middle sections of the river.

**Figure 9**: Oregon Portage Railroad, Photograph by Carleton E. Watkins, 1867 (from Nickel 1999)

Ruckel teamed up with Harrison Olmstead, another property owner on the south side of the Cascades, sometime in 1857 or 1858. They negotiated deals with John Tanner and John Chipman, adjacent property owners, to purchase right-of-ways for a through railroad and an accompanying wagon road. (Unknown 1858) The lands that were transferred are labeled on Figure 8 as sites 18 and 21 respectively. The consolidation of ownership into Olmstead and Ruckel's hands ensured that they had full ownership and control of the portage. Olmstead and Ruckel wasted no time in capitalizing on their new ownership. From 1857 to 1859 they made major improvements on the portage railway. Under the direction of John Brazee, a civil engineer from Portland, the road was graded and extended from the lower to the upper landing, using a large amount of bridging. (Gill 1914) The road was constructed entirely of wood, which leads one to believe that the majority of the building supplies for the road construction came from the sawmill at the confluence of Eagle Creek with the Columbia River (on Olmstead's original land claim). No official construction records remain from the improvements made during these years, so the connection of the railroad building with the sawmill is somewhat speculative. (Figure 10 displays the Eagle Creek sawmill as it stood in 1867.) It is known that the road, cited usually as the Oregon Portage Railroad, functioned similarly to Bradford's north bank road, using mules to pull carts on wooden tramway (also seen in Figure 10). The road used narrow gauge rails made of 6 x 6 fir 'stringers', with planking for mules and passengers to walk on. (Gill 1924, Robertson 1995) A great deal of bridging was constructed during this time. It was undoubtedly easier and more cost efficient to use wood than to make earthen embankments to support the track. (Gill 1924) The extensive use of bridging made the road susceptible to being washed out during the

**Figure 10**: Eagle Creek Sawmill, Photograph by Carleton E. Watkins, 1867 (from Alinder et al 1979)

annual freshets of the Columbia River. Such was the case during the first year of operation for the railway. It was reported that year that 300 feet of the road was washed out near its lower landing. (Unknown 1859)

Both the Oregon Portage Railroad and the Bradford road relied heavily on the presence of steamboats on the river. It was through a coordinated partnership between the roads and the ships that freight and travelers were able to effectively use the Gorge as an efficient transportation corridor. The cutting of firewood for fueling the steamboats became a pursuit of many landowners in the Gorge, as steamships during this era burned on average four cords of wood an hour while traveling on the river. (Williams 1980) While significant for the development of the railroads, steamboat navigation will not be analysed until the next section.

During this same era of private capitalization of transportation through the Gorge, the U.S. government was taking strides to secure the northwest from natives and foreign interests. Government actions sought to ensure control of both the Gorge itself and the greater Pacific Northwest. Towards that end, the government undertook major projects in the Gorge in the 1850's, including the construction of forts and a portage wagon road. The government, too, recognized the central importance of the Gorge as a major transportation artery.

The government's establishment and strengthening of military posts in this region became very significant in the development of the Gorge's transportation infrastructure. Fort Vancouver, at the western terminus of the Gorge, had been a major hub of government activity since its acquisition from the British in the 1840's. Fort Dalles, on the eastern side of the Gorge, was fully functioning by 1850. The fort ensured a military presence at the place on the Oregon Trail where travelers had to begin their westward float down the Columbia River. The establishment of forts on opposite ends of the Gorge increased the amount of military equipment and personnel moving through the transportation corridor. At first the military itself was subject to the portage constructed by Bradford and Company on the north bank of the Cascade Rapids: all military freight and personnel traveled this route and paid the necessary fees.

During this same time period, tensions with the native inhabitants in the Gorge were coming to a breaking point. White settlement since the 1840's had made large impacts on the native populations by stripping the natives of their land and traditional fishing spots. Disease had ravaged the native populations. The government recognized that a military presence was necessary at the vital points along the Gorge, especially around the Cascade portage. Repeatedly the military was called to control hostilities from the natives at the Cascades. (Beckham 1977)

Indeed, the military's presence at the Cascades was essential for ensuring the safety of settlers, the handling of the natives, and the control of transportation flow through the portage. In 1855 the military established Fort Cascades on a section of land that was part of George Johnson's donation land claim (labeled as site 7 on Figure 8). (Beckham 1984) Concurrently the military surveyed the banks of the Gorge and began construction of a wagon road on the north bank of the river around the Cascade Rapids. The original survey of the Gorge, completed in 1855, was charged with the duty of finding the most practicable route from Fort Dalles to Fort Vancouver. The road that was surveyed traversed the south bank from The Dalles westward just past Hood River to Wind Mountain, where a boat ferried people and goods across the river to the north bank. A road then extended from this point to the Cascades and onto Vancouver. It was noted that the only easy section of road construction would be from The Dalles to the ferry point, and the section from the ferry point to the Cascades would be exceedingly difficult. (Derby 1855b) The chief engineer concluded:

> Good steamboat navigation from Vancouver to the Cascades, a good road across the portage, and a continuation of steamboat navigation thence to the Dalles, certainly fulfills all the conditions of a Military Road 'from the Dalles to Columbia Barracks [Ft. Vancouver]' and is moreover the only practicable route. (Derby 1855b)

Further surveying indicated that the north bank was the preferred route, since the south bank was more rocky and precipitous and was covered with dense timber. (Derby 1855a) An emigrant to The Dalles aptly described this section of the river: "giant, bare, rocky slopes crowded to the water's edge on both sides [of the river]. Like a mirror the bright, smooth water reflected the lengthy facades of basalt that towered above us like bastions." (Trautmann 1987: 17) A landowner on the south bank, Roger Atwell, unsuccessfully petitioned that the south bank was better suited for the road, citing the large quantity of landslides on the north bank as a major pitfall of the proposed route. (Atwell 1855)

Construction of the road around the Cascades began late in 1855 and continued well into the summer of the following year. The military road followed the path marked as 'c' on Figure 11. (Note the wagon road ['b'] and pack trail ['a'] on the Ruckel-Olmstead road on the south bank.) The completed road spanned four and a half miles, two miles of which were granted right-of-way from Chenowith and

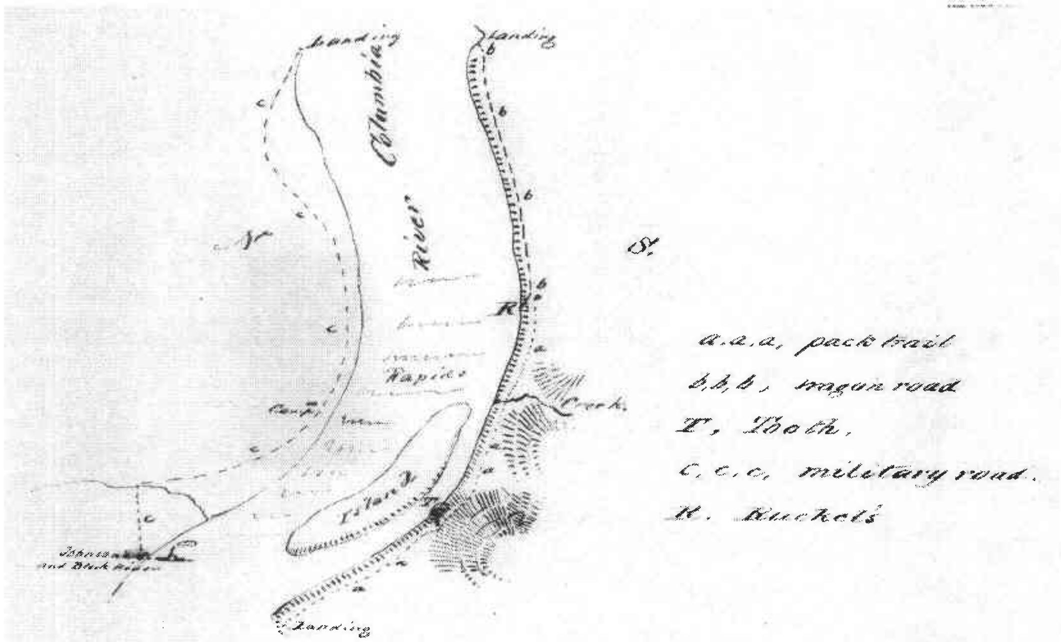



**Figure 11**: Sketch of Cascade Military Road (from Derby 1856b)

two and a half were granted from the Bradfords. (Derby 1856a) Most of the construction consisted of making embankments, straightening, and widening an already existing path. Overall the road extracted and utilized a combined estimate of 28,440 cubic yards of fill material. (Derby 1855a) Ditching, grubbing of vegetation, and construction of ten culverts were then completed. Three significant bridges were constructed, the largest of which spanned 163 feet over Hamilton Creek (a slough of the Columbia River). Over 30,000 feet of wood planking was used for the roadbed, which extended the full four and a half miles at an average width of eight feet. (Derby 1855a)

Beyond the establishment of the wagon road and the military posts in the Gorge, the U.S. government looked to the Gorge as the keystone for large-scale development of the west. General sentiment at this time, backed by the White House and Congress, held that a transcontinental railroad needed to be constructed, and that government support would be essential to construct it. (Russell 1919) Proposed and funded in the Army Appropriation Bill approved March 1, 1853 and undertaken in over the next three years, Congress authorized the Department of War to conduct surveys to ascertain the most practicable route for a railroad from the Mississippi River to the Pacific Ocean. Five expeditions set out across the west to survey the

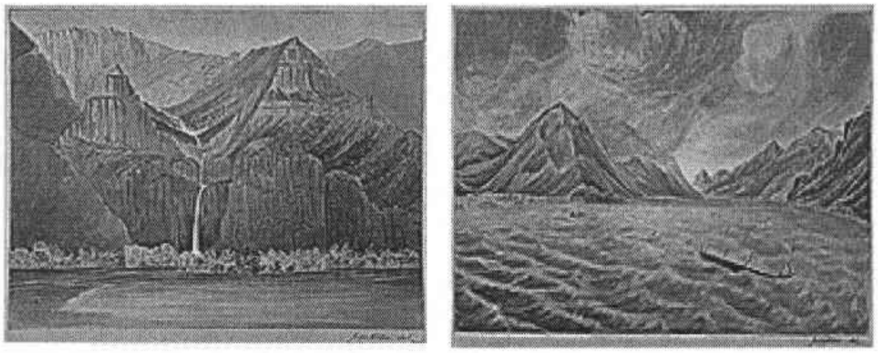


**Figure 12**: Illustrations of the Columbia River Gorge, Made for the Secretary of State, U.S. Commissioner (Alden 1857)

land for a railroad. One such route surveyed was near the 47th and 49th parallels. This would be the route to the northwest. Isaac Stevens, the governor of the newly created Washington Territory, led the team surveying this route. The eventual outcome of these surveys was a transcontinental link completed to San Francisco, instead of the northwest, in 1869. The surveys however provide information vital to understand the landscape of the Gorge in the 1850's. The surveyors were directed to examine a plethora of landscape characteristics including vegetation, geology, soil, and climate as well as favorability of grades, quantity of wood and stone supply, and various other elements necessary for railroad construction. Some landscape descriptions are displayed in Table 4.1.

**Table 4.1**: Columbia River Gorge Landscape Descriptions (from U.S. Secretary of War 1855)

| *Category* | *Description* | *Volume/Chapter/Page* |
|---|---|---|
| General Descriptions | • Steep cliffs,<br>• 'Tremendous chasm'<br>• Numerous waterfalls<br>• Long stretches of 'prairie bottom'<br>• Heavily timbered mountains from The Dalles westward to Cape Horn | 1/IX/111<br>1/A1/176<br>1/C8/218 |
| Ledges | • Can be easily worked<br>• Good supply of stone from ledges<br>• Can be used to form embankments | 1/IX/111<br>1/B4/182 |
| Wood supply | • Large supply<br>• Easily accessible<br>• Good quality<br>• Principle trees: 'three species of *Abies* (spruce and fir), one oak, two maples, one dogwood, one ash, two poplars, various willows'<br>• 'Forest is almost entirely of secondary growth' due to 'vast tracts of fire' | 1/C9/220<br>1/Gibbs Report/474<br>7/A3/55-71 |
| Grades | • 'Favorable grades'<br>• Rarely exceed ten feet per mile | 1/IX/111<br>1/B4/182<br>1/B6/186 |
| River | • Rapid flow<br>• Cascades and Dalles/Celilo Rapids are unnavigable, too rocky<br>• Annual high floods/freshets<br>• A 'basaltic trough'<br>• Near river grew 'poplars, willows, cotton-wood, vine maple, alder and raspberry' | 1/B6/186<br>1/C8/218<br>1/Gibbs Report/473<br>1/Gibbs Report/474 |
| Practicality | • Only one serious obstacle (Cape Horn) where a tunnel of 700 feet will be needed<br>• Large side cutting will be necessary<br>• Moderate quantity of bridging necessary | 1/IX/111<br>1/B6/187 |

These surveys concluded that the Gorge, referred to as the 'Columbia River Pass', was "not only undoubtedly practicable, but is remarkably favorable." (U.S. Secretary of War 1855: 183) The entire collection of these surveys, spanning twelve volumes and covering five east-west routes at various latitudes, underscored the sense of urgency over completing a transcontinental link to the west coast. Similar to the

Lewis and Clark expedition from the beginning of the century, these surveys served dual purposes of land exploration and scientific inquiry into the land.

