THE DEVELOPMENT OF LANDSCAPE DESIGN PRINCIPLES BASED UPON ECOSYSTEM AESTHETICS, AND THEIR APPLICATION IN REHABILITATING DIABLO LAKE OVERLOOK, ROSS LAKE NATIONAL RECREATION AREA, WASHINGTON

By

TRACI MICHELLE DEGERMAN

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the thesis of TRACI MICHELLE DEGERMAN find it satisfactory and recommend that it be accepted.

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Chair

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WASHINGTON.

Abstract

By Traci Michelle Degerman, M.S.
Washington State University
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Chair: William G. Hendrix

As development consumes more land once occupied by natural ecosystems, there is an increasing need for design professionals possessing the knowledge, skill and desire to imbue their works with properties of nature. No longer simply a matter of reduced aesthetic quality and social disconnect from the natural world, the disruption of ecosystem processes by development is accelerating the pace at which the environment is losing its ability to cope with the byproducts of modern civilization: pollution, resource depletion and loss of biodiversity. Ecologically based design offers a promising means for reconnecting humanity with nature's processes. The structure of natural ecosystems and their biotic communities provides a template for ecological design which can be utilized for both new developments and the rehabilitation of degraded sites. *Ecosystem aesthetics* is a set of design principles and practices for creating self-sufficient landscapes

similar in physical structure and species composition to regionally proximate natural vegetation communities. Benefits of this design ethic include the maintenance of biodiversity, the resurrection or perpetuation of ecosystem processes on developed sites, amelioration of the negative visual impacts of development, and a heightened appreciation for the beauty of natural ecosystems and the essential services they provide.

Landscape architects must be both empathetic to the needs and desires of their clientele, and aware of the site's ecological elements and cultural history. Educating oneself in the local biological and social vernacular will aid in the design process and result in a plan that celebrates the region's unique character. This project employs the *ecosystem aesthetic* design principles to create a landscape at Diablo Lake Overlook that will give the public a glimpse of the natural beauty beyond the highway corridor, and return some ecological function to this severely degraded site. Surmountable challenges to the rehabilitation of Diablo Lake Overlook include cost and the availability of materials called for in the design. Long-term management objectives for this site must account for successional change in the vegetation component at the overlook, and determine the appropriate response that will protect both the resource and the quality of the visitor experience.

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Dedication

This thesis is dedicated to my husband, Eric, for his unwavering support, encouragement, patience and love.

INTRODUCTION

The benefits of the ecological view seem patent to me, but equally clear are the profound changes which espousal of this view will effect.[1]
Ian McHarg

On a clear day, the view is stunning: imperious, rocky crests joined by lushly forested slopes cradling a deep valley filled with turquoise water. This was not what I saw during my second visit to Diablo Lake Overlook. My view on that blustery afternoon consisted of a broad expanse of asphalt, a few scattered cars, several vegetated areas rank with invasive plant species, some wind-writhen trees, and a couple of geological displays being pondered by wet, huddled tourists buffeted by blowing rain and mist.

It was a perfect day for a site evaluation, which was my purpose for being there. Undistracted by the surrounding, cloud-obscured grandeur, I was able to focus on the human landscape close at hand. Despite its location along one of Washington's premier scenic highways, and its status as one of the most highly visited sites in the North Cascades National Park Service Complex, Diablo Lake Overlook is a rather bleak place. I was offered the opportunity to making it more inviting, so those not fortunate to be there on a clear day would leave with at least some pleasant memory of their visit. As part of that process, I set for myself the goal of making it ecologically functional as well.

As the world becomes increasingly paved, built-upon and artificial, so grows the need for places that provide people a connection with nature, whether it is in their own backyard, or at a remote National Recreation Area. As areas that can truly be described as "natural" disappear, replaced by constructed landscapes, so grows the need for

[1] McHarg, 1992, p. 197

professionals in the development industry to possess the knowledge, skill and desire to imbue their works with the properties of nature. It is not simply a matter of aesthetics any longer. The destruction of natural ecosystems, with their inherent restorative, cleansing and balancing processes, is accelerating the pace at which our environment is losing its ability to cope with the byproducts of modern civilization: pollution, resource depletion, loss of biodiversity. Incorporating ecosystem features and processes in the design of human landscapes is one of the better alternatives available for reversing this trend.[2]

[2] Van der Ryn and Cowan, 1996; Orr, 2002

PART ONE

DEVELOPING A SET OF WORKING PRINCIPLES FOR ECOLOGICALLY BASED, AESTHETIC LANDSCAPE DESIGN

The Foundation: Properties of Natural Ecosystems

A simple term describing an entity of often extraordinary intricacy and complexity, *ecosystem* refers to a conglomeration of interacting organisms and their abiotic environment.[3] Scale and origin are variable in the designation of ecosystems; the digestive tract of a mouse and the Columbia River estuary represent ecosystems of widely divergent proportions. A backyard pond and a subalpine tarn are ecosystems with a number of shared traits, but the former is a human construct, and the latter develops via natural processes. *Natural*. Can this term still be applied to anything in the 21st century, given the spread of human development to nearly every region of the earth, and the ubiquitous effects of our resource consumption and waste disposal? In the discussion that follows, *natural* refers to anything existing largely outside the realm of direct human influence, global pollution effects aside. In natural ecosystems, the cycling of energy and matter, the makeup of communities, and the pace and course of succession are governed by climate, geochemical and physical aspects, and the interactions of organisms functioning solely upon inputs of solar energy and available organic and inorganic nutrients. Natural ecosystems have many intrinsic properties ascribed to them; the following are those most relevant to developing ecologically based landscape design principles.

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[3] Chapin III, Matson and Mooney, 2002

Vegetation associations

Vegetation associations or zones are a broad classification system based upon the dominant *overstory* (the tallest plants forming the uppermost canopy layer) and *understory* (the shorter plants comprising lower canopy layers) plant species occurring in a particular region. They are greatly influenced by climate and geographic position; each type is indicative of a particular set of climate variables – e.g. seasonal temperature regimes and annual precipitation patterns and amounts – and soil types.[4]

Communities

Ecosystems may be dissected into communities of various organisms adapted to prevailing physical and climatic factors of a particular area or microsite. Within a survivable tolerance range of environmental conditions – their ecological amplitude – species of animals, plants, fungi and microorganisms carry out their roles as consumers, producers and decomposers in the community's resource economy: the cycling of water, carbon, nitrogen and other substances essential to life.[5] Segregating communities into the narrowing classifications of kingdom, order and species reveals a complex web of interrelations between and within these categories. Such relationships can be characterized as predatory, parasitic, competitive or mutualistic, and they influence which organisms are predominant in a community and those present to a lesser extent, if at all.

Diversity

Occurring in myriad forms, diversity confers to ecosystems their biological richness, brings both stability and changeability, and creates visual interest. Diversity in the physical appearance of organisms, particularly those of shared habitats, contributes to

[4] Franklin and Dyrness, 1988; Daubenmire, 1970
[5] Mack, 2005

the aesthetic appeal of natural ecosystems. Biodiversity refers to variation in life forms, species, and the habitats that support them; ecosystems contain a multitude of habitats and niches, each exploited by its own contingent of specifically adapted organisms. Variability within and between communities of organisms plays a role in the perpetuation of ecosystems. Physiological and morphological diversity among functionally similar species – those that utilize the same resources – has a stabilizing influence on ecosystem processes that otherwise would be altered under changing environmental conditions. If a particular species is eliminated through a disturbance such as disease or pest outbreak, for example, other species that were onetime competitors for resources will increase in prevalence to fill the void.[6] Intraspecies diversity is an important factor in maintaining the fitness and resiliency of populations of individual species. According to Rochefort and Peterson (2001),

> *Long-term species survival may rely on both among- and within-population diversity. Diversity among populations, such as ecotypes in different habitats, enables species to respond to changing environmental conditions through time. …Diversity within populations enables specific populations to persist based on adaptive differences among individuals.*[7]

<u>Temporal variation</u>

This ecosystem property involves more than the annual cycle of seasonal variation. The dynamic equilibrium of natural ecosystems, swayed by fluctuations in climate and nutrient availability and shifted through disturbance events, results in an ever-changing cast of floral and faunal characters through a slow but somewhat predictable process called succession.[8] Succession has been defined as "a directional

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[6] Chapin III, Stuart and Mooney, 2002
[7] Rochefort and Peterson, 2001, p. 180
[8] Fitter and Hay, 1987; White and Jentsch, 2004

change in ecosystem structure and functioning resulting from biotically driven changes in resource supply."[9] There are two categories – primary and secondary – which refer to the state of the landscape at the time succession begins. Primary succession occurs on sites lacking pre-existing organic matter, secondary where vegetation once existed but was removed by disturbance. Although the effects may take years to become apparent, successional change must be considered in the landscape design process. Practitioners in ecological restoration are well aware of this and realize their activities constitute a jump-start of secondary succession.

Another driver of temporal variation – global climate change – has garnered attention and concern regarding the influence it exerts on ecosystems. Its effects are most noticeable in ecosystems where plants are at the limits of their existence, e.g., in sub-Arctic and alpine regions, and along the boundary – called the *ecotone* – between two distinct ecosystem types. The elevational advance of treelines in mountainous regions is but one of the known examples.[10] A long-documented phenomenon in both western North America and Europe, forest encroachment is widely but not universally believed to be the result of global climate warming accelerated by 20th century industrial emissions. Occasionally, such plant community displacement places land managers in a dilemma of whether to intervene to preserve scenic views that draw tourists. Mount Rainier National Park, famous for breathtaking wildflower displays in its subalpine meadows, is losing those meadows to encroaching tree stands.[11] The implication for landscape architects is that no design should be considered permanent; all potential long-term fates for a particular site should be considered in the planning process.