The military's presence in the Gorge did not last for an extensive period of time. Two main factors contributed to this—the confinement of the majority of the natives to reservations and the breakout of the Civil War. After numerous conflicts with the natives at the Cascades, including one in early 1856 where Fort Cascades was burned to the ground, the military had prevailed in establishing safety and peace along the portage line. (Beckham 1977) During this same time period, many tribes were consolidating due to the drastic decline of their tribal populations, and were signing treaties that established reservations. (Ruby and Brown 1992) With a general peace achieved, Fort Cascades had lost some of its importance in maintaining the safety of transportation through the Gorge. Coinciding with this was the onset of the Civil War in 1861. On June 11, 1861 Fort Cascades was evacuated, so that officers and enlisted men could move eastward to fight in the war for the Union. (Beckham 1984) Later that year the military wagon road was abandoned, and the road's right of way was given back to Chenowith and the Bradfords. The military would not again return to the Gorge until the survey and construction of the Cascade canal and lock in the mid 1870's.

The start of the 1860's would bring great changes to the Gorge and the portages constructed around the Cascade Rapids. At the onset of the decade, two independent portage railroads were competing for a share of the great wealth pouring through the Gorge. Both roads had made improvements on their original design to increase efficiency and the quantity of materials that could be hauled over the portage. The late 1850's had brought increasingly large amounts of passengers and freight, settlement had accelerated as the General Land Office made more land available through required surveying, and the removal of the natives onto reservations was well underway. Also the first large scale gold discoveries were made in the greater northwest, beginning with discoveries at Colville (Washington) and the Fraser River in British Columbia in 1855 and 1856, followed by multiple sites in the Bitterroot Valley of Montana in 1860. (Minor and Beckham 1984) Since the Gorge acted as a bottleneck in transportation to these gold fields, large quantities of prospectors and freight were a common sight at both the Bradford and Oregon Portage railroads.

Efforts were building during this time period to consolidate interests on the Columbia River. Visionaries and investors imagined a consolidated and coordinated transportation monopoly in the Gorge, where both portages at the Cascades and the steamboats carrying goods above and below them would be under united control. These individuals saw major profits to be made from the portages. The difficulty however would be to get the owner/operators of the two roads to agree. The first attempt to achieve this was initiated by John C. Ainsworth, a steamship captain, owner, and investor in the Gorge. Ainsworth facilitated an agreement made by the Bradfords, Harrison Olmstead (who had gained full control of the Oregon portage from Ruckel), and a series of investors to form the Union Transportation Company (UTC). The agreement, made in April of 1859, loosely divided the amount of freight moving through the bottleneck at the Cascades, utilizing both party's steamships and portages. (Poppleton 1908) The agreement did not function very well, however. There was still feuding and large-scale distrust between the portage owners, and freight was not always divided evenly. The agreement did however ensure that both portages would only accept goods from steamships that were part of the UTC, essentially setting the stage for the forthcoming monopoly.

Ainsworth continued to take a very proactive role in promoting a unified transportation system in the Gorge. As a primary agent for the UTC, he acted as a moderator between the Bradfords and Olmstead. After much maneuvering, including a little manipulation of both parties, Ainsworth was able to get to a more permanent agreement on the portages and steamships. (Ainsworth 1877, Beckham 1984) On December 29, 1860 Ainsworth, Bradford, Olmstead and a number of investors filed incorporation papers for the Oregon Steam Navigation Company (OSNC). (OSNC 1860) The agreement left actual ownership of the portages in Bradford and Olmstead's hands respectfully, but ensured that both parties would get equal profits from the goods moving through the Cascades. The incorporation set out to do a number of things in the Gorge, mainly to unite the transportation infrastructure into one commercial enterprise:

> The object of this incorporation and the business in which it proposes to engauge, is the navigation by steam and otherwise of the Columbia River… together with the construction and use of all necessary rail or plank or clay roads and bridges at any of the portages of the said Columbia… and to collect such tolls, fare or freight on all roads, boats or vessels that may be owned, chartered or controlled by said incorporation… and to purchase, and own all lands, lots, wharves, boats and vessels, and real personal property of every name and nature, that may be deemed necessary to the interests of said incorporation… (OSNC Articles of Incorporation 1860)

The incorporation of the OSNC was a major consolidation of power in the Gorge. The railroad company controlled the largest transportation corridor in the northwest and could thus set whatever freight and passenger rates they desired. In 1860 they set their freight rate at $20 per ton (using estimates that forty cubic feet equaled one ton), wherein one-fourth ($5/ton) would go directly to Bradford and Olmstead. (Poppleton 1908, U.S. Senate 1878)

Incorporation of the OSNC coincided with the largest gold rush yet to hit the Pacific Northwest. The Bitterroot Valley and the Clearwater gold fields had attracted increasingly large amounts of speculators from California and other areas in the west. (Gill 1924) Also at this time, as discussed earlier, the military pulled out of the Cascades, abandoning their wagon road. The military again began using the portages, which also increased the amount of freight and passengers. The large influx of people and freight in the early 1860's led to massive congestion at the Cascade portages. At times the freight was so backed up that the entire portage would be lined with freight from end to end. (Poppleton 1908)

The OSNC wasted no time improving the portages so that they could capitalize further on the influx of gold miners, the movement of military supplies, and the ever-present autumn arrival of settlers. The company decided to first invest in improvements to the south bank (Oregon) portage. From the date of incorporation in 1860 until May of 1861 all portages were done on the north bank, while the south bank was refurbished. The portage was extended to cover four miles, so that freight did not have to be hauled more than a few hundred yards from the lower landing, and iron strips were added to the road. (Gill 1924) Furthermore, as an anonymous reporter added, the road was equipped with "every desirable facility for transferring freight to The Dalles steamers." (Unknown 1861) Starting in May of 1861 all passengers and freight were carried on the south bank road.

While the south bank road was built stronger and spanned a greater length than its northern counterpart, it was continually plagued with washouts from annual freshets coming down the river. (Minor et al 1986) The *Daily Oregonian* reported that an 1862 freshet was more than four feet above the previous high water mark and that the railroad at the Cascades was impassable, due to "a considerable portion of it being under water." (Unknown 1862) The same newspaper over the next few days reported quantities of rock being placed in numerous places along the portage to repair the road and ensure less damage in the future.

The first locomotive to be employed in the northwest was placed on the Oregon portage in 1862. Known as the 'Oregon Pony' (shown in Figure 13), this wood fired steam engine replaced the mule-drawn carts that had been on the portage since its construction. (Minor and Beckham 1984) During its short tenure on the south bank portage road, lasting about 20 months, the engine hauled on average 200 tons of freight per day going up river, and 500 to 1000 pounds of gold dust twice a week going down river. (Gill

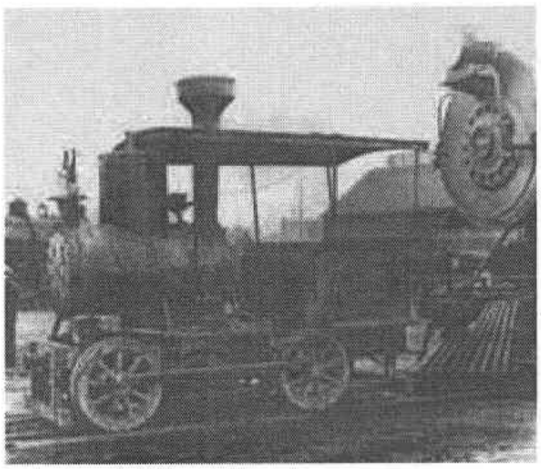


**Figure 13**: The 'Oregon Pony', Photographer Unknown, Circa 1900

1924) It also, judging from the size of its fire box (33"x18"), utilized great quantities of wood in its operation. (Robertson 1995)

The fate of the south bank road was not promising during the early 1860's. Built primarily on piles, and hugging the river's shoreline closely, the railroad was subject to constant repair. Investors at the time were looking at the north bank property as the solution. In late 1862 the OSNC began a series of major projects to improve, and essentially rebuild, the north bank road, which had laid fallow for a number of years. In April of 1863 the road was completed, having been extended to cover the same distance as the Oregon portage. The road was also regraded and T-iron rails were added. (Unknown 1865) On April 20$^{th}$ the Oregon road was abandoned and all freight and passengers were hauled over the portage on the north bank. At this time the Oregon Pony was moved to The Dalles/Celilo rapids, 40-miles upstream, and a new engine was added to the north bank road. (Bailey 1907, Gill 1924) By the middle of the decade the south bank portage road had fallen into disrepair. (Trautmann 1987) In 1865 the newly redone north bank road would officially incorporate as the Middle Cascades Portage Company, a subsidy of the OSNC. The objective of the company was to:

> Have full power to survey, locate, and relocate, own, construct, maintain in repair, and use a single track railroad with such turnouts as may be necessary... between suitable points on the navigable waters of the Columbia River above and below the middle Cascades, in the County of Clarke [WA]... (Middle Cascades Portage Company 1865)

Other investors in the northwest, including Olmstead, the original owner of the portage, were interested in the property on the south of the Cascades, now that the OSNC was not using their portage. Ainsworth and the other operators of the

OSNC enjoyed a full monopoly on the river, and saw to it that no other interests could get the valuable property. The right-of-way that they enjoyed on the south bank ensured that no freight could be portaged on the south shore without trespassing on their property. An agreement was made however in late 1862 to allow livestock to use the portage road on the south bank. (Minor and Beckham 1984) The Columbia River Road Company was, at the time, attempting to make a pack trail along the south bank of the river. Unfortunately no records could be found about this company, and little is known about their success (or more likely failure) in constructing the trail. It is known however that they entered into an agreement with the OSNC to use the roadbed as a portage trail for livestock. The agreement included a 25-cent toll for crossing the 'Tooth Rock' bridge on the portage, and a typical rate for moving cattle from Portland to The Dalles was between $3 and $6 per head. (Stewart 1949) Transportation of livestock boomed over the ensuing years. In 1865 for example, one steamer, *Julia*, transported over 3,000 live animals (summarized in Table 4.2).

**Table 4.2**: Transportation of Livestock, 1865

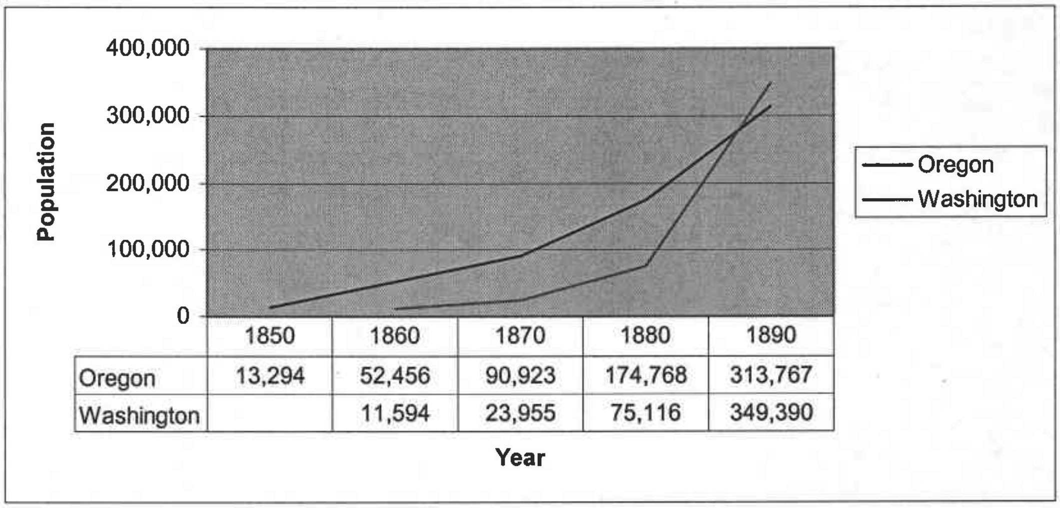
| | Cattle | Horses | Mules | Hogs | Sheep | **Total** |
|---|---|---|---|---|---|---|
| Total Heads (February – April 1865) | 1928 | 371 | 293 | 400 | 405 | **3397** |

(Unknown 1865)

The remainder of the 1860's was relatively uneventful compared to the previous decade. The OSNC continued to dominate all trade and travel in the Columbia River Gorge. Their monopoly on river travel and the portages, both at the Cascades and The Dalles/Celilo, dominated the movement of all goods and people on the mid-Columbia River. Competing interests, like the 'Portland and Dalles

Wagon Road Company', would have little success at challenging OSNC's monopoly. Even with help from the state government, they were only able to build a small, primitive road from The Dalles to the Cascade portage. (Gill 1924) In the later half of the decade and into the beginning of the 1870's, prosperity was increasingly common in the northwest. Major booms and rushes happened throughout the region, including gold finds in the Bitterroot Valley of Montana and the Colville region of eastern Washington. The 'inland empire' in eastern Oregon, Washington, and Idaho became increasingly settled, now that natives were contained to reservations and the GLO had completed surveying the land. Grazing and wheat farming began to dominate the land use of this arid landscape. The geographical position of Portland, being the major economic center of the State of Oregon (formed out of the Oregon Territory on February 14, 1859), necessitated that the products of the land east of the Cascades be shipped there for trade. The Columbia River acted as a conduit to connect the east and the west of the mountains, just as it did for Natives and Oregon Trail migrants in the previous decades. Livestock, wheat, gold and a variety of other minerals coming out of the 'inland empire' were forced to pass west through the Gorge.