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[9] Chapin III, Matson and Mooney, 2002, p. 285
[10] Rochefort, et al., 1994; Zolbrod and Peterson, 1999
[11] Rochefort and Peterson, 1996

Distinguishable patterns of species assembly

Ecosystem ecology includes one phenomenon that remains poorly explained and a subject of study and debate: *ecosystem assembly rules*. An awareness of this esoteric concept is essential to understanding why natural ecosystems may appear and function as they do. Ecosystems and their component communities are not assemblages of species thrown together at random; rather, they are organisms that coevolved to succeed in a particular environment to the exclusion of other organisms, sometimes even those of the same species. This is widely understood, even by non-scientists (whether all accept it as fact is another matter). What remain unclear are the driving factors behind the formation of particular species assemblages found in different environments. The following is how Temperton, *et al*., describe the premise of ecosystem assembly rules:

> *…if only certain species can establish and survive in any given area, and if species tend to occur in recognizable and repeatable combinations or temporal sequences, then maybe we can identify a set of rules governing the assembly of ecosystems and communities*.[12]

The prospect of identifying the means by which species assemblages come about has implications for the landscape design process introduced in a subsequent section. If it can be determined that unique natural ecosystems develop due to the presence or absence of a particular soil element, for example, or the symbiotic relationship between a particular set of organisms, or competition between particular species, that knowledge can be utilized to recreate those ecosystems elsewhere.

Aesthetic value

This is a property of natural ecosystems seldom addressed in scientific literature, even though it may provide the guiding inspiration for many who choose a career in the

[12] Temperton, et al., 2004, p. 1

life sciences. The inherent beauty of the natural world arises from its seemingly contradictory elements of diversity, structure, consistency and propensity for change. The most extravagant flower garden of human design cannot compete with a subalpine meadow in full bloom in the measure of delight and awe experienced by the viewer. This may reflect a cultivated bias toward nature over the constructs of humanity, but more likely it reveals an innate perception – even in the most environmentally naive among us – that when compared with natural ecosystems, traditionally designed landscapes are less unique, less functional, and less alive.

The Framework: Basic Landscape Design Principles

Humans have altered the landscapes in which they live for ages predating recorded history.[13] Whether the intent was cultivation of food, acquisition of water, defense of the village or for spiritual ceremony, even the earliest landscape "designers" likely formulated a plan of some sort to follow in shaping the earth to meet their needs and desires. As we have discovered through archaeological remnants of early civilizations, these ancient works contain the same elements of design taught to students of landscape architecture today: aesthetic organization, form composition, and spatial composition.[14] Form composition considers the two-dimensional planes – the lines and edges of a design – while spatial composition explores the three-dimensional areas – outdoor rooms, in effect – created by the design. Aesthetic organization is considered paramount of the three elements and is the first taken into consideration in the design

[13] Rogers, 2001; Antrop, 2005
[14] Booth and Hiss, 2005

process, for it covers the three basic principles of design – *order, unity, rhythm* – defined by Ching (1996) as follows:[15]

> *Order: A condition of logical, harmonious, or comprehensible arrangement in which each element of a group is properly disposed with reference to other elements and to its purpose.*
>
> *Unity: The state or quality of being combined into one, as the ordering of elements in an artistic work that constitutes a harmonious whole or promotes a singleness of effect.*
>
> *Rhythm: Movement characterized by a patterned repetition or alternation of formal elements or motifs in the same or modified form.*

The principle of order is applied in a landscape design though the placement of elements (plants, objects, structures) in groupings either symmetrical or asymmetrical in form. To achieve order, design elements should always be massed, not scattered randomly about. Unity in the landscape is established through the inclusion of elements varying in the dominance of their profile or presence, through the repetition of certain elements throughout the landscape, and through interconnection of the elements via physical proximity or visual cues. Consideration of how the elements flow through time and space – meaning how they are experienced by the visitor passing through the landscape – brings a sense of rhythm to the design. In this sense, each area of the landscape is part of a sequential composition, created through both the alternation and repetition of particular elements, and a subtle gradation between distinct spaces within the landscape.

All three principles of what we consider "design" are inherently present in natural ecosystems. Order, aggregation, variances in dominance, repetitiveness, interconnectedness, flows and gradients emerge in nature through the influences of climate, geochemical resource availability, physical features of the land, inter- and intra-

[15] Ching, 1996, pp. 381-383

specific relationships, and perhaps other factors (i.e. community assembly rules) not yet understood. In nature, landscape elements have a singular reason for being: they serve some function in processes that maintain the health of the ecosystem. Therein lays the fundamental difference between natural landscapes and the vast majority of those designed to serve human needs.

Consequences of Design Disconnected from Nature

> *We need to acquire the skills to effectively interweave human and natural design. The designed mess we have made of our neighborhoods, cities, and ecosystems owes much to the lack of a coherent philosophy, vision and practice of design that is grounded in a rich understanding of ecology.*[16]

When land is cleared of its natural components – a typical practice during conventional development – it loses its ecosystem processes and its identity. Scoured, reshaped, compacted and covered by impermeable surfaces, the earth is cut off from the environment. Precipitation that once replenished the ecosystem and facilitated its biological processes now must be collected and directed into gutters, ditches, culverts, pipes and channels. It carries with it the residue of contemporary human life, a cocktail of synthetic chemical pollutants and eroded soil.[17] Traditional landscaping installed to soften the hard edge of conventional development does not replace in structure and process the natural ecosystem once present on a site; rather, it often contributes to further decline in the health of the environment, requiring copious additions of water, chemical fertilizers and pesticides, and generating excess biomass that must be removed from the

[16] Van der Ryn and Cowan, 1996, p. 17-18
[17] Ferguson, 1998

site to maintain its desired appearance.[18] The appearance of such landscapes often is standardized and foreign, bearing none of the unique physical and biological characteristics of the region, providing little connection to nature aside from the sense of open space.

Healing the Dichotomy between Human-Centered and Ecologically Based Design

> *If he is perceptive to the processes of nature, to materials and forms, his creations will be appropriate to the place; they will satisfy the needs of social process and shelter, be expressive and endure.*[19]

Nearly all the landscapes created by humanity share two interrelated traits: they were designed with little or no regard for local ecology, and they require continuous upkeep to maintain their intended appearance and function. Among the factors underlying the historic dominance of anthropocentric principles in landscape design are:[20]

- Religious tenets interpreted to mean that Earth and its resources were created for humans to use as they see fit.
- Widespread conviction that natural landscapes are wastelands to be tamed and made “productive.”
- Hubris over the superiority of human technological achievements.
- Desire for rapid development to meet burgeoning human needs.

[18] Thompson and Sorvig, 2000
[19] McHarg, 1992, p. 29
[20] McHarg, 1992; Orr, 2002; McDonough and Braungart, 2002

Disconnecting human developments from the earth's processes had ramifications that have been evident since the early decades of the twentieth century[21], but only recently has there been broad, international public and official acknowledgement of the severity of the problems and the urgent need for change. According to ecologists, social scientists, and others who have studied these issues, three significant obstacles impede the path to reconciliation between modern human society and the natural environment: 1) commercial, political and public resistance to capital investment in new, ecologically sustainable industrial and development practices and the perceived higher costs of products and services that would result; 2) unwillingness to adopt behavioral changes that are believed to entail personal sacrifice and a reduction in standard of living; 3) apathy and paralysis resulting from the fear that it is already too late to reverse deleterious impacts we have had on the earth's environment.[22] One common thread connecting these quandaries is a widely held conviction that ecologically friendly practices are prohibitively costly, produce aesthetically and experientially inferior outcomes, and are too inconsequential to do much good – an assumption based in ignorance about the workings of ecosystems, gross undervaluation of the services they provide, and unwavering faith in the power of technology to deliver salvation from impending world crises.

Approaches currently favored in efforts to reduce or reverse environmental degradation are government regulation, financial enticements, public awareness campaigns and societal pressure. Each has delivered mixed or limited results and comes with significant drawbacks. Government mandates have proven to be the most successful

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[21] Leopold, 1966; Rogers, 2001

[22] McDonough and Braungart, 2002; Orr, 2002; Oskamp, 2000

approach to date, but they engender hostility and resentment among many, not only towards the enforcement agencies, but also toward the very concept of environmentalism itself. Financial incentive programs established to encourage ecologically benign or beneficial practices have proven ineffective when universal participation is not required, and they send the message that environmental stewardship is an inconvenience that merits monetary compensation. Public education efforts on the part of environmental organizations, government agencies and schools to raise awareness of the issues have increased citizen involvement in basic activities such as recycling and using mass transit, but they have unintentionally engendered in many people a sense of helplessness, a fatalistic view that such efforts constitute too little, too late. Movement of the mainstream populace – particularly in the United States – toward an environmentally sustainable lifestyle has been slowed by an erroneous association with sub-modern living conditions and material asceticism, connotations inadvertently supported by the physical appearance and aura of martyrdom assumed by some sustainability adherents. Societal pressure meant to encourage lifestyle change is counterproductive when those applying it are viewed as members of a slovenly, superciliously pious counterculture. Multiple studies on environmental ethics have shown that when reasonable people are led to believe making environmentally responsible lifestyle choices constitutes a step backward from modernity and resignation to a lesser quality of life, they will avoid such choices until there are no other.[23]

Two promising tactics for encouraging the acceptance and adoption of ecologically benign and beneficial practices have been proffered, one by a psychologist, the other an environmental scientist. University of Michigan psychology professor

[23] Oskamp, 2000; Orr, 2002; Wenz, 2001

Stephan Kaplan, in his 2000 article *Human Nature and Environmentally Responsible Behavior*, described an approach that offers people "multiply desirable choices." These ecologically sound alternatives would be developed through proactive collaboration among citizens and experts in many fields, a process that will help people understand that they are sacrificing nothing in terms of living standards, and contributing to a healthier environment for future generations.[24] Eldon Franz, environmental science professor at Washington State University (now retired), described in a 2001 article titled *Ecology, Values and Policy* the great need for a shift in humanity's self-perception of being separate from the environment to being engaged participitants in its natural processes. He coined the term "vivantry responsibility" – derived from the widely known phrase *fiduciary responsibility* – to describe "the human obligation to the living systems of the earth."[25] A marriage of these two concepts – *vivantry responsibility* and *multiply desirable choices* – provides pathway for developing acceptable, ecologically based design principles applicable to any field, including landscape design.

Defining *Ecosystem Aesthetics*, its Design Principles, Applications and Benefits

> *…aesthetics will prompt a gardener to take decent care of the land, but aesthetics untethered from nature are notoriously subjective.*[26]

Origins of the concept

Despite the increasing public interest in sustainability and native plant landscaping, as well as the growing number of landscape designers specializing in a more

[24] Kaplan, 2000
[25] Franz, 2001, p. 473
[26] Freyfogle, 2004, p.1001

naturalistic style, there has yet to be a widespread shift away from the traditional, ubiquitous lawn/foundation shrubbery combination, even in newly developed communities. Possible reasons for its failure to gain widespread acceptance include misconceptions about the effort involved in installing naturalistic, self-sustaining landscapes, lack of understanding about the myriad benefits they provide, and a dearth of professionals with the ecological education that would enable them to understand and incorporate ecosystem properties into their designs.[27] There is a need for reference materials and guidelines that eliminate the uncertainty and confusion over what qualifies as good ecological design and how to do it. Some general guiding principles for ecologically based design already have been defined. In their book *Ecological Design*, Sim Van Der Ryn and Stuart Cowan (1996) describe the following design tenets:

> *Solutions Grow from Place*
> *Ecological design begins with the intimate knowledge of a particular place. Therefore, it is small-scale and direct, responsive to both local conditions and local people. If we are sensitive to the nuances of place, we can inhabit without destroying.*
>
> *Ecological Accounting Informs Design*
> *Trace the environmental impacts of existing or proposed designs. Use this information to determine the most ecologically sound design possibility.*
>
> *Design with Nature*
> *By working with living processes, we respect the needs of all species while meeting our own. Engaging in processes that regenerate rather than deplete, we become more alive.*
>
> *Everyone is a Designer*
> *Listen to every voice in the design process. No one is participant only or designer only: everyone is a participant-designer. Honor the special knowledge that each person brings. As people work together to heal their places, they also heal themselves.*

[27] Calkins, 2005; Rodiek, 2006

Make Nature Visible

De-natured environments ignore our need and our potential for learning. Making natural processes and cycles visible brings the designed environment back to life. Effective design helps inform us of our place within nature.[28]

By combining such ecological design principles with the voluminous data collected on the natural ecosystems of different regions, and condensing this mélange into practical guidelines, it may be possible to create reference manuals that can be used by land planners and developers, landscape architects, and homeowners seeking attractive, sustainable alternatives to traditional landscaping. To ensure the long-term health and functionality of these simulated natural ecosystems, the manuals should include comprehensive species lists for various community types, provide templates for the spatial arrangement of landscape elements and species, discuss soil types and moisture requirements, and incorporate the basic and easily replicable properties of natural ecosystems. A design practice founded upon such information may be best-defined by the term *ecosystem aesthetics*, signifying the dual emphasis on both natural function and beauty. Below is a description of this concept, its principles, practical applications and distinctions from other forms of sustainable landscaping.

Definition

Ecosystem aesthetics is the integration of vegetation associations, community structure, diversity, natural landforms, temporal variation trends, and the species assembly patterns of regionally proximate natural ecosystems in the design of ornamental landscapes comprised of native plant species.

[28] Van Der Ryn and Cowan, 1996, pages 57-161.

Principles and practices

- Vegetation associations and community types should be chosen that require little, if any, supplemental irrigation in the prevailing climate at the planting site. Water-intensive areas such as ponds and wetlands should be limited in size and situated such that the adjacent physical features aid in minimizing moisture loss through evaporation or runoff.
- Delineate and appropriately utilize microclimatic zones within the project site, thereby creating variation in community types based on differences in resource availability and physical site conditions similar to those that occur in natural ecosystems.[29]
- Include all commercially available native species that occur in the reference ecosystem. In the event that particular species from the reference ecosystem are not available, substitution with similar species of the same genus and habitat requirements native to a homologous climate zone outside the region is permissible, provided that the substitute species have been confirmed to be non-invasive, and the planting site is not subject to regulatory restrictions against such substitution (e.g. the National Park Service's restoration guidelines[30]).
- Whole plants should never be removed from the wild for transplanting, unless the site from which they are taken is slated for development, timber harvest or mining operations. Seeds and cuttings may be collected from natural ecosystems for propagation, provided that permission is obtained from the landowner or management agency, and sustainable collection practices are followed.

[29] Kruckeberg, 1996
[30] Rochefort and Gibbons, 1992

- Spatially arrange vegetation associations and species in the design according to assembly patterns observed in natural reference communities. The arrangements may be aligned to accentuate structural landscape elements, to frame a view, or to create distinct spaces within the landscape.
- Take into account the mature sizes of the included species during the design process and leave adequate space around structures and walkways.
- Avoid pruning whenever possible, except where necessary to protect structural elements; native plants should be allowed to assume their natural growth forms and sizes.
- Ground plane hardscapes – e.g. walkways, patios and plazas – should be constructed of semi-permeable to permeable materials to permit stormwater infiltration and minimize runoff.[31]
- Rocks and boulders found on the planting site should be used in the design or re-buried in the landscape.
- Any imported rock, soil and other substrate material should be similar in type and structural consistency to that of the community's native range and habitat. Consult vegetation association literature to determine the appropriate soil consistency for a particular community type.
- Drip irrigation should be used to water areas of the landscape that must receive supplemental moisture to satisfy the physiological requirements of a particular plant community. The irrigation system should be timed to deliver the appropriate

[31] Thompson and Sorvig, 2000

amount of moisture for the community type.[32] Consult annual precipitation records for the community's native range to calculate the amount of supplemental irrigation needed at the planting site.

- Physical maintenance of the landscape should be limited to late winter/early spring removal of excess dead plant material, the removal of any non-native plants that invade the landscape, and optional deadheading of some forb species during flowering season to prolong their bloom period. Pruning of shrubs should be limited to the removal of stems that impinge upon access corridors or seating areas. The senescent upper canopy of perennial forb and grass tussocks may be cut back to within 4 to 8-inches above the ground in early spring, depending on the size of the plant.
- A one- to three-inch layer of duff (senescent plant material) should be left in all planted areas to serve as moisture-retaining/weed-discouraging mulch and to provide compost for replenishing soil nutrients.
- Applications of fertilizer should be limited to the time of planting and only if soil conditions warrant it. Native plants do not require supplemental fertilizer once established, and fertilizers encourage the growth of annual weed species.

Applications for the practice of *ecosystem aesthetics*

- Residential, commercial and municipal landscaping.
- Rehabilitation of derelict urban areas and industrial sites.
- Modification of existing developed sites to reduce their ecological impact.
- Educational and interpretative displays in parks and tourism destinations.

[32] Kruckeberg, 1996

- Urban wildlife habitat corridors.

<u>Benefits of ecologically based landscaping</u>

Replacing traditional landscaping with sustainable and native plant landscapes reduces the need for landscape maintenance supplies. This is a significant contribution to the health of the environment, considering the ecological impacts that result from the processes associated with the manufacture, transport and use of such products. These processes include:

- Extraction – via mining or drilling – of the raw materials required to produce herbicides, insecticides, fertilizers, chemical applicators, personal protective equipment (PPE), lawn mowers, edge-trimmers, yard waste disposal containers, etc., and their packaging.
- Transport of the raw materials to the production facility.
- Synthesis of the various landscape maintenance chemicals, applicator equipment and their packaging.
- Packaging, transport and distribution of these products to sale outlets.
- Packaging, transport and disposal of the waste materials generated in the manufacturing processes.
- Transport of the products to their site of use.
- Requisition and transport of gasoline, electricity or other fuels necessary to operate landscape maintenance equipment.
- Packaging and transport of the landscape wastes, empty product packaging, soiled PPE, broken equipment, etc., to a disposal site.

While it can be argued that any type of planted landscape is more ecologically beneficial than pavement or other hardscaping, native plant landscaping provides ecosystem services that traditional ornamental or exotic plant landscapes do not, including:

- Reestablishing natural groundwater recharge patterns, thereby facilitating the infiltration and on-site sequestration of stormwater.
- Provisioning natural roosting/nesting sites and specific food sources utilized by migratory and resident birds.
- Protecting and supporting populations of beneficial insects that elsewhere might be killed through pesticide applications.

Among the many societal benefits of ecologically based landscaping, perhaps the most important are the promotion of a sense of stewardship of nature and the fostering of emotional attachment to natural ecosystems as places of health, peace and beauty. Other social and aesthetics benefits include:

- Serving as a living laboratory and museum for natural history education.
- Heightening awareness of humanity's role in ecosystem processes.
- Promoting greater appreciation for the natural versus the artificial.

Distinctions from other sustainable and native plant landscaping practices

The terms *sustainable* and *naturalistic* have been used for many years to describe alternative landscaping practices that are more aligned with ecological principles than are traditional practices and emphasize efficient use of natural resources. There are established standards for such practices; the Leadership in Energy and Environmental Design (LEED™) certification program, established by the U.S. Green Building Council, awards points for developments – including constructed landscapes – that achieve specific environmental objectives.[33] The essential distinction between *ecosystem aesthetics* and other environmentally sensitive landscaping practices is its emphasis on the creation of built landscapes modeled after actual natural ecosystems, assemblages of species that evolved together to function as a unit, rather than random species brought together because they have similar physiological needs. In this regard, *ecosystem aesthetics* resembles ecological restoration, but it also is very distinct from that field for reasons explained below.

A Critical Difference between *Ecosystem Aesthetics* and Ecological Restoration

> *Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.*[34]

Ecological restoration describes a process through which whole, functioning ecosystems are re-created. The resulting landscape should to the greatest extent possible resemble – in biodiversity, species composition, geochemical processes, and structure – the natural reference ecosystem it is modeled after, *and* have the capacity to sustain itself indefinitely.[35] A project with any lesser goal than that falls under another of the headings listed in Table 1. Ecosystem-based landscape design, the intent of which is to mimic as well as possible the appearance and composition of a specific natural ecosystem, does not go to the great lengths required to achieve ecological restoration and is accurately described as rehabilitation or renewal.

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[33] Thompson and Sorvig, 2000
[34] Society for Ecological Restoration International Science and Policy Working Group, 2004
[35] Hobbs and Harris, 2001; Higgs, 1997

Restoration	Reconstruction of a prior ecosystem, including reestablishment of former function, characteristic species, communities and structure.
Rehabilitation	Reintroduction of certain ecosystem functions. Tends to make landscape more "natural" but does not necessarily result in a significant increase in biodiversity.
Reclamation	Attempts to increase the presence of a resource, i.e. water, soil and biodiversity, often on highly disturbed sites such as surface mines. Does not necessarily establish prior ecosystem structure or function, nor contribute to wildlife habitat and protection of threatened and endangered species.
Renewal	Enhancement of certain functions and/or resources, often in urban settings. Attempts to marginally increase biodiversity.
Remediation	Improvement of a resource by counteracting or removing a deleterious agent or material. Attempts to protect offsite resources. Does not attempt to significantly increase on-site biodiversity.
Revegetation	Reestablishment of vegetation.
Reintroduction	Return of a plant or animal species formerly occurring in an ecosystem.