Population in the northwest was also growing at a rapid rate during this time. The population grew more than six-fold in Oregon between 1850 and 1870 alone, then almost doubled from 1870 to 1880. (See Figure 14) Washington's statistics are strikingly similar. As the population and the economy grew in the northwest, transportation infrastructure became of paramount importance. The overall sentiment was that transportation development was the key to economic success in the




| | 1850 | 1860 | 1870 | 1880 | 1890 |
|---|---|---|---|---|---|
| Oregon | 13,294 | 52,456 | 90,923 | 174,768 | 313,767 |
| Washington | | 11,594 | 23,955 | 75,116 | 349,390 |

(U.S. Census Bureau 1890)

*The Census Bureau did not report Washington population statistics before 1860

**Figure 14**: Oregon and Washington Population Growth, 1850-1890

northwest. (Cochran 1970, Robbins 1997) From the standpoint of the Euro-American capitalist, western transportation *was* progress, and progress meant money. The trade and travel routes that were established were the result of the landscape level geography encountered and the mechanical devises employed for overland travel. (Mills 1948) The economic growth of the northwest created an expanding pattern of movement in the frontier west. Thus a new geography of trade and transportation would come to dominate Oregon as a result of technological advancement.

During the course of the 1870's and 1880's the prophecy of a transportation-oriented and connected Pacific Northwest would come to fruition. Beginning with the completion of the first transcontinental rail link to central California in May of 1869, a frenzy of railroad building gripped the west. After California was linked to the east, investors began examining the feasibility of construction to the northwest. Interest in building a railroad to the Pacific Northwest had existed since the surveys completed by the Department of War in the mid 1850s. It was not until 1870, with the ambition of the Northern Pacific Railroad Company, that construction to the northwest began in earnest. The Northern Pacific had chosen Tacoma, Washington as their western terminus. The company surveyed a route along the Oregon side of the Gorge as a possible route, and made a proposal in 1872 to purchase a right-of-way from the OSNC. No agreement was ever reached. (Bryan 1936) Ultimately the railroad would bypass Oregon completely and build over the Bitterroot Mountains, into eastern Washington, and over the central Washington Cascade Mountains at Stampede Pass. Financial troubles, including the credit failure of Jay Cooke and Company, the primary investor, hindered the construction of the road from 1873 until the end of the decade. (Bryan 1936) Additionally, engineering difficulties, especially with the tunnel at Stampede Pass in Washington, further delayed the completion of the road. (Robertson 1995) The line was not completed until 1887, almost four years after a road would be built through the Gorge.

The choice to bypass Oregon left the OSNC as the primary railroad power for east-west transport in southern part of the northwest. Operators of the railroad, namely John Ainsworth, recognized the railroad's potential for transcontinental linkage. Investors did not want to lose their monopoly however. Between 1876 and 1878 at least two different companies, the Oregon Pacific Railroad Company and the Columbia River Portage Railroad Company attempted to break OSNC's hold on the Gorge, all of which were unsuccessful. (Minor and Beckham 1984) To maintain its interest in the Oregon portage line (the north bank was still the only one in use), the OSNC composed numerous plans to upgrade the line. The plans called for standard gauge iron rails, new grading, and a new roadbed. (Gill 1924) The improvements were never made. Despite this, large surveys were made of the south bank during this time period. Chief engineer J.W. Brazee wrote to Ainsworth in 1877,

> I have thoroughly examined the Oregon side of the river but cannot give you any idea of how the hills are tipping and sliding around… It would be to your great satisfaction for you… to come up… and have a good look at the country. You could then fully appreciate the beauties of building a road of any kind in such a place. (Brazee 1877)

In 1878, H.M. McCartney, an engineer for the railroad, found that the original south bank portage was in great decay and, like Brazee a year earlier, noted the slow moving landslides pushing the track toward the water. He reported, "for two miles along this side hill the whole country seems to be moving steadily toward the river like a glacier. It is all broken and full of fissures." (McCartney 1878)

The monopoly stronghold of the OSNC was waning in the late 1870's. No significant improvements had been made on their portage lines for almost a decade and other interests in the northwest were becoming increasingly spiteful toward them. The general sentiment of the public was that the monopoly held by the OSNC on the Columbia River was contrary to the public good and needed to be removed. (An editorial in the *Daily Oregonian* by Chapman (1873) provides great insight into this sentiment.) Henry Villard, a visionary investor and organizer who had much success with investing on the west coast, especially with the Oregon and California Railroad, entered into negotiations with the OSNC in 1878. He saw the great possibility of opening up the riches of the 'inland empire' through investing in the construction of a through rail line in the Gorge. (Bryan 1936) Furthermore, and contrary to public interest, he saw the potential to perpetuate the monopoly enjoyed by the OSNC, increase the regional influence of Portland, and control commerce in the northwest. (Lewty 1995) With the backing of investors on the east coast, Villard bought out the OSNC and incorporated the Oregon Railway and Navigation Company (OR&NC) on June 13, 1879. (Gill 1924) The buyout, at a price of $400,000,000, covered all properties of the OSNC including steamboat investments on the Willamette and Columbia Rivers, and the portages on the north and south banks of the Cascades and the south bank portage around The Dalles/Celilo Falls. (Minor and Beckham 1984) The Articles of Incorporation show the following property at the Cascades being transferred to the OR&NC:

- <u>Cascade Portage Railroad [North Bank]</u>: 6 miles road bed and track with sidings, turn tables, tanks, inclines, car shops and blacksmith shop complete, and all track material, and tools for track and bridge repairs, 3 locomotives, 3 passenger cars, 35 box cars, 10 flats, 2 hand cars, 1 rubber car
- <u>Oregon Portage Railroad [South Bank]</u>: 5 miles grading and trestle complete with 1 inline 7 miles, telegraph lines, 236 tons, 30 lb. steel rails, 1850 splice bars, 171 keg spikes, 1 flat car, 1 hand car, lot wheelbarrows, picks, shovels and drills, and other grading tools
- <u>Land in Oregon</u>: Tanned [Tanner?] donation claim 151 7/100 ac, Ruckel donation claim 150 81/100 ac, Olmstead donation claim 140 39/100 ac, Chipman donation claim 312 48/100 ac
- <u>Land in Washington Territory</u>: all of Cheacwith [Chenowith?] claim 635 53/100 ac, Retz property 134 50/100 ac, Bishop donation claim 320 ac, Bardford [Bradford?] donation 639 78/100 ac, ½ of the Hamilton Island accounting for 15 ac

(OR&NC Articles of Incorporation 1879)

Villard did not waste any time in commencing to expand the rail system he had just taken over. His overall plan had three components. First, in 1880, he started building northeastward from The Dalles to Wallula, a major hub of agricultural trade in eastern Washington. Eventually this line would connect to the Northern Pacific Railroad and serve as a northern transcontinental link. Second, in 1881, he built southeastward from The Dalles, over the Blue Mountains, to connect with the

Oregon Short Line in Huntington (OR). This would serve as a connection with the transcontinental Union Pacific rail system. Lastly, and most importantly (at least for this study), in 1882 he built a line through the Columbia River Gorge connecting The Dalles and Portland.

The line through the Gorge was started late in 1881, with the start of grading and track laying in Albina, on the east side of Portland. Soon after that began on the west side of the Gorge, crews began grading and building embankments moving westward out of The Dalles. The two construction crews were to meet at the lower end of the Cascades near Bonneville. Advertisements for workers needed for building the line appeared in numerous editions of the *Daily Oregonian* in 1881. One article mentions that 185 men were already employed near The Dalles and more were needed to 'clear timber'. (Unknown 1881) Grading and track laying was completed from Portland to Bonneville sometime in October of 1882. Easy grades, minimal bridging, and easy supply access from steamboats aided the expediency of building this part of the line. (Gill 1914)

The section from The Dalles to Bonneville was quite the opposite. Many precipitous bluffs crowded down to the river, which required a great deal of engineering to secure an adequate ledge. The records of the construction of this section of the road attest to this: "The line closely follows the base of high rocky bluffs which form the Columbia River Gorge. Because of the many drainage channels leading in the Columbia River from the high Cascades, the construction of much bridging was necessary." (Unknown 1882a: 2) The construction records also indicate that there were large quantities of rock taken from the 'Rocky Butte' quarry.

While there is no mention of where the quarry was located, it can be assumed, since the Gorge has a copious supply of stone, that the quarry was located in close proximity to the construction project. The project from The Dalles to Bonneville used 46,000 linear feet of pile and frame creosote-treated trestles and seven pre-constructed bridge trusses. (Unknown 1882a) Four tunnels were also built along this section of the road, in places where rocky bluffs abutted the water. Great difficulties with landslides were encountered near the upper terminus of the old Oregon Portage line. As mentioned previously, H.M. McCartney had reported years earlier troubles with a 'sliding mountain' that was plaguing improvement to the OSNC portage line. Engineers, including chief survey engineer H. Thielson, discovered the cause of the slide and remedied it by placing a series of underground tunnels beneath the hillside, which drained subterranean water into the Columbia River. (Gill 1924, Unknown 1882a)

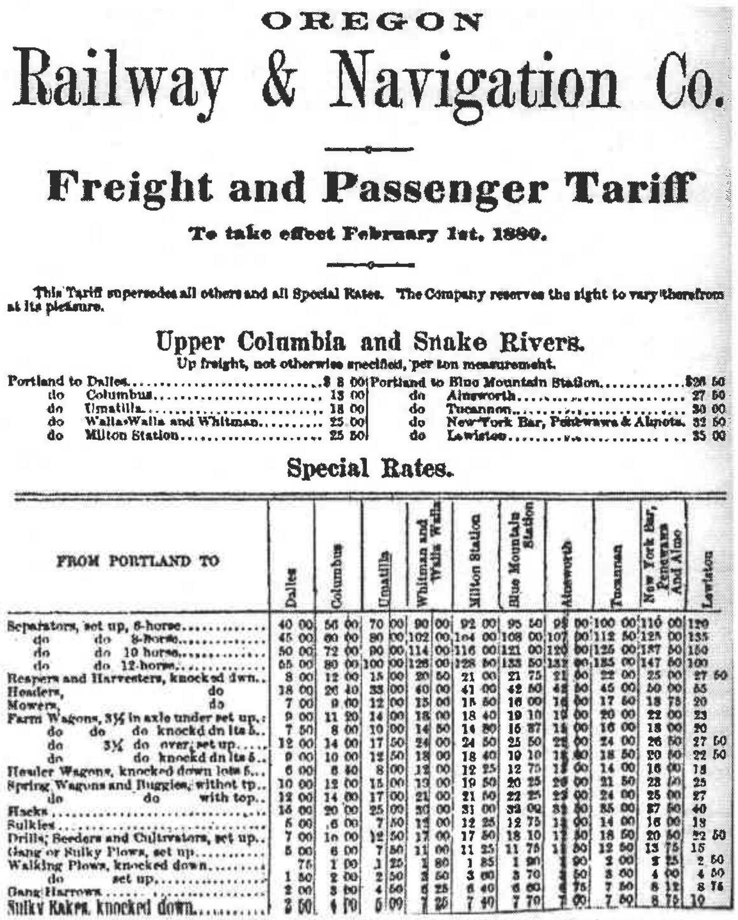
From the upper landing of the old portage to Bonneville, the survey and construction crews encountered the remnants of the decaying portage road. The crews found five miles of usable grade overlaid with roughly 236 tons of thirty pound steel rails. The existing grade was improved by the addition of embankments and reinforced bridging, and the rails were replaced with standard gauge fifty-six pound steel. (Unknown 1882a)

The railroad through the Gorge was completed on October 31, 1882, and the first through train passed over it on November 20$^{th}$ of that year. The *Daily Oregonian* reported the following day:

> Traffic by rail was commenced yesterday between the metropolis of Oregon and the tributary empire lying east of the Cascade Mountains. There was no

hurrah, no confusion, no excitement. One passenger train and two freights left Albina in a plain matter-of-fact way, as if the practice of running cars into that now prominent railroad town has been established for years. (Unknown 1882c)

At this time the line to Wallula was completed and working and the line to Huntington was being pushed to completion at a hurried rate. (Gill 1924) Passengers to Wallula were able to take a connection ferry to the Northern Pacific line, which was completed from Ainsworth (near Wallula) to points eastward. The through link to the Northern Pacific was completed in 1883, and Villard's first transcontinental connection was accomplished. (Spranger 1984) Later in that year Villard reached an agreement with the Union Pacific Railroad Company to connect their Oregon Short Line road (which was attached to the central transcontinental link finished in 1869) with the OR&NC line at the Idaho border. By



OREGON

Railway & Navigation Co.