Table 1 Common terminology used by professionals in ecological restoration, civil engineering, resource management and landscape architecture.[36]

Essential References for Developing Ecologically Based Design Principles

As plants require water, light and soil nutrients to germinate and grow, so must ideas have a resource base from which to draw inspiration for their development. The field of ecological design provides fertile ground for restoring the connection between humankind and nature. Its depth and richness arise from the myriad aspects involved: ecology, geomorphology, climate, biochemical cycling, plant ecophysiology, succession, diversity, ecological and societal functionality, aesthetics, basic design principles, culture psychology and ethics. To ignore any of these factors is to invite the failure of a particular concept to produce ecologically or socially acceptable outcomes; this is especially true in the endeavor of landscape design for public spaces. The following publications were the most influential in inspiring and informing the development of the *ecosystem aesthetics* design ethic.

[36] Source: Craig Benson, restoration ecologist, Schaaf and Wheeler Consulting Civil Engineers. Adapted from his e-mail posting to an online forum operated by the Society for Ecological Restoration International.

Ecology and ecosystem function

An excellent and thorough review of ecosystem structure and function – including biogeochemical cycling and climatic processes – *Principles of Terrestrial Ecosystem Ecology* (Chapin III, Matson and Mooney, 2002) presents a voluminous quantity of information in an approachable manner. The topic of community assembly rules receives an equally detailed examination in *Assembly Rules and Restoration Ecology* (Temperton, et al., 2004). Landscape and community ecology – essential elements of ecologically based design – are the focus of two influential references for this project: *Land Mosaics: the Ecology of Landscapes and Regions* (Forman, 1995), and *Community Ecology: the Web of Life* (Mack, 2005).

Natural history of the Pacific Northwest and North Cascades region

The native plant communities of the Pacific Northwest comprise a rich palette for landscape architects, but one must be able to identify individual species and have knowledge of their habitat requirements in order to properly utilize them. The essential native plant reference for this region is *Flora of the Pacific Northwest* (Hitchcock and Cronquist, 1973). Plant community stratification patterns discussed in this paper are well-explained in *Vegetation Zones of Oregon and Washington* (Franklin and Dyrness, 1988). Less technical and comprehensive, but still of value as quick references are *Plants of the Pacific Northwest Coast* (Pojar and MacKinnon, 1994), *Field Guide to the Cascades and Olympics* (Whitney and Sandelin, 2003), and *Cascade-Olympic Natural History* (Matthews, 1999).

Ecologically based design

Ian McHarg's eloquent treatise *Design with Nature* (1992) served as the principal motivator and guide in developing the *ecosystem aesthetics* concept. This book, along with *Ecological Design* (Van der Ryn and Cowan, 1996), and *Cradle to Cradle: Remaking the Way We Make Things* (McDonough and Braungart, 2002) should be required reading for every student in the fields of landscape architecture, architecture, interior design, civil engineering, land use planning and product design. The valuable lessons they provide point the way toward an environmentally sustainable society, vastly more livable cities and human endeavors that are in step with nature's processes.

Native plant, sustainable, and naturalistic landscaping

Arthur Kruckeberg's informative and highly readable *Gardening with Native Plants of the Pacific Northwest* (1996) serves the dual purposes of inspiring interest in native plant landscapes and supplying useful guidance in terms of plant selection and placement. The Oregon State University Extension Service offers three pamphlets on sustainable landscapes that have proven useful in the course of this project: *Plant Selection for Sustainable Landscapes* (VanDerZanden and McNeilan, 2002), *Basic Design Concepts for Sustainable Landscapes* (VanDerZanden and McNeilan, 2002), and *Hardscapes for Sustainable Landscapes* (VanDerZanden, 2003). *Landscaping with Nature* (Cox, 1991) provides an introduction to the aesthetic beauty of natural plant communities and the basic means for replicating them.

Landscape construction

J. William Thompson and Kim Sorvig provided a valuable service to landscape architects and contractors with the publication of their book *Sustainable Landscape*

Construction: a Guide to Green Building Outdoors (2000). A descriptive reference for minimizing the impacts of development and comprehensive guide for implementing environmentally beneficial landscaping and building projects, this text provides ample reason for abandoning traditional landscaping and building practices.

Environmental ethics

There is simply no better reference for environmental ethics than *A Sand County Almanac* (1966), Aldo Leopold's collection of prescient essays on the workings and values of natural landscapes. *The Nature of Design* (Orr, 2002) offers sobering examples of how many of societies ills are linked to the dichotomy between humanity and the natural world. Both texts provide the moral foundation for *ecosystem aesthetics* and its design principles.

Human psychology in regards to nature

A tremendous amount of attention has been given to the relationship of people to the environment, their emotional ties to the natural world, and how society's mores and attitudes contribute to both ecological degradation and the subsequent desire to ameliorate it. Four publications that proved particularly helpful in the gestation of the ecosystem aesthetics concept are *Human Nature and Environmentally Responsible Behavior* (Kaplan, 2000), *Conservation and the Lure of the Garden* (Freyfogle, 2004), *A Quantity of Engaging Work to be Done: Ecological Restoration and Morality in a Technological Culture* (Higgs, 1991) and *Ecology, Values, and Policy* (Franz, 2001). Just as it is no longer easy to ignore the environmental impacts of development, it is also no longer expedient to disregard human considerations in the ecological design process — the success of any project will be measured by how well it serves all of its functions and users. The aforementioned articles suggest practical avenues to satisfying both human and environmental needs.

Strategies for minimizing visitor impacts to wilderness: site design and public education

The ongoing struggle to protect natural areas from the deleterious effects of increased visitation has produced a vast body of research into various means for reducing wilderness visitor impacts. Two strategies that have shown promise – and are highly relevant to the design of public spaces – are the use of educational displays and structural landscape elements to influence visitor behavior and attitudes. The former is described in Paul MacLennan's 2000 report *Visitor Information as a Management Tool*, the latter in *Minimizing Conflict between Recreation and Nature* (Cole, 1993). Both are well-written pieces that discuss the strengths and weaknesses of their respective strategies, and offer practical guidelines for utilizing them.

PART TWO

A THEORETICAL APPLICATION OF THE ECOSYSTEM AESTHETIC DESIGN PRINCIPLES: DIABLO LAKE OVERLOOK

Overview of the North Cascades Region

Landscape architects should not only be empathetic to the needs and desires of the end users of their products, but also aware of the site's natural and historical background. Such knowledge is a potent design aid, and making liberal use of it will result in a plan that celebrates the unique character of the region. Educating oneself in a region's biological and social vernacular is a healthy practice for any design endeavor, but when the design is intended for a site within the jurisdiction of the National Park Service, it is imperative.

The physical environment

A landscape of deep, verdant valleys overshadowed by jagged, glacier-flanked peaks, the North Cascades comprise some of the most rugged topography in North America. Extending from the headwaters of the Yakima and Snoqualmie rivers in Washington north to the Fraser River in British Columbia, the region is part of the Cascade mountain chain that bisects the Pacific Northwest from northern California into southern Canada.[37] Its layout, however, departs from the typical north-south alignment that characterizes much of the Cascade Range. A jumble of prominent ridgelines and drainages radiating in every direction, the North Cascades are the product of turbulent geological processes dating back more than 100 million years. The various ridges and peaks consist of a mosaic of strata drawn together from distant regions by the movement

[37] Matthews, 1999

of tectonic plates. These strata, called *terranes*, have through geologic time been added upon, contorted, uplifted, and even overturned through the actions of two major fault lines that dissect the region; there are places where rock of more recent origin has been found buried beneath older material. The volcanic activity normally associated with the Cascade Range did not begin until relatively late in the formation of the North Cascades. Two emergent volcanoes – Mount Baker and Glacier Peak – arose in the westernmost segment of the region and deposited lava and ash on the older granitic substrates, in some places causing them to crystallize into the serrated ridgelines visible today. Mount Baker – its 10,778' summit forming the apex of the North Cascades region - is at c. 30 million years one of the youngest volcanoes in the range and considered one of the most active.[38]

Water has long been a powerful accomplice to plate tectonics and volcanism in shaping the North Cascades. The ridges and peaks snag storm fronts pushed inland from the Pacific Ocean, wringing moisture from them as they rise and cool in crossing the Cascade crest. Precipitation decreases from west to east across the region – the west inundated with much as 160 inches annually, while the east might receive as little as 10 inches.[39] Glaciers formed during ice ages and through millennia's worth of accumulated winter snowpack have scoured the land, forming deep valleys bounded by steep forested slopes and vertiginous mountain walls. Vast elevational differences – 4000' from valley floor to ridge crest is not uncommon – characterize the North Cascades and lend credence to their portrayal as the "American Alps."[40] Five distinct watersheds – the Stehekin, Skagit, Nooksack, Chilliwack (Appendix A, Figure A1, page 64) and Methow – drain the

[38] Tabor and Haugerud, 1999; Whitney and Sandelin, 2003
[39] Tabor and Haugerud, 1999
[40] Louter, 1998

high country, fed by a multitude of named rivers and creeks and innumerable tributary streams and runoff channels.