Freight and Passenger Tariff

To take effect February 1st, 1880.

This Tariff supersedes all others and all Special Rates. The Company reserves the right to vary therefrom at its pleasure.

Upper Columbia and Snake Rivers.

Up freight, not otherwise specified, per ton measurement.

| | | | |
|---|---|---|---|
| Portland to Dalles | $ 8 00 | Portland to Blue Mountain Station | $26 50 |
| do Columbus | 13 00 | do Ainsworth | 27 50 |
| do Umatilla | 18 00 | do Tucannon | 30 00 |
| do Walla-Walla and Whitman | 25 00 | do New-York Bar, Penawawa & Almota | 32 50 |
| do Milton Station | 25 50 | do Lewiston | 35 00 |

Special Rates.

| FROM PORTLAND TO | Dalles | Columbus | Umatilla | Whitman and Walla Walla | Milton Station | Blue Mountain Station | Ainsworth | Tucannan | New York Bar, Penewawa And Almo | Lewiston |
|---|---|---|---|---|---|---|---|---|---|---|
| Separators, set up, 6-horse | 40 00 | 56 00 | 70 00 | 90 00 | 92 00 | 95 50 | 98 00 | 100 00 | 110 00 | 120 |
| do do 8-horse | 45 00 | 60 00 | 80 00 | 102 00 | 104 00 | 108 00 | 107 00 | 112 50 | 125 00 | 135 |
| do do 10 horse | 50 00 | 72 00 | 90 00 | 114 00 | 116 00 | 121 00 | 120 00 | 125 00 | 137 50 | 150 |
| do do 12-horse | 65 00 | 80 00 | 100 00 | 126 00 | 128 50 | 133 50 | 132 00 | 135 00 | 147 50 | 100 |
| Reapers and Harvesters, knocked dwn. | 8 00 | 12 00 | 15 00 | 20 50 | 21 00 | 21 75 | 21 00 | 22 00 | 25 00 | 27 50 |
| Headers, do | 18 00 | 26 40 | 33 00 | 40 00 | 41 00 | 42 50 | 42 50 | 45 00 | 50 00 | 55 |
| Mowers, do | 7 00 | 9 00 | 12 00 | 15 00 | 15 50 | 16 00 | 16 00 | 17 50 | 18 75 | 20 |
| Farm Wagons, 3½ in axle under set up. | 9 00 | 11 20 | 14 00 | 18 00 | 18 40 | 19 10 | 19 00 | 20 00 | 22 00 | 23 |
| do do do knockd dn lts 5. | 7 50 | 8 00 | 10 00 | 14 50 | 14 80 | 16 87 | 15 00 | 16 00 | 18 00 | 20 |
| do 3½ do over, set up | 12 00 | 14 00 | 17 50 | 24 00 | 24 50 | 25 50 | 22 00 | 24 00 | 26 50 | 27 50 |
| do do knockd dn lts 5. | 9 00 | 10 00 | 12 50 | 18 00 | 18 40 | 19 10 | 18 00 | 18 50 | 20 50 | 22 50 |
| Header Wagons, knocked down lots 5. | 6 00 | 6 40 | 8 00 | 12 00 | 12 25 | 12 75 | 12 00 | 14 00 | 16 00 | 18 |
| Spring Wagons and Buggies, withot tp. | 10 00 | 12 00 | 15 00 | 19 00 | 19 50 | 20 25 | 20 00 | 21 50 | 23 50 | 25 |
| do do with top. | 12 00 | 14 00 | 17 00 | 21 00 | 21 50 | 22 25 | 23 00 | 24 00 | 25 00 | 27 |
| Hacks | 16 00 | 20 00 | 25 00 | 30 00 | 31 00 | 32 00 | 32 50 | 35 00 | 37 50 | 40 |
| Sulkies | 5 00 | 6 00 | 7 50 | 12 00 | 12 25 | 12 75 | 12 00 | 14 00 | 16 00 | 18 |
| Drills, Seeders and Cultivators, set up. | 7 00 | 10 00 | 12 50 | 17 00 | 17 50 | 18 10 | 17 50 | 18 50 | 20 50 | 22 50 |
| Gang or Sulky Plows, set up | 5 00 | 6 00 | 7 50 | 11 00 | 11 25 | 11 75 | 11 50 | 12 50 | 13 75 | 15 |
| Walking Plows, knocked down | 75 | 1 00 | 1 25 | 1 80 | 1 85 | 1 90 | 1 90 | 2 00 | 2 25 | 2 50 |
| do set up | 1 50 | 2 00 | 2 50 | 3 50 | 3 60 | 3 70 | 3 50 | 3 50 | 4 00 | 4 50 |
| Gang Harrows | 2 00 | 3 50 | 4 50 | 6 25 | 6 40 | 6 60 | 6 75 | 7 50 | 8 12 | 8 75 |
| Sulky Rakes, knocked down | 2 50 | 4 00 | 5 00 | 7 25 | 7 40 | 7 70 | 7 00 | 7 50 | 8 75 | 10 |

**Figure 15**: OR&NC Advertisement (from Robertson 1995)

early 1884 the road was completed and the OR&NC operated two transcontinental links, in cooperation with the Northern Pacific (the northern route) and the Union Pacific (the central route). (Due and French 1979) The OR&NC published a promotional pamphlet on their new line through the Gorge:

> After leaving the Cascades the topography and climate undergo a change. The shores grow less abrupt, the country in general more level and timber thinner. By far the most engaging feature of the ride will be the tracing of the newly laid track on the south bank, which, winding in, through and around the immense boulders, creeping fearlessly over stupendous heights, rattling over miles of bridges and trestles, and anon lost to view behind a clump of trees, has been rightly pronounced the most marvelous piece of railroad engineering in the world. (Unknown 1882b: 7-8)

The frenzy of railroad building completed by Villard in the early 1880's left a large imprint on transportation in the northwest. The rails contributed tremendously to Portland's prosperity over the next decades. The opening of an interconnected rail system enabled goods to be moved with more efficiency and for vast sections of the 'inland empire' to be opened up for agricultural and mineral production. There were limitations however. One researcher on the economics of the transportation routes built in the late nineteenth and early twentieth centuries argues "the OR&N[C] did not materially expand either shipments or profits with its railroad, nor lower costs for shippers." (Cochran 1970: 39) Essentially the route eased the transportation of passengers and goods, but did not substantially alter the economics of the Pacific Northwest because freight prices were still inflated. The tremendous expense put into the railroads had not, in many senses, paid off for Villard and his investors. The monopoly that was enjoyed by the OSNC was not as fruitful for the railroads new owners. For this reason, and many more, Villard was forced to resign as the president of the OR&NC (and from the executive board of the Northern Pacific) in early 1884.

From the mid 1880's to the end of the century the Gorge's prominence as a transportation corridor remained unchallenged for travel and trade in Pacific Northwest. While other railroad links were made to the northwest, namely the Northern Pacific route to Tacoma and the Puget Sound completed in 1887, the Gorge experienced increasing rail traffic for both freight and passengers. Trains would continue to pass through on their way to points as close as Portland and as distant as Salt Lake City, Utah.

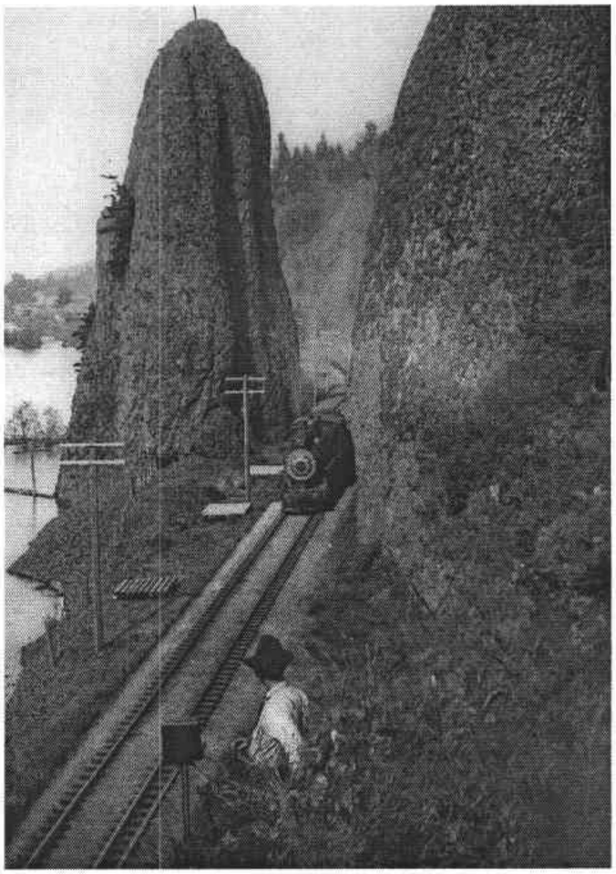


**Figure 16**: OR&NC Train Passing Through the 'Pillars of Hercules', Unknown Photographer, Circa 1900 (from Williams 1980)

Not a great deal of landscape change happened in the closing years of the nineteenth century. The well-surveyed and well-engineered railroad through the Gorge experienced few maintenance and repair problems during its first fifteen years. Minor damage was sustained in the largest flood in recorded history in the Gorge in 1894. Some bridging and embankments needed repairs (ORR&NC 1901), but on the whole, the line was well constructed and did not sustain much damage. In the first decade after the turn of the century the Oregon Railroad and Navigation Company (the successor of the Oregon Rail*way* and Navigation Company) would be absorbed into the Union Pacific system. The track through the Gorge would undergo large renovations from 1905 to 1910, especially from Cascade Locks eastward to The Dalles. (Due and French 1979) In the last development in the nineteenth century, the Spokane, Portland and Seattle Railway bought the abandoned north bank portage road. The road, as well as another abandoned portage road around The Dalles/Celilo Rapids, was purchased in 1897 with the thought of constructing a competing railroad through the Gorge. The through line on the north bank was constructed in 1905 and began carrying passengers and freight in 1906. (Robertson 1995)

The Cascade Rapids—and The Dalles/Celilo Rapids for that matter—had become less of a hindrance to transportation in the Gorge by the end of the nineteenth century. What was once a three steamer and two portage route was now connected by one single, continuous line. The trip from Portland to The Dalles, a two day journey before the railroad, now took on the order of three or four hours, with freight costing $8.00 per ton. (Robertson 1995) The engines and railroad cars of the OR&NC passed directly over the old railroad bed that J.S. Ruckel and Harrison Olmstead had build three decades earlier, and where the first engine in the northwest had turned its first wheel. The coming of transportation infrastructure had changed the Gorge in many ways. Massive changes were brought by the railroads to the social landscape, the economy, and the endemic environment of the Gorge. The riparian area felt the brunt of the railroad's impact on the Gorge's ecosystem. This idea will be taken up again, after the other significant development in the Gorge, the construction of navigation infrastructure, is explored.

**4.2- Early River Transportation**

From the time that Robert Gray first entered its bar in 1792, trade and travel on the Columbia River has been a seminal component to the growth and prosperity of the northwest. Known as the 'Great River of West' by white explorers, the river's bounty was plentiful. Well before the entrance of European-American settlers into the northwest, native inhabitants gathered by the shores of the river in the annual exercise of fishing for salmon and trading with other tribes. Virtually all parts of the river, above and below the Gorge, were used for transportation. Dug-out canoes, carved out of the abundant cedar of the western side of the mountains, carried natives up and down the river, often to participate in elaborate trading relationships.

When Gray's successors came to the northwest, the Gorge's role as a transportation corridor would be greatly amplified. As we have already seen, white settlement increased at a moderate pace throughout the first half of the nineteenth century. First came fur traders, then explorers and missionaries, and finally the overland settlers from the east. With each incursion into the northwest by these parties, trade and travel became increasingly significant. Boating on the river grew in importance, owing much of its growth to the presence of the U.S. military and the autumnal arrival of settlers. The introduction of steamboats on the section of the river below the Cascade Rapids began in the 1840's, using sidewheelers to transport people and freight up and down this section of the river. (Wright 1961) The steamboat era on river did not truly begin until 1850, when the first mail service was established between San Francisco and Portland, and the first steamer built in Oregon, the *Columbia*, was placed on the river. (Willingham 1983) The *James P. Flint*, the first steamboat to ply the waters of the middle river, between the Cascades and The Dalles, began service on the river in 1851. It was built at the Cascades by the Bradford brothers (owners on the north bank portage) and operated by Captain Van Bergen, an established steamboat captain in the northwest. (Mills 1947) During the following year the *Flint* was moved to the upper river (above The Dalles) and the sidewheeler *Mary* replaced it. An agreement was set up that year with steamboat operators below the Cascades and above The Dalles. Using two portages and three different steamboats, a through line from Portland to the 'inland empire' east of The Dalles was now up and running. By the end of the decade the number of steamboats involved in the through-route in

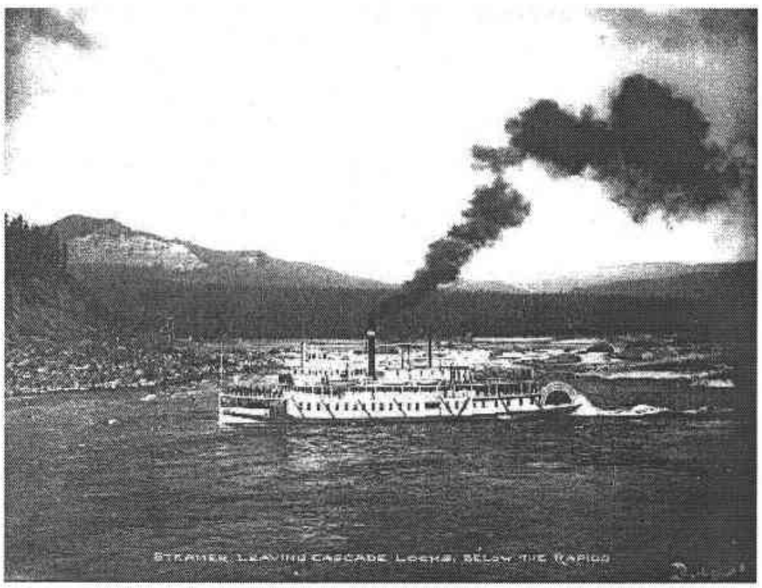



**Figure 17**: Steamboat Leaving the Cascade Rapids, Unknown Photographer, Circa 1900 (Salem Public Library, Photo ORN8)

the Gorge swelled to over seven. (Wright 1961) The business of transporting goods and people on the river was booming.

As the role the Gorge played in transportation became increasingly significant, the United States government took more interest in improving the river for navigation. Before the 1870's the government's role in the Gorge, as already explored, was largely limited to subduing the native population, ensuring safety for white settlers, and protecting transportation interests at the Cascade Rapids. As early as the mid-1860's individuals, including the OSNC president John Ainsworth, called for the government to survey and discuss options to bypass and/or eliminate the rapids that hindered through steam navigation. (Ainsworth 1877) The stage was set for the first of a series of government actions in the Gorge that would leave massive imprints on the land, many of which are still evident to this day.

### 4.3 Creating the Industrial River: The Cascade Locks

The portage railroads at the Cascades were enjoying steady, thriving business in the Gorge during the 1860's and 1870's. Major improvements to the roadbeds and tracks had been made, enabling the OSNC to reap increasingly large profits. The company enjoyed a full monopoly in the transportation of goods and people through the Gorge, setting prices at their discretion. Frustrations with the monopoly were gaining momentum in the northwest, so much so that it was brought to Congress' attention: "The whole of the navigation of the Upper Columbia and Snake is now in the hands of a single company. It owns and operates all the steamers on the waters, and has railroad portages around the Cascades and between The Dalles and Celilo.

All freight has to be handled twice at each place." (U.S. Senate 1879) Increasingly the public became suspicious of the company and implored the government to take action, both in transportation rate regulation and navigation improvement. Congress recognized that the lack of good navigation in the Gorge "is a serious burden upon the people thereof and tends to retard settlement and cultivation." (U.S. House of Representatives 1876) To some extent, even the operators and owners of the portage line saw the major advantage that an 'open river' would have to the northwest. (Of course they wanted to capitalize on its construction and operation.) As Ainsworth wrote Lieutenant W.H. Heuer in the San Francisco office of the U.S. Army Corps of Engineers (USACE),

> [the] Walla Walla Valley alone… to say nothing of Eastern Oregon, Northern Idaho, and Western Montana, is wholly dependant on the Columbia River for the transportation of the large surplus of grain (increasing so rapidly every year as to assume even now huge proportions) to the markets of the world. [If improvements were made,] we could then run our large-sized steamers, and, by the assurance of transportation, and consequently good markets, this large, important, and rapidly improving country would have free communication with, and access to, the commerce of the world. Every available house in Wallula is now filled with wheat that will have to remain there till next May. (Ainsworth 1867)

Early river work, which the USACE completed by 1869, focused on easing the entrance to the Columbia River where it meets the Pacific Ocean, and improving the navigability of the Willamette River from Oregon City south to Eugene. The first river work on the mid-Columbia addressed the 'John Day Rock', just east of the Gorge. Blasting and excavation removed 43.6 cubic yards of this major rock, eliminating the dangerous eddy that it caused. (USACE 1869) Three years later, Ainsworth and Major Robert, the chief of the newly created (1871) USACE Portland

Office, toured the Gorge and other major rapids upstream to examine the most practical means of easing navigation and increasing the quantity of grain moving on the river. (Richmond 1970, USACE 1872) Finding that improvements like removing the John Day Rock had significant impact on the ease of river transportation, and deliberating on the reports made by Major Robert, Congress authorized surveys of the worst rapids of the river, specifically the Cascades. Two surveys were completed over the course of three years spanning from 1874 to 1876 by the new Portland chief, Major N. Michler. They focused predominantly on two aspects: the character of the riverbed and the possibilities and feasibility of navigation improvements. Some landscape characteristics described in the surveys are summarized in Table 4.3.

**Table 4.3**: USACE Landscape Characteristics of the Cascade Rapids

| |
|---|
| *RIVER:* Very strong current, sudden bends, large rise of river level during freshets, 10-40 feet deep |
| *RAPIDS:* Eddies/whirlpools, uniform river bottom, 5 ¾ miles long, fall of 37.3 feet |
| *ROCK:* Basalt, easily cut/good for masonry, upper section is a rocky plateau, high tendency for slides on north bank, many fissures |

(USACE 1874, 1875, & 1876)

The 1875 report concludes that "a permanent improvement [of the Cascade Rapids] can, without any doubt, be successfully accomplished at this locality by the construction of a canal, and locks across the rocky neck of land… between the head of the upper rapids and the basin at the foot of them." (USACE 1875: 788) Furthermore it called for the canal to be 2,600 feet long, with two 215-foot locks, and a width of 40 feet, with a substantial amount of excavation below the canal to ensure safe entry and exit.

In 1877, Major J.M. Wilson, the new Portland Chief Engineer, submitted to U.S. Congress a revised proposal for the construction of the canal and locks at the Cascades. The new plan was a 7,200-foot long, 70-foot wide canal with two 300-foot locks complete with guard gates at each terminus, to be constructed at a cost of $1,188,680. (USACE 1877) Congress approved the revised plan and work began in December of 1878. Due to a lack of competent supervision and a series of complex land condemnations, the largest of which was with the OSNC, real progress did not begin until the following year. (Richmond 1970, Willingham 1992) Starting late in 1879, blasting and excavation work began at the site.

Upon commencement of the work, engineers quickly realized that the canal plan needed revision. This would be a common occurrence over the next 20 years until its completion. The new plans changed the dimensions of the canal once again and called for much more extensive work to be done on the lower approach. This also now meant that the canal's depth would be greater than the depth of the river at numerous points along the canal, and a greater amount of rock would need to be excavated from the canal's prism. (Willingham 1983) Immediately the engineers faced unexpected problems of all sorts. For example, "the spoils arising on the excavation of the canal prism accumulated in such quantities as the work progressed that it became a matter of importance to determine what to do with them within the limited area of the government land, and how they could be disposed of at the least expense." (USACE 1880) Poor weather conditions and annual freshets coming down the river every spring added further complications to the project. Regardless, some of the largest excavation work was completed during the first two years of construction.

Figure 18 displays the amount of excavation, and the amount of fill material added, occurring per year at the site of the canal and lock from 1879 to 1895. (For reference, 10,000 cubic yards is equivalent to a little over the volume of three Olympic-sized swimming pools)

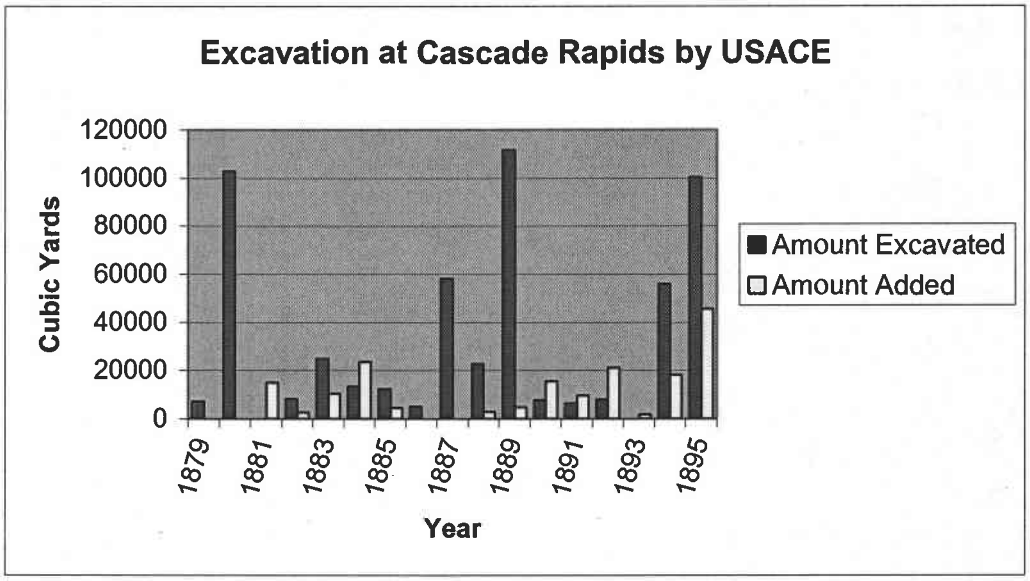



**Figure 18**: Excavation and Fill Amounts for Cascade Canal and Lock

Regardless of technical revisions, the canal and lock project got off to a relatively smooth start, having a stable amount of funding and a supply of workers from a Portland-based contractor. The success did not last long, however. By mid 1880 the primary contractor for the project was facing serious problems involving competent supervision, and little was actually accomplished on the ground. (Willingham 1992) The contractor was fired and a new one was brought in. The high rate of turnover for supervision of the project was virtually continuous until the early 1890's. (By then Congress was at the end of their patience with the project.) As a result of the revised plans, the new contractor ceased all work on the canal prism from mid 1880 to 1883, so that work could be focused on the lower approach. The primary goal during these years was to eliminate treacherous 'reefs' (places where jagged rocks extruded out of the water) and a major whirlpool, aptly named 'Big Eddy,' beside the reefs. Reports from this time indicated that the reefs were easily drilled and blasted, and the excavated rock was being used to fill in the Big Eddy. Overall, "this work consists of removing rock from projecting points of both banks, and depositing it in the bends, and in blasting bowlders [sic] and reefs in the river channel and either removing the debris or dragging it into deep holes, the object being to increase the water-way and ease the currents at places of difficult navigation." (USACE 1882: 2669) An overview map of the work completed at the Cascades canal and lock area in 1883 and 1884 is attached as Appendix 2. Note the route for the canal, the location of 'Big Eddy', and the location of the major reef removal. From 1880 to 1883 over 125,000 cubic yards of material was excavated from the site.

The troubles facing the canal and lock project came to a climax in the mid 1880's. Despite Congress repeatedly recognizing the commercial significance of an open river, the project was severely under funded. Several work stoppages occurred during this time period due to an empty treasury. (Willingham 1983) Other projects in the northwest, namely improving the entrance to the Columbia River from the ocean and improving navigation on the Willamette River, required continual funding and were seen as equally important to opening the northwest to increased commerce. A snagging boat, whose sole purpose was to remove tree snags from the river, was placed on the Willamette in 1870. It would stay there, with the exception of one year where it was used on the lower Columbia (below Portland), for the rest of the nineteenth century and well into the twentieth century. (For a well written, brief treatment of the snagging on the Willamette River, see Sedell and Froggatt (1984))

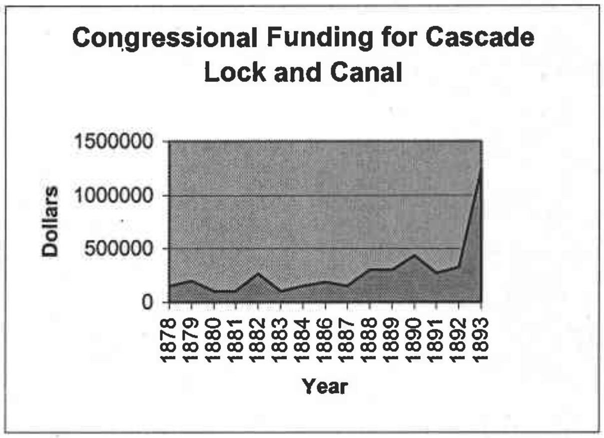



**Figure 19**: Congressional Funding, 1878-1893

Beyond lack of funds, continuous poor weather conditions made in-stream work exceedingly difficult. In numerous years, starting in 1883, whole seasons were lost due to dangerously high river levels, crippling snow and ice storms, and pounding rains. (The site of the canal averages around 80 inches of precipitation annually [See Figure 3 in Chapter 3].) Major Thomas Handury wrote in his annual report that "at this rate, it will require perhaps twenty-four more years before any benefit to commerce will result from this work." (USACE 1888: 2455)

The character of the landscape was also proving difficult to work in: "the water and mud preclude the use to any extent wagons, carts and sleds… The canal site and the ground on either side of it was exceedingly rough and broken, covered with a mass of bowlders [sic] varying from one-half to one hundred tons and more in weight." (USACE 1883: 2048) Excavated material was lifted out of the canal by derricks and loaded onto tramways. Carts on iron rails pulled by teams of mules— similar to the original portage railroads from decades earlier— were used to haul the excavated material to piles on the interior edges of the government-owned land. (Willingham 1983) A great deal of the excavated material was used for the masonry work in the canal itself. One USACE chief noted, "all stone so far used in the wall has been obtained from quarrying or blasting these [excavated] basaltic bowlders [sic]." (USACE 1883: 2048) The use of the excavated materials for masonry helped keep construction costs lower and kept the excavation piles smaller than they otherwise would have been.