Plant associations

Diverse topography and climate patterns fostered the development of a variety of plant associations and habitat types in the region. Through a gradient governed by elevational climate regimes and precipitation patterns, plant communities ascend from coastal temperate rainforest to montane forest to subalpine parkland to alpine tundra (Appendix A, Figure A2, page 64). A west-to-east gradient of decreasing precipitation creates the transition from moist forests and meadows to dry open woodlands and shrub-steppe. Interspersed throughout are microclimates influenced by topographic factors including slope and aspect. Any five square mile section within the North Cascades region may host several distinct ecosystems, each with its own floral and faunal communities and species assemblages. Vegetation associations of this region include:[41]

- Lowland forest (0-2500' elevation): Climatic characteristics include high fall/winter/spring precipitation, summer drought, and a moderate, maritime-influenced temperature range. Dominant overstory species are western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*). Less-prevalent overstory constituents include grand fir (*Abies grandis*), Pacific silver fir (*Abies amabilis*), big-leaf maple (*Acer macrophyllum*), black cottonwood *(Populus trichocarpa*) and red alder (*Alnus rubra*). Understory dominants include vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), various wild blueberries and huckleberries (*Vaccinium* spp.), Oregon grape (*Mahonia nervosa*), sword fern (*Polystichium munitum*),

[41] Franklyn and Dyrness, 1988; Whitney and Sandelin, 2003; Hitchcock and Cronquist, 1973

trillium (*Achlys triphylla*), twinflower (*Linnaea borealis*), along with numerous mosses, lichens and fungi. A collection of subsidiary understory plants too numerous to list contributes to the verdant diversity of this zone.

- West side montane forest (2000-5500' elevation): Comprising the middle elevational band on the Cascades' western flanks, this zone is cooler and receives more precipitation – much of it as snow – than the lowland forests. It is subject to deep winter snowpack accumulations that can persist well into summer in ravines and on north-facing slopes. The dominant overstory species in the low- to mid-elevational range are Pacific silver fir, Douglas fir, western white pine (*Pinus monticola*), western red cedar and western hemlock; mountain hemlock (*Tsuga heterophylla*) and Alaska yellow cedar (*Chamaecyparis nootkatensis*) become more prevalent with increasing elevation. Soils in this zone are typically acidic, favoring understory plants of the family Ericaceae: *Gaultheria* and *Vaccinium* spp., Cascade azalea (*Rhododendron albiflorum*), prince's pine (*Chimaphila umbellata*), and wintergreen (*Pyrola* spp.). Other understory dominants are beargrass (*Xerophyllum tenax*), bunchberry (*Cornus canadensis*), queen's cup (*Clintonia uniflora*), and various wild raspberries (*Rubus* spp.). Forest openings created by avalanche chutes are dominated by vine maple, Sitka alder (*Alnus sinuata*) and Sitka willow (*Salix sitchensis*).
- Subalpine parkland (4500-7000' elevation): In the uppermost elevations where tree populations can exist, the overstory dominants are subalpine fir (*Abies lasciocarpa*), mountain hemlock, subalpine larch (*Larix lyallii*), whitebark pine (*Pinus albicaulis*), and Engelmann spruce (*Picea englemannii*). Trees tend to

grow in clumps in this zone (Appendix A, Figure A3, page 64), and exposure to wind and freezing temperatures can reduce their mature size to a stunted, contorted form called *krummholz*. The Cascade's subalpine zone is best known for its understory component: lush herbaceous meadows consisting of lupine (*Lupinus* spp.), paintbrush (*Castelleja* spp.), Sitka valerian (*Valeriana sitchensis*), bistort (*Polygonum bistortoides*), mountain daisies and asters (*Erigeron* and *Aster* spp.), red fescue (*Festuca viridula*), monkeyflowers (*Mimulus* spp.) and various sedges (*Carex* spp.), interspersed with agglomerated populations of low shrubs such as red and yellow mountain heather (*Phyllodoce empetriformis* and *glanduliflora*), Cascade huckleberry (*Vaccinium deliciosum*), Sitka mountain ash (*Sorbus sitchensis*), and subalpine spirea (*Spirea densiflora*).

- Alpine meadow and fellfield (6500-9000' elevation): The uppermost limit of plant life is characterized by low average soil temperatures, rocky and often shallow soils, deep winter snowpack, and year-round exposure to chill, desiccating winds. This zone also supports surprisingly diverse ecosystems dominated by low shrubs such as yellow mountain heather, white and Alaskan mountain heather (*Cassiope mertensiana* and *stelleriana*) and shrubby cinquefoil (*Potentilla fruiticosa*), and small herbaceous species such as partridgefoot (*Luetkea pectinata*), Davidson's penstemon (*Penstemon davidsonii*), spreading phlox (*Phlox diffusa*) and black alpine sedge (*Carex nigricans*). Other floral inhabitants of this harsh environment include common juniper (*Juniperus communis*), yellow monkeyflower (*Mimulus tilingii*), Tolmie saxifrage (*Saxifraga tolmiei*) and moss campion (*Silene acaulis*).

- East side montane forest (2000-4000’): Upper-elevational montane communities east of the Cascade crest are similar to those of mid-elevational west side forests, with grand fir, western red cedar, Douglas fir, and western white pine as dominant overstory species. Overstory co-dominants specific to east-side mid- and lower-elevational forests are western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta* var. *latifolia*), and Ponderosa pine (Pinus ponderosa). With eastward progression and decreasing elevation, the climate becomes drier and warmer; mixed forest gives way to pure stands of Ponderosa pine, followed by mixed Ponderosa pine/shrub associations (Appendix A, Figure A4, page 64). Understory dominants in montane east-side communities include snowberry (*Symphoricarpos albus*), serviceberry (*Amalanchier alnifolia*), birchleaf spirea (*Spirea betulifolia*), creeping Oregon grape (*Mahonia repens*), pine reedgrass (*Calamagrostis rubescens*), and elk sedge (*Carex geyerii*). In mixed pine/shrub communities, bitterbrush (*Purshia tridentata*), buckbrush (*Ceanothus velutinus*), mountain sagebrush (*Artemisia tridentata* var. *vaseyana*), bluebunch wheatgrass (*Pseudoegnaria spicatum*), yarrow (*Achillea millifolium*) and arrowleaf balsamroot (*Balsamorhiza sagittata*) dominate the understory.

The human component: aboriginal residents and European immigrants

What seems by contemporary evaluation a remote, pristine and somewhat forbidding wilderness actually has been home to humans for thousands of years; archeologists have found stone quarries and artifacts dating back 8,000 years in the upper Skagit River valley.[42] Aboriginal tribes of the northern Puget Sound lowlands – including the Lower and Upper Skagit, Suiattle, Sauk, Samish and Swinomish – lived primarily on

[42] Tabor and Haugerud, 1999

the great salmon runs of the Skagit and Nooksack River, but also conducted summer hunting excursions into the high country, seeking mountain goats, bears, elk and beaver.[43] To the east, the Methow, Okanogan, Wenatchee, Kittitas and Yakama peoples made forays of their own into the North Cascades. Tribes on both sides of the range used the cross-mountain route known today as Cascade Pass, and there were trade relations and even intermarriage between these geographically isolated groups.[44] The region held spiritual as well as material significance to its earliest human inhabitants; connections to ecosystem processes and with other living things were sewn into the fabric of their daily lives and cultural traditions.[45]

The first European explorers arrived in the Skagit Valley in the late 1700's; some had made the westward passage through the Columbia River Gorge, then continued north into the Puget lowlands and up to the Skagit basin. Encountering dense vegetation and steep terrain to the east, white settlers initially limited their activities to the river delta and lower valleys, but the mountains beckoned with the promise of a wealth of untapped resources. Fur trappers were the first Europeans to explore the high country, followed by miners, who constructed the first "roads" into the rugged upper Skagit valley. Their treacherous paths – in some places mere catwalks carved by dynamite from the cliffs above the river – enabled further exploration and led to the exploitation of new resources. Logging operations began in the upper Skagit in the late 1800's, hydroelectric development in the early 1900's.[46] Each new endeavor improved access to the once-forbidding wilderness, and reports of the region's great beauty soon lured a new type of

[43] Weisberg, et al., 1993
[44] Collins, 1974; Ruby and Brown, 1986
[45] Van der Ryn and Cowan, 1996
[46] Weisberg, et al., 1993

explorer to the North Cascades – one with different ideas about managing wild, scenic places.

Land management history

The drive to create a wilderness park in the North Cascades began in 1892, fueled by concern over development wreaking further damage to the magnificent scenery people had come to value. A citizen group's proposal to designate the Lake Chelan region as national park initiated a 76-year conflict that pitted neighbor against neighbor, citizens against industry, recreationists against preservationists, and the U.S. Forest Service (USFS) against the National Park Service (NPS). Decades of public pressure, political wrangling, agency compromise and industry appeasement finally produced on October 2, 1968 what we now know as the North Cascades National Park Service Complex (Appendix B, Figure B1, page 65). Administered by the NPS, this nearly 700,000-acre management area fulfills both oft-opposed objectives of recreation and wilderness protection. It consists of two geographically separated national park units (totaling 505,000 acres) that preserve the most rugged, remote and pristine areas in the northernmost and central sections of the range, and two national recreation areas – Ross Lake (117,000 acres) and Lake Chelan (62,000 acres) – in predominantly lowland valleys and foothills with historically intensive human use.[47] Bounded on the west, south and east by designated wilderness areas managed by the USFS – Mount Baker, Noisy-Diosbud, Glacier Peak, Lake Chelan-Sawtooth and Pasayten – and on the north by British Columbia's Skagit Valley Recreation Area and Manning Provincial Park, the complex essentially preserves intact the North Cascades bioregion, a unique achievement in an age of fragmented and degraded ecosystems.

[47] Louter, 1998

Completion of the North Cascades Highway

The quest to establish a cross-mountain highway in the North Cascades was an arduous endeavor characterized by sheer determination and unwavering optimism. It predates the battle for wilderness designation, but was not fulfilled until 1972, four years after the creation of the park complex. The earliest European explorers sought out the most easily traversable routes through the steep terrain, often following paths established and long-used by aboriginal tribes. The first of several state-funded expeditions to scout feasible highway routes was initiated in 1895, and culminated with the eventual selection in 1932 of a passageway up the Skagit River Valley to Ruby Creek, following that to Granite Creek, ascending that valley to cross Rainy and Washington passes, and finally descending into the Early Winters Creek valley to the east. The North Cascades Highway –referred to at the time as Washington Route 32, later designated SR 20 – was dedicated on September 2, 1972.[48] It was a spectacular engineering achievement, brought about through the labor of thousands of workers that opened – if only a little bit – a door to this rugged region, offering the average traveler a glimpse of its natural splendor.