The project continued at a relatively slow pace for the rest of the 1880's and into the early 1890's. Despite wavering funding, the canal project inched towards completion. This was aided by a reversing streak of good weather, especially in 1889 (the largest excavation year of the entire endeavor). Three primary projects were worked on during this time period: the excavation of the canal prism, the laying of masonry on sections of the canal already excavated, and the construction of embankments on the upper end of the canal to protect it from flood waters. The projects were aided by the addition of construction infrastructure. In 1887, a 25-pound T-iron railed tramway replaced the old one on the upper end of the canal. (Willingham 1983) This eased the movement of materials in and out of the canal prism, and enabled the pace of construction to quicken. The following year hydraulic hoses, often used in placer mining, were added to clear out rubble from surfaces after blasting. (USACE 1888) Revisions were also made during this time on the type of gates that later would be used for the upper and lower approaches (steel was preferred over wood), as well as the size of the necessary embankments above the entrance to the canal. (U.S. Senate 1891)

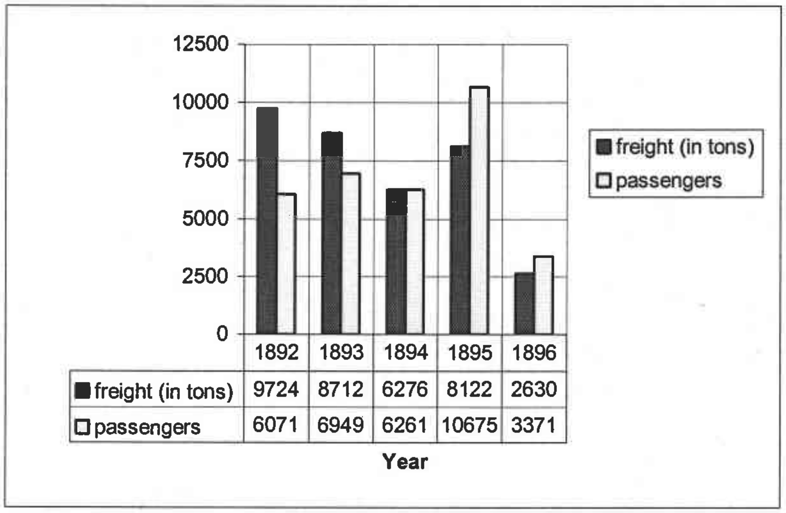
By the early 1890's most of the high quality rock that was excavated from the canal prism was already used for masonry. The contractors then turned to a series of quarries on the interior section of the government owned land. Since they supplied only a small portion of the needed masonry stone, more quarries were needed. Thus in 1891

> A lease was obtained from owners of the adjoining property to that belonging to the government on the east, and extending along the bank, for a right of way for a tramway and the exclusive privilege of taking the basaltic bowlders [sic] strewn along the land for a distance of nearly a mile. The supply of rock on the government ground suitable for lock construction is now about exhausted. There is an abundance on this leased ground. (U.S. Senate 1892)

By 1893 leases had been made as far as four miles upriver from the canal, including one quarry where over 3,000 cubic yards of masonry was cut. An agreement was reached with Union Pacific, which had recently acquired the ORR&NC, to utilize their tracks to transport stone from these lands to the site of the canal. (USACE 1893) Also during this time, a shortage of good quality sand for the mixing of concrete arose on the government owned land. Another agreement was reached in 1890 with Union Pacific to extract sand from their land on the north bank of the river. (The north bank portage railroad property was absorbed in the OR&NC, and then passed to the ORR&NC followed by the Union Pacific.)

These convergent events—the construction of the canal and locks at the Cascades, together with the construction and operation of a mainline railroad through the Gorge— had major implications for steamboat travel and commerce. Previously steamboats could discharge their cargo onto a portage at the Cascades where it would be transported up or down river to another boat. The absorption of the portage roads by the OR&NC and its successors, and their construction of the through rail line, took away the vital portage link for river commerce. Passengers and freight on the middle river (between The Dalles and the Cascades) were unable be transported around the Cascade and The Dalles/Celilo Rapids, essentially eliminating river transportation for a time. The federal government's efforts to open the river to through navigation had temporarily eliminated it. Furthermore the continual slow pace of progress on the project left many Oregonians deeply frustrated with the project.

In the early 1890's the government took two steps to alleviate this problem. First, in 1892, the federal government authorized the State of Oregon to build a temporary portage railroad around the Cascade Rapids. The road was constructed on federally owned land adjacent to the canal. It spanned only the worst of the rapids, or about two miles. Figure 20 displays the amount of freight and passengers using the state portage railway during its short lifetime. The road was used only until 1896 when the canal and locks opened for through navigation. (The 1896 freight and passenger figures are proportionately lower, since it was only in operation for the first five months of that year.) Once the canal opened, the road was abandoned. The second major governmental action to alleviate pressing




| | 1892 | 1893 | 1894 | 1895 | 1896 |
|---|---|---|---|---|---|
| freight (in tons) | 9724 | 8712 | 6276 | 8122 | 2630 |
| passengers | 6071 | 6949 | 6261 | 10675 | 3371 |

**Figure 20**: State Portage Railway Statistics, 1892-1896

issues with the canal in the early 1890's was the establishment of stable federal funding to complete the project. The Rivers and Harbors Act of 1892 added over $300,000 to the project's treasury. More importantly, however, the Sundry Civil Act of March 3, 1893 specified that it was a primary goal of the federal government to complete this project in an expedient manner, and therefore allocated $1,239,653 towards its completion. (USACE 1893) This sum of money, the government believed, was all that was needed to finish the canal and lock.

A private contractor, J.G. & I.N. Day Company from San Francisco, won the bid to complete the work at the Cascades. Work commenced immediately. Over the course of 1893 and 1894, virtually the entire canal was completed. An estimated 16,000 cubic yards of stone was removed from adjacent lands under lease during these years. Excavation of the canal prism was finished with the exception of a few places where hand excavation (instead of blasting) still remained. Early in 1894, work commenced on building steel gates for the locks and installing their foundations in the canal. All the steel used came from the Maryland Steel Company and was brought to the site by the Union Pacific Railroad. (USACE 1894) A great deal of time was spent revising the specifics on valves and culverts.

While funding and supervision were finally on the right track, nature threw a monkey wrench into the project. In 1894 a major flood occurred on the Columbia River, causing the highest flow ever recorded (145.7 cubic feet per second). The freshet disrupted work and produced minor to moderate damage to sections of the canal. The flood breached the canal wall in a few places, and about 460 feet of the canal was reported to be completely submerged. (USACE 1894) Minor damage was sustained to some of the embankments on the canal's upper end. A mile or so above the canal, two acres of riverbank washed away, depositing great quantities of sediment in and around the canal. (U.S. Senate 1895) The floodwaters were so high that they even disrupted the masonry yard on the upland riparian area, where stones were being cut for placement.

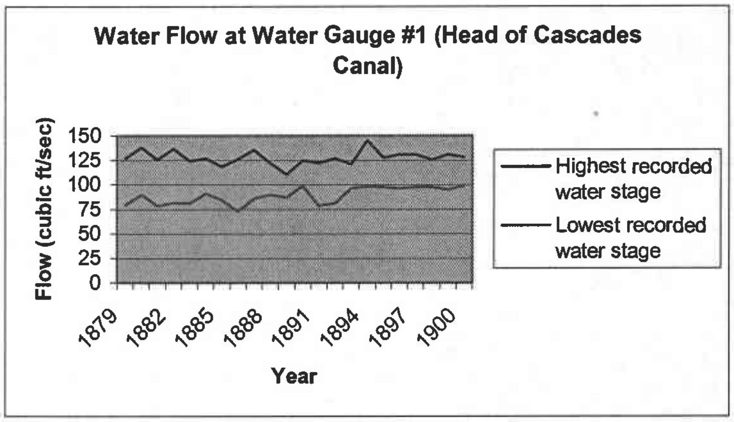



**Figure 21**: Columbia River High and Low Water Stages, 1879-1900

By 1895 the masonry yard was back in order and the sediment that the flood deposited was removed. The flood was a relatively minor setback in the progress toward completion of the canal. It did however lead the engineers to revise their plans for the canal: they now called for an extra six feet of height to be added to the canal walls. The project administrators decided that opening the canal was the most important thing at the time and the higher wall could be added subsequently. The pace of work was frenzied. The final excavation and in-canal masonry were completed, steel gates were added, test runs for steamers were made of the approaches, and water supply pipes and valves were tested. (USACE 1895, 1896) Minor improvements and corrections were made in 1896, most of which involved the steel gates and water supply systems.

At a total expense of $3,793,497 (about $83.5 million in 2000 dollars), and after twenty years of painstaking trial and error, the Cascade canal and lock was opened to navigation on November 5,1896. The steamer *Sarah Dixon* was the first to pass through, celebrating the opening by firing a small cannon from the deck of the ship. (Richmond 1970) In the end, the canal was 462 feet long, 90 feet wide, tapering to 140 and 250 feet wide at the lower and upper entrances, respectively. One lock was used rather than the original plan of two, having a total lift of 24 feet. The canal walls, after the six-foot additions made in the late 1890's, were 34 feet tall. (Willingham 1983)

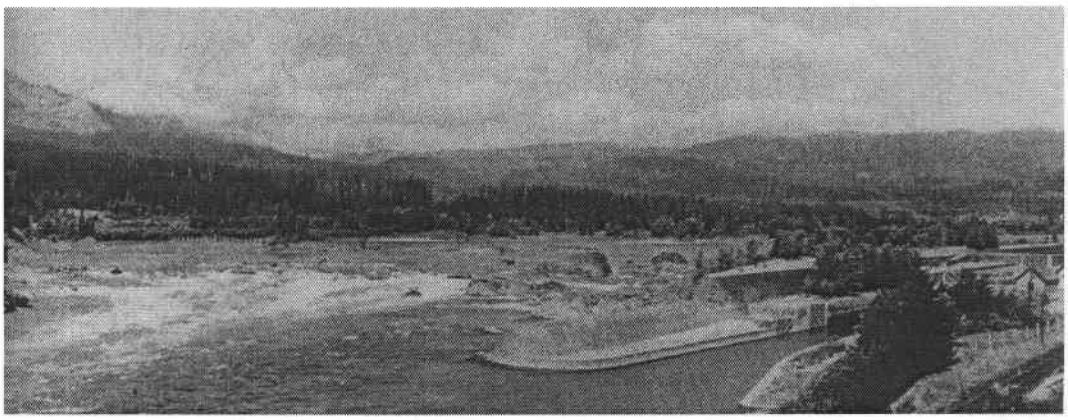


**Figure 22**: Cascade Canal and the Upper Cascade Rapids, Unknown Photographer, Circa 1900 (Salem Public Library, Photo ORN7)

In the closing years of the nineteenth century minor improvements were made on the canal, including the addition of stone to an upper embankment and the dredging of material placed by a freshet at the bottom of the canal. (USACE 1898) Opening the canal had immediate results in the northwest. The value of freight moving through the canal in the first years of operation, at no charge to shippers, equaled the entire cost of constructing the canal. (Willingham 1983) Furthermore, the canal's competition forced the railroad to lower freight rates to more moderate levels.

The monopoly started by the OSNC, subsequently owned by Union Pacific, had at last lost its stronghold over transportation in the central section of the Gorge. Yet they still wielded great amounts of power. The canal at the Cascades enabled easy navigation from the Pacific Ocean to above the Cascades. The rapids at The Dalles, about 40 miles upstream, posed a formidable barrier to through commerce. Above them, river navigation was easy for hundreds of miles. Union Pacific owned and operated the only railroad around these rapids as well as the old north bank portage, which was not in use. Congress and the USACE instantly recognized the need for opening up these rapids. An 1893 report indicated "that about 15,000,000 bushels of wheat were shipped to the Pacific coast from the country which would be… affected by the removal of these obstructions at The Dalles." (USACE 1893) Indeed, Congress authorized surveys to find the most practicable way to open the rapids to navigation. Originally agreeing on a boat railway (a railway that would lift boats out of the water, carry them up or down stream, and deposit them on the other side of the rapids), land deals for right-of-ways began in 1894. No actual construction was started until after the turn of the century. In 1903 the boat railway project was abandoned in favor of a canal and lock system, similar to that at the Cascades. (Willingham 1983)

Construction of this canal began in 1905. An open river, with navigation from the Pacific Ocean to beyond the confluence with the Snake River in Washington, would not happen until the completion of The Dalles canal and locks in

1915. The dream of a linked river transportation network to bring the agricultural wealth of the arid lands of Eastern Oregon and Washington to the markets of the populous of the west side of the mountains was finally realized that year. Despite this, the canals were not used to their projected ability. The Cascade canal moved only 29,500 tons annually between 1896 and 1923. (White 1995) Little traffic passed through The Dalles canal until the 1930's, and the Cascade canal would be inundated by the slackwater behind the Bonneville Dam, whose much larger locks opened in 1938. (Richmond 1970)

Altogether, the construction of the Cascade canal and lock project, along with the construction of various terrestrial transportation infrastructure projects (wagon, military, portage, and rail roads), had diverse and profound effects on the landscape of the Columbia River Gorge. Landscape change in the Gorge in the twentieth century—perhaps best symbolized by the vast slackwater created behind the Bonneville Dam—was certainly profound. But our focus on this later time period has obscured an important fact: that the building of portages and canals in the nineteenth and early twentieth centuries *also* caused widespread and significant imprints on this region.

## Chapter 5- CONCLUSION: LESSONS LEARNED AND NEW QUESTIONS RAISED

The nineteenth century was a time of discovery and exploration in the western regions of the United States. New transcontinental routes were being etched out of the plains, desert and mountains that carpet the western section of the country. The introduction of transportation technology, particularly in the second half of the nineteenth century, ultimately changed the geography of the west. Rivers such as the Columbia were modified to make them more amenable for shipping and commerce. New overland railroad links also were made, using the easiest grades and most practicable routes. Cities became nodes on a continent-wide array of connecting lines. These rail lines cut across the low points in mountain ranges, the flat lands of the prairie and desert, and the lowland bottoms of major rivers (Vance 1995). At the same time, following the passage of the Donation Land Claim Act in 1850, white settlement became the dominant objective of U.S. western land policy. The removal of the native populations and the growth of military presence, like the addition of transportation infrastructure, were all means to facilitate western settlement.

The impact of these changes were particularly apparent in major transportation corridors, such as the Columbia River Gorge. The first large-scale, broad changes to this landscape, specifically around the Cascade Rapids, came during this era of rapidly expanding European-American settlement. Relationships of work and energy between humans and the land were fundamentally changed, as nineteenth century technologies gave people increased control over nature. The second half of the nineteenth century experienced change from a direct human-land work, characterized by sweat and human perseverance, to a human-machine-land work relationship where human ingenuity reigned. At the same time, another important change occurred. Prior to the arrival of white explorers and settlers, certain native tribes along the Columbia held a monopoly on passage through the Gorge. By the late nineteenth century, this monopoly had passed into the hands of the OSNC followed by the OR&NC. This change not only foreshadowed much larger technological transformations in this transportation corridor in the twentieth century (including the construction of interstate highways and large hydroelectric dams), but also marked the time when the development of new transportation infrastructure began to alter the riparian zone of the Gorge as well as the riverbed itself.

This research has indicated that impacts to this nineteenth century landscape were relatively widespread and diverse. Numerous alterations to the in-stream and adjacent riparian areas were made as transportation infrastructure developed. Intensive impacts were largely limited to the nearby locations of road construction and the staging area for the Cascade canal and lock. Table 5.1 summarizes ecological impacts suggested by historical records that occurred in relation to, or as a result of the development of transportation infrastructure during the later nineteenth century. It is important to note that these impacts remain speculative, as the historical record does not precisely indicate most of the ecological changes from infrastructure development.

Table 5.1- Possible ecological impacts in the Gorge, 1850-1900

| **Action** | **Event** | **Possible Impacts** |
|---|---|---|
| Excavation of stone from river bottom and shorelines | Cascade canal and lock construction | • Scouring<br>• Bank erosion<br>• Downstream sediment delivery<br>• Channelization |
| Removal of streamside vegetation | Cascade canal and lock staging area<br>Road construction<br>Steam engines | • Loss of shading<br>• Bank erosion<br>• Bank instability<br>• Changes to nutrient/organic material input |
| *Possible impacts* based on the following studies: Gregory et al (1991), Sedell and Froggatt (1984), Sedell and Luchessa (1981), Swanson et al (1982) | | |

Additionally, the impacts outlined above could also affect habitat distribution and diversity, in-stream turbidity, and nutrient cycling. Declining fish populations may have resulted from such changes to the riparian and in-stream landscapes. This is not to insinuate that the addition of transportation infrastructure was the primary reason for the large-scale declines in salmon populations during this era, because it certainly was not. Over-harvesting by fishwheels for commercial purposes had the largest impacts on salmon. (Donaldson and Cramer (1971) provide a good overview of fishwheels on the Columbia River and a thorough environmental history of salmon on river is found in Taylor (1999).) Yet the transformations to the Gorge made by the addition of transportation technologies contributed to reductions in many aspects of river systems on which salmon rely, namely habitat characteristics and diversity. The possibilities of using spatial and ecological methodologies to explore the quantitative changes to the Gorge will be given attention later.

Changes in the landscape in the Columbia River Gorge provide a window into historical transformation of the Pacific Northwest, and beyond. The transition from in-stream to terrestrial transportation, and the usage of river bottoms in the west for construction of wagon roads and railroads, is not unique to the Gorge. Western rivers—and indeed many eastern rivers—were choice target corridors due to the ease of their grade and their ready supply of timber. (Vance 1995) Thus many rivers (and other water bodies) in the west likely experienced similar kinds of historic landscape change as transportation infrastructure was developed. For example, Montgomery et al (2003) found that the addition of transportation infrastructure in the nineteenth century contributed to the changes to the landscape of the Puget Sound in Washington State. Some alterations made to the Puget Sound from transportation infrastructure included loss of streamside forests, channelization, loss of woody debris input, and changes to habitat conditions and distribution.

Employing environmental history greatly enhances our understanding of the past. Prior to the mid-twentieth century, historical studies of the western U.S. focused largely on politics and culture. More recently, however, historians have become increasingly interested in the role of women on the frontier, the history of the west as seen from the Native American viewpoint, and—as indicated by this research—environmental changes that resulted from western resource exploitation and the addition of technological systems. While previous studies on the expansion of the railroads have shown how they "revolutionized the demography and altered the pattern of opportunity in the west" (Cronon et al 1992: 113), more detailed environmental histories provide an additional avenue for understanding historical developments. Thus by telling an environmental history of the west—in this case of the Columbia River Gorge—historically important environmental and landscape changes, including on-the-ground impacts previously unexplored and/or ignored, are incorporated into our general historical understanding.

New environmental studies of the west, exemplified by the work of Montgomery et al (2003) and the present study of the Gorge, advance our understanding of the historical processes of landscape change. By detailing episodes of landscape development (i.e. portages, military roads, mainline railroads, and canal/lock for the Gorge), one can begin to see the cumulative changes that contributed to the evolution of this landscape. Additionally, studies in environmental history help improve our understanding of what implications these changes have for ecosystems in the western U.S. While the particular approaches and materials useful for studying the Gorge are not directly transferable to other landscapes, this study provides both a case study of the usefulness of traditional historical methodology in understanding historical landscapes as well as an example of how this understanding of landscape evolution occurs in relation to historic developments. In particular, this study illustrates how the addition of transportation corridors in riparian areas occurred and some of the possible ramifications of such events (i.e. channelization, habitat modification, vegetation changes). Similarly focused studies, probing more deeply than current scholarship (for instance, Donald Worster's (1985) general examination of the history of western waterways), would be valuable for understanding the history of other major western water bodies that have experienced development of transportation corridors, especially the Colorado River and the Rio Grande.

This study both embraces and departs from the new historiography of the American West. Along with recent studies by William Cronon, Richard White, and Patricia Limerick, this study has emphasized the importance of incorporating environmental change in assessing the transformation of the West (Cronon et al 1992, Limerick 1987, White 1995). It departs from them, however, in focusing primarily on understanding environmental alterations that occurred in a particular region within an important transportation corridor. By looking carefully at the building of transportation infrastructure in the Gorge during the second half of the nineteenth century, this study has sought to illuminate the promise of historical inquiries for assessing larger historical and ecological transformations along transportation corridors in the Pacific Northwest, and beyond.

Furthermore, this research has helped extend our baseline knowledge about the Gorge's changing environment, by providing detailed information about specific changes and disturbances introduced to this transportation corridor during the second half of the nineteenth century. Most prior studies of this area have focused on developments during the twentieth century (for instance, Minor and Beckham (1984) and White (1995)). This study has demonstrated that numerous landscape impacts took place well before the era of dams and highways. Extending the baseline provides insight into the processes that caused changes in the land and yields a more comprehensive understanding the past.

Several specific conclusions can be drawn from this study, some with implications for policy and land management. In general, this research provides a case study of how a landscape's history may be reconstructed using historical methodology. This study reveals in detail the process of landscape development from 1850 to 1900. The construction of portage, military, and mainline roads, and the construction of the Cascade canal and lock, were among the most significant chapters in the development of the Gorge during this time. These technological systems impacted the floodplain forests of the river's riparian corridor. Portions of these forests were cleared for fuel wood and infrastructure development. Furthermore, changes to the bed and banks of the river, especially around the site of the Cascade canal and lock construction, also impacted the landscape of the Gorge. These landscape alterations likely affected ecosystem processes such as nutrient cycling, sediment retention, and water chemistry. Landscape impacts were thus widespread, covering a broad spatial footprint in the Gorge. More intensive impacts were limited to select locations where transportation infrastructure was most heavily developed. Lastly, the knowledge gained through this research, especially concerning landscape impacts, provides insight into possible restoration activities that could theoretically be undertaken in the Gorge. This issue will be given more consideration later in this chapter.

The methodology underlying this research was chosen partly of want and partly of necessity. As described in the introduction, three primary types of historical landscape studies are commonly accepted as fruitful methodological approaches to undertake projects such as this one: archeological, ecological, and historical. This research primarily rests on historical analysis. Ideally all three approaches ought to be equally represented in a historical landscape study, as Kenneth Carloni (2005) has achieved in analyzing the historical relationship between climate and Native American burning practices in the Umpqua forests of southwest Oregon. Yet practicality often limits such studies. Confining this research to the methods of historical geography has limited the potential strength of arguments made here about historic ecological changes. The nature of historical research, being deductive, means that historians may take different paths while exploring historical questions. In addition, there are continually more source materials that could be sifted through.

Nevertheless, this study has extended the works of Beckham (1984), Minor and Beckham (1984) and Minor et al (1986), each of whom studied the history of the Cascades area. These authors were primarily concerned with social and cultural history; environmental change was a secondary concern for them. By contrast, the present research reversed this priority. To achieve a robust environmental history of the Gorge, numerous overlapping and cross-referenced source materials were used. These included journals, diaries, letters, maps, photographs, newspapers, surveys (GLO, Dept. of War, USACE), census data, government reports and secondary source materials. The layering of source materials not only enhances the value of the historical record but also helps the historian and the reader better understand the historical events in question (for a complete description of methods used in this study, see the discussion in Appendix 1). In particular, maps and photographs were very useful in understanding the landscape imprint made by infrastructure development, most notably the GLO parcel map called upon during the discussion of the first white land owners in the Gorge (Figure 8 in Chapter 4).

Historical studies ideally raise new questions in the process of answering those that launched them. Here, many questions that remain involve matters where the historical record is lacking. For example: what was the spatial distribution of quarries and excavation piles on the federal-owned land used for staging the Cascade canal and lock project? What about on the private land leased for rock excavation during the last six years of the project? There is evidence of large quarries and piles in the reports from the Chief of the USACE, but no mention of their location. Locating these quarries is an object for further research. Another question not yet resolved by this research involves the usage of cordwood during this time period. Records on the *amount* used are spotty at best. It is generally known that the riparian forest provided a significant amount of the cordwood used, but it is not known to what spatial extent. Answers to these questions would make it possible to evaluate more precisely the ecological impacts of infrastructure development during this time period. Other areas for further inquiry have emerged from this research as well. For instance, more work on the historical ecology of this region is desperately needed. Contemporary ecological understanding of the Gorge is relatively strong, yet no work to date focuses on its ecological history.

This research has used solely historical geography methods. How can the knowledge gained here be extrapolated to larger ecological questions such as fire history, forest history, and successional patterns? What role can traditional historical methodology play in understanding the ecology of the near past?