The Project Site: Diablo Lake Overlook

Location

Diablo Lake Overlook (Appendix B, Figure B2, page 66) is at milepost 132 on SR 20, twelve miles east of the town of Newhalem, Washington (Appendix B, Figure B1, page 65). Situated on a small plateau at approximately 1,600' above sea level and over 400' above Diablo Lake, the site has a panoramic view of the lake and the surrounding mountains to the south-southwest, west and north-northeast (Appendix B, Figure B3,

[48] Washington State Department of Transportation, 1972

page 66). The east-southeastern view comprises the 7,408' mass of Ruby Mountain, upon the flanks of which the overlook sits.[49] An engineering drawing (Appendix I, Figure I2, page 81) dated November 1970, obtained from the NPS Technical Information Center, illustrates how the highway and overlook plateau were excavated from the existing slope; the depth of this cut can be seen in the cliff wall southeast of the overlook (Appendix C, Figure C1, page 67).[50]

Contemporary site description

Much of DLO is dominated by a large asphalt parking lot (Appendix C, Figure C2, page 67); there are no delineated parking spaces and no directional signage, aside from two arrows painted on the asphalt near the entrance designating the in/out driveways. The entire site is slightly tilted with an aspect of 240° toward a large culvert located at the southwestern end, below the safety railing. The overlook has 180° exposure from the southwest to the northeast. Strong winds are a common – if not daily – occurrence in the upper Skagit River valley, generated by the general temperature disparity between the western and eastern side of the mountains. The prevailing wind direction is from the west, evidenced by the many flagged evergreen trees at the overlook. At the southern end of the site are two small buildings, each housing two composting pit toilets (Appendix C, Figure C3, page 67). Constructed in 2004, these are attractive structures designed in the traditional rustic style used by the NPS. They are aesthetically appropriate for their setting, and the native stone and plants installed around them blend well with the natural landscape, as intended (Appendix C, Figure C4, page 67). Aside from the toilet buildings, there are no shelters or structural windbreaks.

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[49] U.S. Geological Survey, 1963

[50] U.S. Department of Transportation, Federal Highway Administration, Region 8, 1970, p. 22

Thirteen natural history interpretive plaques are posted at regular intervals on the safety railing around the western perimeter of the site. There is also a circular geology display and two large geological information signs toward the west end of the main planting bed (Appendix C, Figure C6, page 68). Two large commemorative signs – one a tribute to Senator Henry M. “Scoop” Jackson, a member of Washington’s Congressional delegation and influential proponent of the park’s establishment – are placed together in the midst of the planting bed at the east end of the site (Appendix C, Figure C8, page 69). There are four flat wooden benches on the site, one at the west end and three at the east end. The naturalized areas of the overlook consist of:

- Three vegetated islands in the parking lot (two small areas at the west end, one large area at the east end, near the entrance driveway).
- A long, narrow planting bed that runs between the parking lot and the walkway along the north-northeast side of the site.
- Three small, separate planting beds within the midst of the large bed described above.
- One large, oblong planting bed in the southwest corner of the overlook.
- The berm between the parking lot and the highway.
- The recently revegetated area surrounding the toilet buildings.
- A large, undeveloped area south of the overlook that is effectively fenced off by the safety railing and the highway guardrail (Appendix C, Figure C9, page 70).

The locations of all existing site elements are displayed in the current site plan (Appendix E, page 73).

Shortcomings of the existing situation

The geographic location of Diablo Lake Overlook, the interpretive signs, the toilet buildings and their adjacent landscaping, the trees, the open plateau to the south and the safety railing protecting it are the site's best assets with its current configuration. The remaining site elements not only epitomize many of the flaws of human-centered design, but also go beyond that by failing to address even some of the most basic human proclivities. In addition, the landscaped areas bear little resemblance to the region's topography and are overrun with non-native plant species, including at least one – common tansy (*Tanacetum vulgare*) – included on the state's noxious weed list. The following is a brief description of the site issues that should be addressed.

- The parking lot is much larger than it needs to be, and its dearth of visual cues for drivers creates a safety hazard for pedestrians, bicyclists and other vehicles. It also constitutes a vast swath of impermeable surface, resulting in stormwater runoff and pollutant deposition downslope from the site.
- The site lacks visitor amenities, such as shelter and adequate seating areas. There are few places to sit and enjoy the view, and no picnic tables. The few benches provided are too small for more than two people to comfortably sit on at a time. The garbage receptacles are unsightly and in some cases poorly located.
- This site has the potential to be an excellent forum for educational displays and interpretive programs to highlight the region's natural and cultural history and enhance visitor's appreciation for its designation as a protected area. The interpretive displays now on site are interesting and informative, but they fail to convey why the region is special and worthy of protection. The North Cascades'

biological diversity and rich history provide ample material for a comprehensive display at the overlook that would not duplicate what is housed in the Newhalem Visitor Center.

- While the location of the overlook provides its visitors a splendid view of the natural scenery around them, it does nothing to draw them into what they are seeing, to tactilely experience what the mountains and meadows offer. They may as well be looking at a panoramic painting on a museum wall. With the exception of the new plantings around the toilets, and the native trees – some of which were planted or have subsequently sprung up in awkward places, as described below – the landscaping at DLO is similar to that of an urban park, with many of the plants no different than those growing in a derelict rural lot.
- The natural tendency for plants to establish wherever conditions are favorable to them has created some problems for the current design. Mature trees have overgrown paths, a bench and an interpretive display, and new trees are emerging immediately adjacent to paved areas (Appendix D, Figure D1, page 71).
- The lack of structural barriers and strong visual cues in the landscape design has permitted the development of social trails, allowed vehicular intrusion in inappropriate places, and contributed to soil compaction in one large planting area on the site (Appendix D, Figure D2, page 72).

Table 2 summarizes the major design flaws of the overlook, their ramifications, and proposed solutions.

Shortcomings of Existing Layout	Undesirable Effects	Proposed Solutions
Oversized asphalt parking lot.	Generates significant stormwater runoff and pollutant flushing to surrounding landscape, potentially as far as Diablo Lake. Visually dominates the landscape at the overlook, detracts from scenery..	Reduce impermeable surface area through the addition of new planting beds. Replace traditional asphalt in remaining parking areas with permeable paving materials. Add natural landforms and vegetation.
Parking lot not striped, no directional signage, no traffic barriers.	Creates potentially hazardous conditions for motorists, cyclists and pedestrians.	Restructure the parking lot, designate parking spaces and zones, direct vehicle/cyclist traffic in a one-way circulation pattern, and install speed bumps at designated crosswalks.
Dearth of site amenities such as shelter, picnic areas, adequate seating.	Visitors may use the existing site in inappropriate ways, such as walking, sitting or picnicking in the vegetated areas, creating social trails and causing soil compaction and loss of vegetative cover.	Add new benches, picnic tables and a shelter building.
Too few interpretive displays.	Missed opportunity for public education about the park's wealth of natural resources and its rich cultural history.	Create new educational displays and features, including "interpretive gardens" that expose visitors to the region's native flora and characteristic landforms.
Derelict appearance of landscaping: the site is overrun with non-native plant species, and trees are growing in places where they impinge upon paths, interpretive signs and benches. Lack of native plants and the uniformity of the terrain.	The site has no visual connection to its surroundings, is urban in character and feel, and does not provide visitors direct interaction with the park's natural features and vegetation. The unkempt appearance may contribute to a lowered public perception of the park's management.	Reintroduce varied landforms and native plants in groupings that reflect the structure of natural communities. Establish short and long term maintenance plans. Schedule site maintenance activities as appropriate to preserve desired features and appearance.

Table 2. Summary of deficient elements at Diablo Lake Overlook and proposed remedial measures.

<u>Essential improvements and new features: the design program</u>

- Redesign the site to represent the region's topography and integrate native vegetation communities. The design should visually emphasize the natural over the artificial through the careful placement of visitor amenities within the landscape.
- Restructure the parking area to reduce its size and ecological/visual impact; delineate parking spaces and specific parking zones – areas reserved for disabled visitors and oversize vehicles – and create safety zones for pedestrians.

- Include landscape elements that provide shelter for visitors as they use the site; these features can be either structural or natural, or a combination of both.
- To the fullest extent possible, make each element of the landscape an educational device for enhancing visitor knowledge of and appreciation for the region. This can be accomplished directly through additional interpretive displays and passively through the use of building materials, structural forms and biotic elements unique to the region.
- Incorporate both private seating areas and spaces for people to congregate, and develop a sheltered, designated picnic area.
- Design the vegetated areas such that they require minimal maintenance once the plants are established.

Description and benefits of the Diablo Lake Overlook rehabilitation design

The proposed rehabilitation design (Appendix F, Figures F1 and F2, pages 74-75) addresses all the shortcomings of the existing DLO site layout using *ecosystem aesthetics* design principles. The primary goals of the design are to reduce the ecological impact of the overlook on the surrounding landscape, reintroduce native vegetation communities to the site, provide for visitor safety, comfort, education and enjoyment, and showcase the natural features and cultural history of the North Cascades region. Significant changes include the restructuring of the parking area, the addition of a building that serves the dual purpose of housing interpretive displays and providing shelter to visitors, new picnic and seating areas, and the expansion of vegetated areas.

The expansive parking lot now covering much of the overlook is the most ecologically and aesthetically detrimental feature of the site, and it also poses perhaps the greatest hazard in terms of visitor safety. Its size and impacts are mitigated in the redesign through the expansion of two vegetated islands in the current layout to form a continuous landscaped area with walking paths and picnic tables. Vehicular traffic within the overlook is directed unambiguously in a counter-clockwise direction, and parking zones and individual spaces are clearly defined. The curvilinear layout of the driveway, the tight radii of its two opposing turns, its narrow width at the three designated crosswalks, and the placement of speed bumps at these crosswalks will act to reduce the speed of vehicles moving through the site. Impermeable surface area is greatly lessened with the expansion of the vegetated space within the parking lot and could be further reduced by substituting porous concrete, gravel paving inserts or other permeable surfacing materials for conventional asphalt in the driveway and parking zones.

Regional landscapes are represented in the rehabilitation design via the installation of topographic features revegetated with native plant communities. These interpretive gardens of replicated rock formations and undulating expanses of native flora are intended to afford visitors the sense of walking through an alpine fellfield, subalpine meadow or montane forest. The vegetated areas also may attract native bird, insect and mammal species to the site, thereby introducing the public to a sample of the region’s fauna as well as flora. Such small, isolated patches of habitat cannot be expected to host fully representative communities of plants or animals, but they will be of significantly greater ecological value than anything currently in place at DLO.