Spatial analysis, using geographic information system (GIS) tools, may provide a robust avenue for quantitative evaluation of changes to the landscape. Montgomery et al (2003), mentioned previously, used GIS spatial analysis to aid their analysis of changes in the land to the Puget Sound. Further research could attempt to quantify the amount of floodplain forest existing in the Gorge historically, followed by a quantification of the amount of floodplain forest cut down for transportation corridors and the Cascade canal staging area. The result of such a study may indicate the relative amount of floodplain forest cleared during this time period, and may have broad importance in assessing the environmental impact of transportation infrastructure development. Still, such analysis is hard to achieve. It would be difficult to assess how much floodplain forest existed at the time period as well as the extent to which railroad construction cleared forests (since sections of the road were built on embankments and in some instances over rocks jutting into the river [i.e. Cape Horn]). Nevertheless, the research completed here could also form the foundation of a subsequent study that utilized ecological methodology, including dendrochronology and soil sampling. Ecological methodology, like spatial analysis, may provide robust quantitative evidence of landscape change. Archeological investigations would also have similar value. Once these studies are completed, a comprehensive landscape history involving all the accepted methodological avenues for understanding changes in the landscape of the Gorge would finally be in hand.

A study similar to this one is greatly needed for The Dalles/Celilo Rapids. The history of this area is similar to the Cascades in many ways. The portage at these rapids, while not as severe, remained a very significant limitation on the commercial growth of the northwest. Despite any similarities, however, the character of The Dalles/Celilo landscape and the historical processes that altered its channel and riparian landscapes are distinctly different. The geographic position of The Dalles/Celilo was such that it played a major role in the transfer of people and goods from all points eastward. It was the gateway to the 'inland empire' more so than the Cascades. While some historical studies exist for this area, environmental- and ecological-based research is highly lacking.

Further inquiry beyond this research could also address specific sites within the Gorge. A change in scale—for instance, looking at one land claim or one quarter-mile stretch of river—may yield results. Minor et al (1986) completed just such a project on an archeological site on the north bank of the river (as part of the construction of a second powerhouse for the Bonneville Dam in the 1980's). Three places come to mind where additional detailed research might yield fruitful insights: a) the Ruckle/Olmstead donation claims (site of the first south bank portage line), b) the sand dunes on the east side of The Dalles, and c) as previously mentioned, the federal site where rock was quarried and fill piles ultimately disposed. Of these three, the sand dunes, thus far unexplored, hold the most promise. These dunes were repeatedly reported as a major obstacle and annoyance to construction and maintenance of transportation infrastructure. A very plausible research project might look at the historical record of the dunes over a broad time scale (say 1850 to present) and pursue fieldwork surveying the dunes as they exist currently. Such a project could use both historical and ecological based methodology and has the potential to exhibit on-the-ground and concise changes to the unique dune landscape.

Lastly, relying on traditional historical methodology, new studies could analyze changes in the landscape of the Gorge in the *twentieth* century. Impacts from development were accelerated and expanded during this time period. From 1900 to 1950, highways were built on both sides of the river, the through railroad line was built on the north bank, the south bank road was almost wholly reconstructed, and the massive Bonneville Dam was erected just below the site of the Cascade canal and lock. Such a study might focus primarily on the Gorge rather than the entire Columbia River, on which White (1995) has already written. Completing such studies would allow the larger temporal context of landscape changes to be explored. Repeat photography (rephotographing a landscape imaged in earlier times to see landscape-level change) offers a very valuable tool for this sort of assessment. Recent articles from Slovlin et al (2001) and Bierman et al (2005) display the utility of repeat photography as a robust method to analyzing landscape change.

The Columbia River Gorge was preserved as the nation's first National Scenic Area in 1986. One objective of this designation was to preserve its unique history, namely through historical site preservation and interpretation. The Management Plan's cultural resource objectives specify that preserving archeological and historical relics aids in understanding the culture and landscape of the Gorge. (Columbia River Gorge Commission 1992) While the plan does not call for active restoration of the riparian areas of the Gorge, it is surely within the scope and purpose of the Scenic Area designation.

History-based landscape studies can help contribute to these objectives in the Scenic Area. Contemporary studies on restoring riparian systems often raise the question as to what landscape, or more accurately what landscape *in time*, should be the goal of restoration. The overall consensus is that restoration should not be aimed at a particular past landscape—often impossible to achieve politically, financially, or ecologically—but rather a landscape that promotes and serves as part of a functioning ecosystem. (Berg et al 2003) A 'functioning ecosystem' is undoubtedly a weighted term, yet in general it means a landscape where the ecosystem and its species maintain a high level of interaction, creating an environment characterized by interconnectedness and interdependence. For riparian areas such as the Columbia River Gorge, this entails (among other issues) a functioning riparian corridor that aids in sediment retention, inputs woody debris to the channel, and maintains the hydrographic integrity of the river. These riparian in-stream and out-of-stream functions then support the surrounding ecosystem of plant succession and animal communities.

Overall, historical evidence and interpretation can help frame restoration choices made by land managers. As Collins et al (2003) assert, "Because the processes that create riverine landforms, dynamics, and habitats vary between and along rivers, initial planning for restoring a river includes identifying the historically dominant processes." (111) Thus historic changes to riparian areas are important to understanding the options available to landscape restoration efforts. Within the time limits of the present study, this research suggests that any restoration options for the Gorge should focus particularly on floodplain forests. This is especially true for those forests abutting the river channel, since they are a major contributor to bank stability and erosion control and a major source of in-stream organic material inputs.

It is important to note that this study was not intended to establish policy options/alternatives for restoration of the Gorge. Significant events of the twentieth century have intensified and diversified human impact on the Gorge at many scales. Impacts from the construction of the Bonneville Dam and the highways on both sides of the river have largely overshadowed many of the impacts discussed in this research. The modern floodplain riparian landscape of the Gorge is now bisected by numerous transportation corridors. The result is an even more fragmented and altered landscape than described in this research. If riparian restoration does become an active objective of the contemporary National Scenic Area land designation however, studies like this one, coupled with studies that address the more modern alterations to the riparian landscape of the Gorge, will be essential to planning restoration activities.

At the start of this research it was asserted that the juxtaposition of the Gorge's physical attributes and its importance to human settlement in the region created a landscape unparalleled in the United States. Rimmed by mountains, and acting as a giant wind funnel between the Pacific and the Interior west, the Columbia River Gorge stands as a physically and ecologically unique landscape. The endemic environment was shaped by the forces of wind, water, and rock, creating a landscape that is covered with unique features like waterfalls, cliffs, monoliths, and mountains. Human habitation of the Gorge too produced a unique landscape. Faced with the

Cascade Mountains as a major barrier, the Gorge, by virtue of its geography, was the path of least resistance for human settlement and development. The banks of the river, from the time of the first indigenous settlement, were desirable landscapes for human habitation. The addition of transportation routes significantly changed the character of the landscape, enhancing the corridor nature of the Gorge, while changing its in-stream and riparian properties. The growth of settlements, resource development, and technological innovation contributed to a landscape where ecology and human society amalgamated into an intricate web of interactions. The product is a landscape that reflects both the grandeur of the west and the perseverance of the Euro-American pioneer spirit in a way that has and will continue to awe onlookers for generations to come.

> What a distinct privilege to witness the giant steps of civilization into this wilderness, an epic drama on the American stage. Go where you will, it is everywhere the same across the endless expanses of this continent: virgin forests, railroads, Indians, and steamboats crowded together. The free citizen battles wild Nature, overpowers it stride by stride, fears no difficulty, and strives onward, ever onward. (Trautmann 1987: 16)
>
> -Theodor Kirchhoff, Columbia River Gorge, 1863

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# APPENDICES

**APPENDIX 1:** A Note on Archival Sources Consulted for this Study

While the primary and secondary sources I consulted for this project were invaluable, this study would not have been possible without utilizing a wide range of archival sources (some previously untapped). Since no previous work plumbed this topic, I needed to map out what turned out to be a diverse and rich set of archival collections. Many were located in Oregon, but one important collection was located and reviewed at the National Archives in Washington, D.C.

Locating archival research for this project required significant advanced preparation. Bibliographic information from secondary sources became invaluable in helping guide acquisition of materials. Using on-line finding aides for each archive as well as correspondence with archive staff prior to my visits proved crucial to acquiring the desired primary source materials. Special attention was given to environmental engineering, manipulation of natural resources (i.e. stone, wood, soil), and general environmental alterations in each source material examined in the archives.

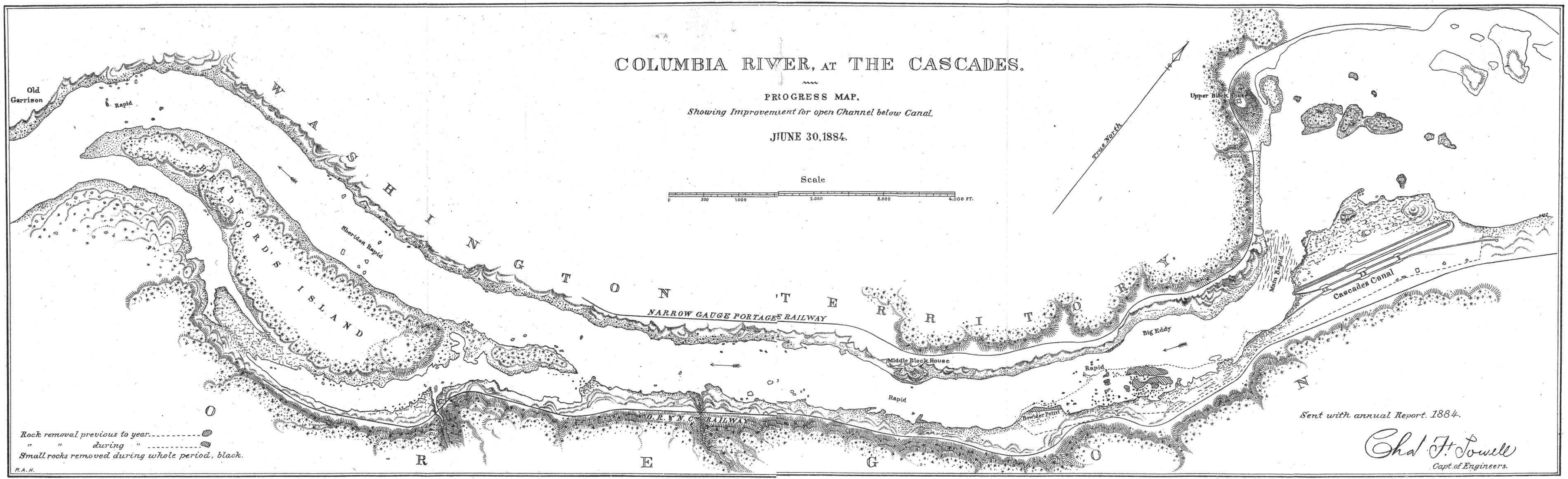
Information on the construction of the railroads in the Gorge was primarily found at the Oregon Historical Society (OHS) in Portland, and in the Division of Special Collections and University Archives at the University of Oregon. The rich amount of materials at OHS necessitated many trips to their archive: for instance, it holds the manuscript papers of historian Frank Gill as well as the manuscript records of the Union Pacific Railroad Company, which fortunately contained abundant financial ledger-books and construction records for both the OSNC and OR&NC. Letters, diaries, and a manuscript copy of an autobiography found in the John

Ainsworth collection at the University of Oregon were also useful in understanding the history of the Gorge railroads.

Early military records on the Gorge were accessed in the National Archives in Washington, DC. The Records of the Office of the Chief of Engineers became a significant primary source for this work. The letters, diaries, and reports made to superiors by Lt. George Derby were well documented and useful in their landscape and project descriptions (and for their maps).

Research on the Cascade canal and lock was exhaustive. A collection of all documents presented to the United States Congress, called a *Serial Set*, was consulted in the Oregon State University Special Collections. Using an on-line finding aid, I searched, found and photocopied all resolutions and reports made to Congress from 1850 to 1900 on the construction of the canal and lock at the Cascades. Similarly, the *Annual Reports of the Chief of Engineers* were consulted during a three-day trip to the Portland Office of the Army Corps of Engineers. Using the paper index at the back of each report (since no computerized finding aid was available), I searched for the 'Cascade Rapids' and/or 'Canals- Cascade Rapids' for all reports made from 1850 to 1900. Photocopies and notes were taken on each report, giving special attention to information on excavation, fill, dredging, and other landscape manipulations. These materials were exhaustively plumbed for my research.

Additional information was gathered from published diaries available at academic libraries in the Pacific Northwest, the General Land Office records on file at the Portland Office of the Bureau of Land Management, and photographic albums at the Oregon State Archives in Salem.


COLUMBIA RIVER, AT THE CASCADES.
PROGRESS MAP,
Showing Improvement for open Channel below Canal.
JUNE 30, 1884.
Scale
0 500 1,000 2,000 3,000 4,000 FT.
True North
WASHINGTON TERRITORY.
OREGON
Old Garrison
Rapid
BRADFORD'S ISLAND
Sheridan Rapid
NARROW GAUGE PORTAGE RAILWAY
Middle Block House
Upper Block House
Main Rapid
Cascades Canal
Big Eddy
Rapid
Bowlder Point
O.R.& N.Co. RAILWAY
Rock removal previous to year
" " during "
Small rocks removed during whole period, black.
R.A.H.
Sent with annual Report. 1884.
Chas F. Powell
Capt. of Engineers.

48 2 CH ENG