Placement of the replicated plant communities in the rehabilitation design is based partly on localized growing conditions in various areas of the overlook, and partly on what native species are already established on the site. Alpine and subalpine associations are recommended for areas with few or no existing trees, open spaces that will permit the importation of soil, boulders and other materials needed to construct the landforms appropriate for these communities. The wind-blasted western end of the overlook is the designated planting site for low-growing, hardy alpine species that thrive in exposed, rocky habitats, and the slightly more-sheltered central planting bed within the parking lot will host a subalpine meadow community (Appendix G, Figures G1 and G2, pages 76-77). Revegetation with montane species is recommended for areas of the overlook with stands of trees already in place (Appendix G, Figure G3, page 78). As this is the vegetation type that naturally occurs at the elevational zone in which the overlook is situated, these plantings will reconnect the site to the surrounding landscape.

The rehabilitation plan does call for the removal of five coniferous trees at the western end of the overlook, where the new visitor shelter is located. It may seem regrettable to destroy native trees, but the subalpine/alpine landscape and interpretive features installed in their place will have significant aesthetic and educational value. The new plantings will engender public awareness of the diversity of native species and an appreciation for their beauty, as well as potentially stimulate interest in native plants for residential landscaping endeavors. Park resource personnel and data archives will benefit from the information gained in the collection and propagation of seeds and cuttings of plants included in the overlook's revegetation effort. The collectors will need to make note of species assembly patterns in the native seed source communities in order to properly replicate the arrangements in the overlook plantings. They must also collect data on the soil, moisture and exposure conditions favored by each plant. Greenhouse staff will learn through trial and error what methods of propagation work best for each species.

Such information will enhance resource managers' understanding of the resource, what is required for its continuing health and survival, and what the best means are for restoring degraded areas.

Structural elements of the rehabilitation design include a three-sided building to house interpretive displays and shelter visitors from wind and rain. As envisioned in the plan, this shelter will be constructed of wood and stone in a style resembling that of the toilet buildings currently on site. Like the toilet buildings, the shelter's roof will be metal and angled to shed snow away from walkways and other areas where visitors congregate. The rear of the structure will be partially embedded in the landscaped area behind, giving the appearance of it having been built into a hillside. The plantings installed behind the shelter building should be of species that will not be harmed by potentially heavy deposits of snow from the roof, and also will not impinge upon the structure at mature size; the alpine community recommended in the plan is the most appropriate vegetation type for this location. As envisioned in the rehabilitation design, the entire corner of the overlook in which the shelter is located would consist of alpine habitat types, one grading into the next as the ground rises in elevation and increases in ruggedness.

The central planting bed within the parking area envisioned as a subalpine meadow community grades down to montane forest associations in the outer vegetated areas, including the picnic and restroom areas at the southern and north-northwest end of the site, and the berm between the overlook and the highway. No existing trees will be removed from these areas, but some of the soil present on the site must be replaced with a substrate of appropriate consistency and composition for the native community type to be planted there. Removal of the old soil – contaminated as it is with exotic plant species – will reduce the likelihood and intensity of weed reemergence in the new plantings.

Stone walls will enclose the vegetated area adjacent to the interpretive shelter (Figure H, page 79), and the central planting bed in the parking lot island. These will range from two to three feet in height and 18 to 24 inches thick. Low portions of the stone wall can serve as seating, but there also are 11 designated seating areas in the rehabilitation plan, including five long, crescent-shaped benches to accommodate families or groups. Several smaller seating alcoves are distributed along the western and northern perimeter of the overlook, and there are benches located near the toilet buildings. The five picnic tables included in the plan are sheltered within stone-walled alcoves to provide picnickers some protection from the wind. The walls will be at least four feet tall around the picnic tables, and their sheltering effect will be augmented by mounded plantings and tall shrubs. The stone walls called for in the rehabilitation design serve aesthetic, tactile and practical functions. Constructed of native material, they reintroduce a natural element now largely absent from the site, enabling visitors to see and feel the stuff of which the North Cascades are made. They also will discourage people from walking in the planted areas, thereby reducing the deleterious impacts that result from trampling, including the formation of social trails.

All the interpretive signs and displays currently at DLO will be retained, but some will be relocated in the new design. The circular geological display now located where the shelter building and alpine interpretive garden are situated in the new plan will be moved to the southeastern corner of the site, near the toilets. It will be accompanied by an adjacent new display describing the features of the remarkable stone cliff wall across the highway. The natural history plaques currently in place along the overlook's safety railing will remain where they are, and new plaques describing the region's floral and faunal communities will be added throughout the site. The inner walls of the shelter building should be hung with displays detailing the cultural and development history of the Skagit River Valley, emphasizing how aboriginal peoples and early European explorers found sustenance and moved about in this rugged region. There also should be a display that briefly summarizes the conflict preceding the designation of the park complex. Commemorative signs now in place at the overlook will be moved to the area near the interpretive shelter.

The southernmost end of the overlook – the toilet buildings, their adjacent landscaping and the undeveloped plateau beyond them – remains unaltered in the new design. These areas already support native vegetation and, aside from the removal of exotic plants, should be left as they are.

Short- and long-term maintenance of the rehabilitation design following installation

Every landscape requires some type of maintenance; in natural ecosystems, this equates to the annual growth cycles, decompositional processes, and the gradual transformation of communities through succession. These natural maintenance activities also occur to some extent in anthropogenic landscapes, and they sometimes conflict with human aesthetic and functional objectives. Such will continue to be the case at DLO in the absence of a plan and schedule for achieving both short- and long-term administrative goals for the site. Trees are sprouting and establishing themselves in all the unpaved areas of the overlook; at some point in the future, they may obscure the panoramic vista the site offers today if no action is taken to control their growth. Whether or not any rehabilitation design is implemented on the site, Diablo Lake Overlook will still require some level of long-term maintenance to preserve its primary purpose as a scenic viewpoint. Unlike an ecological restoration effort or backcountry revegetation project in which the landscape is subsequently left alone to follow natural successional paths, rehabilitation of a busy front-country site requires ongoing care and oversight to maintain the landscape in the form that best serves its function.

If the rehabilitation plan presented here is installed at DLO, a schedule for upkeep must be established and followed to retain the original intent and appearance of the design. Within the first 3 to 5 years of installation, monthly maintenance will be required during the growing season to eliminate any exotic plants that appear on the site, and to remove tree seedlings that arise in undesirable locations. Over time, as the native species in the planted areas become established and successful competitors for resources, exotic plants should become less of a problem, but native tree recruitment may persist as a maintenance issue for the indefinite future of the site. However, the relatively slow growth rate of trees, as compared with those of herbaceous species[51], may limit the need for tree seedling removal to once every two years. It should be noted that it is not necessary or even desirable to remove all new trees that emerge on the site; tree reestablishment is appropriate within those areas designated in the rehabilitation plan for the montane forest community type, and those where existing vegetation will not be altered at all. Table 3 (page 49) lists maintenance tasks for the plant communities represented in the rehabilitation design over short- and long-term periods. Specific activities are shown for moderate and intensive landscape maintenance regimes.

[51] Fitter and Hay, 1987

	0 to 5 Years Post-installation		5+ Years Post-installation	
Community Type	**Moderate Regime**	**Intensive Regime**	**Moderate Regime**	**Intensive Regime**
Alpine and Subalpine	- Remove exotic species bi-monthly during growing season - Remove emergent trees annually	- Remove exotic species monthly during growing season - Remove emergent trees monthly - Remove and replace dead plants - Add appropriate mulch where needed for soil and moisture retention	- Remove exotic species annually - Remove emergent trees biannually	- Remove exotic species bimonthly during growing season - Remove emergent trees annually - Thin plants annually to prevent overgrowth and overcrowding - Add appropriate mulch where needed
Montane Forest	- Remove exotic species bi-monthly during the growing season	- Remove exotic species monthly during the growing season - Add appropriate mulch where needed for soil and moisture retention	- Remove exotic species annually - Remove excess woody debris biannually - Prune shrubs and trees biannually if they are overgrowing walkways or structures	- Remove exotic species bimonthly during the growing season - Remove excess woody debris annually - Annually prune shrubs and trees that are overgrowing structures or walkways, or remove them entirely and replace with smaller species - Add appropriate mulch where needed

Table 3. Activities entailed in moderate and intensive post-installation landscape maintenance regimes at Diablo Lake Overlook.

Lessons from the past: alternative, unrealized visions for Diablo Lake Overlook

There have been several proposed site configurations for DLO, including four different designs that were not – or only partially – implemented; they are shown in Appendix I. Especially intriguing is a site plan dated February 3, 1966, designed and drawn by R.C. Stevens; this document is stored in the NOCA curatorial facility in Marblemount, Washington (Appendix I, Figure I1, page 80). It is a very naturalistic design consisting of a large, open vegetated space with meandering interpretive paths and site designations for benches and a proposed shelter. There are two parking areas in pullouts on the highway shoulder, with twenty-one 90° automobile spaces and parallel spaces for three autos with trailers. Had this plan been implemented, visitors to the overlook would have had a view of the lake and the peaks untrammeled by parked cars and asphalt. One can only speculate why it was not; it may be that expediency outweighed aesthetics in determining how the overlook eventually was constructed.

CONCLUSION

CHALLENGES INVOLVED IN THE REHABILITATION OF DIABLO LAKE OVERLOOK

The intent of this project is to create a place that gives people a glimpse of the wilderness beyond the highway corridor, while at the same time returning some ecological purpose to a severely degraded site. The landscape that results from this design also must be safe, functional and easy to maintain. Cost is another issue; the NPS rarely receives sufficient funding to address a backlog of maintenance issues, much less to initiate new projects. If the design should ever be implemented, the financing will most likely come from a variety of sources – grants, benefactors, environmental and civic organizations, state and federal government – and in varying amounts over time, not all at once. For this reason, the design plan is structured such that it can be completed in stages, as funding becomes available; this also facilitates the exclusion of any aspects or sections of the plan that NOCA managers deem unfeasible, undesirable or too costly.

Complicating Factors: the Ecological Component

Any restoration, revegetation or rehabilitation work conducted on land managed by the NPS must following certain guidelines and meet specific requirements. Some of the guidelines pertain to the acquisition of materials – everything from structural components to vegetation – to be used in the project. For example, seeds and cuttings used to propagate plants used in restoration projects must be collected from within the close vicinity of the project site; this practice maintains the genetic integrity of local populations.[52] Because the project described here is a *rehabilitation* rather than *restoration* effort, and includes interpretive plantings to represent communities found outside of the highway corridor, there may be greater leeway in selecting source communities for the DLO plantings. The rehabilitation design calls for the inclusion of community types that do not occur naturally at the altitude where the overlook is positioned. Their absence from this elevational zone is due to environmental conditions unfavorable for natural seed germination and seedling establishment for those species. This does not mean that subalpine and alpine plants grown in the park's greenhouse from seeds and cuttings collected on the slopes of nearby Colonial Peak and Sourdough Mountain and transplanted at the overlook will not survive and do well there. Information collected through botanical surveys in the park can and should be used to define the species makeup of plant communities represented at the overlook; line-intercept and canopy coverage plot data would be particularly useful in determining species placement. The decision regarding what is eventually planted at the overlook ultimately will be made by the Park Superintendent, based on recommendations from the park's plant ecologist and other resource personnel.[53] Constraints on what plants may be included in the interpretive gardens are the availability of seeds and cuttings of the various species, whether they can be successfully propagated in a greenhouse environment, and if they are resilient enough to survive the transplanting process and become established. These factors already are known for a fair number of species native to the region. Table 4 lists plants currently grown in the NOCA greenhouse that would be suitable for inclusion in

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[52] Rochefort and Gibbons, 1992
[53] Regina Rochefort, personal communication, 26 April 2007

the DLO landscape. The vegetation zone in which each species is known to occur is also denoted in the table as follows: A = alpine zone; SA = subalpine zone; MF = montane forest zone.[54]

Acer circinatum (MF)	*Hieraceum gracile* (SA)	*Rubus pedatus* (MF, SA)
Acer glabrum (MF)	*Holodiscus discolor* (MF)	*Rubus spectabilis* (MF, SA)
Alnus sinuata (MF, SA))	*Luetkea pectinata* (A, SA)	*Rubus ursinus* (MF)
Amelanchier alnifolia (MF)	*Luzula sp.* (A, SA, MF)	*Salix scouleriana* (MF)
Arctostaphylos uva-ursi (MF)	*Pachistima myrsinites* (MF)	*Sambucus cerulea* (MF)
Berberis aquifolium (MF)	*Philadelphus lewisii* (MF)	*Sambucus racemosa* (MF)
Berberis nervosa (MF)	*Phleum alpinum* (A, SA)	*Spirea betulifolia* (SA)
Carex nigricans (A, SA)	*Phyllodoce empetriformis* (A, SA)	*Symphoricarpos albus* (MF)
Carex spectabilis (SA)	*Potentilla flabellifolia* (A, SA)	*Tsuga heterophylla* (MF)
Cassiope mertensiana (A, SA)	*Pseudotsuga menziesii* (MF)	*Vaccinium membranaceum* (MF, SA)
Ceanothus sanguineus (MF)	*Ribes lacustre* (MF)	*Vaccinium parvifolium* (MF)
Erigeron peregrinus (SA)	*Ribes sanguineum* (MF)	*Viburnum edule* (MF)
Festuca viridula (A, SA)	*Rubus leucodermis* (MF)	*Xerophyllum tenax* (MF, SA)
Gaultheria shallon (MF)	*Rubus parviflorus* ((MF, SA)	

Table 4. Native species currently propagated at NOCA, and the vegetation zones in which they occur.
Source: http://www.nps.gov/nwresearch/species.html

The design also contains a substantial amount of stone, in the form of both structured masonry work and naturalistic formations. Like the plant materials, the stones and boulders should be of local origin; obtaining the quantities needed for the design should not pose a problem, as the steep slopes continually shed debris onto the highway corridor which must be cleared. The collected material can be cached – if this is not done so already – for use in this and other building and restoration projects. In addition to stone, the design calls for the placement of new soil over a large portion of the overlook. This *could* pose a challenge, as spare or cast-off soil is not easy to come by in the park complex, and it cannot be collected from undisturbed sites. Moreover, the texture, structure and pH of soils in particular areas of the landscape must be appropriate for the community type that will be installed there. It will not work to import a generic soil mix for use over the entire site. That practice, in part, is why the overlook is now dominated

[54] Pojar and MacKinnon, 1994; Biek, 2000; Hitchcock and Cronquist, 1973

by non-native species; the soil is identical to that of the lowland pastures these weeds already have overtaken. Tansy and orchard grass (*Dactylis glomerata*) might not grow so vigorously in the lithosols favored by spreading stonecrop (*Sedum divergens*) or tufted saxifrage (*Saxifraga caespitosa*), or the acidic soil in which heather and partridgefoot thrive.[55] Exotic plant control efforts will constitute much of the site's maintenance during the first two to five years after construction and revegetation, until the native plants are well-established; providing the native species with their ideal soil conditions gives them a competitive advantage over the weeds.

Complicating Factors: the Human Component

The term *park* has been used throughout this text in referring to region in which the project site is located. Although DLO officially lies with a national recreation area, some visitors to the area may not make the distinction either; it is all a big park to them, and it exists for their enjoyment. This design attempts to fulfill the expectations of such people, as well as those who understand that parks exist for purposes more important than human recreation.

Some people feel that their activities on public lands – particularly in recreation and wilderness areas – should be unrestricted, but the documented reality is that natural resources suffer when there are no enforced rules in place to protect them[56]. It comes down to a balancing act between giving people the amenities they desire and regulating

[55] Pojar and MacKinnon, 1994
[56] Cole and McCool, 2000

their activities to protect those amenities.[57] The design presented here provides structural cues to discourage certain kinds of behavior. Resource protection signs alone will not prevent everyone from walking where they are not supposed to.[58] On the other hand, a stone wall surrounding a planted area presents a physical and psychological barrier to such transgressions[59]; it is not so easy to claim that you did not see a wall you have just climbed over. When it becomes difficult to break the rules without drawing unwanted attention, social pressure will encourage compliance.[60]

A social issue of a different sort also may be addressed in the DLO redesign – the representation of all participants in the cultural history of the North Cascades. The plan creates space for interpretive displays to describe the region's human usage and development history, and both aboriginal and European cultures should be included. It is important to convey the fact that these mountains provided sustenance for humans for thousands of years, humans whose lives were structured according to natural cycles and ecosystem processes. People in developed countries are so far-removed from that state of being that many have lost the ability to think of wilderness as home. If humanity is to attain the ecologically sustainable lifestyle that will enable its continued existence – and that of all other living things – its innate connection with the natural world must be reawakened and strengthened. Awareness of a not-so-distant past in which people lived by nature's rules and thrived may facilitate this reconnection.

[57] Cole, 1993; Watson, 2000
[58] MacLennan, 2000
[59] Cole, 1993
[60] Harding, Borrie and Cole, 2000

Long-term Oversight and Maintenance

The DLO rehabilitation design is meant to produce a landscape that is self-sustaining and low-maintenance *once the plants have become established*. There will be a period of two to five years after installation during which monthly maintenance will be required during the growing season to remove exotic species and replace dead or damaged native vegetation. This may seem like large time investment in management terms, but actually amounts to a trivial commitment in an ecosystem time scale. What is required of park managers is long-term vision, because this landscape most likely will change over time through succession. At some point in the future, park administrators will need to decide whether to intervene in these natural processes to preserve valued assets – for example, removing trees to maintain the overlook's panoramic view. Forest regeneration may be the inevitable natural fate for this site, and policies regarding how to deal with this issue should be established now.

Determining the Appropriate Management Emphasis

The National Park Service's mandate specifies management objectives that occasionally produce conflict: protection of natural resources and processes versus enhancement of the park visitor's experience.[61] In the majority of such cases, it is imperative that natural resource protection be given priority over visitor enjoyment – after all, the health and integrity of ecosystems must be sustained if future generations of visitors are to see them. However, in the case of high-use visitor attractions such as

[61] The National Park Service Organic Act, 16 U.S.C. 1 and 3

Diablo Lake Overlook, it may be appropriate to tamper with nature to preserve historic scenic values, or to introduce elements that enlighten visitors.

North Cascades National Park Service Complex is one of the few units in the national park system in which public roads are excluded from the actual park itself. Ross Lake and Lake Chelan National Recreation Areas serve in effect as "wilderness thresholds" to the more remote, less-trammeled wildlands within the northern and southern halves of North Cascades National Park.[62] Two allied implications arise from this arrangement, the first being that these two recreation areas must satisfy the expectations of a wilderness experience for the vast majority of people who will never set foot within North Cascades National Park itself. Failure to meet this requirement may one day rekindle public support and legislative pressure for the development of roads or other mechanical means of transport into park itself, actions that would endanger the region's fragile subalpine and alpine ecosystems and degrade the very scenery to which access is sought. The second implication is that within recreation areas, which are not considered wilderness and not typically managed as such, it is permissible to intervene in natural processes such as succession to maintain and enhance scenic values and other visitor amenities. Such management latitude also opens the door for the application of *ecosystem aesthetics* to create replicates of natural landscapes for the benefit of visitors. Aside from panoramic vistas viewed from afar, most people never experience for themselves the exquisite beauty of the wilderness beyond the parking lots and roadways of our national parks; a sample of it must be brought to them if they are to appreciate fully why these places are worth protecting.

[62] Louter, 2006

BIBLIOGRAPHY

Antrop, M. 2005. Why landscapes of the past are important for the future. *Landscape and Urban Planning* **70**:21-34.

Biek, D. 2000. *Flora of Mount Rainier National Park*. Oregon State University Press, Corvallis, OR.

Booth, N.K., and J.E. Hiss. 2005. *Residential Landscape Architecture: Design Process for the Private Residence*. Pearson Education, Inc., Upper Saddle River, NJ.

Calkins, M. 2005. Strategy use and challenges of ecological design in landscape architecture. *Landscape and Urban Planning* **73**:29-48.

Chapin III, F. Stuart, P.A. Matson, and H.A. Mooney. 2002. *Principles of Terrestrial Ecosystem Ecology*. Springer Science+Business Media Inc., New York, NY.

Ching, F.D.K. 1996. *Architecture: Form, Space and Order*. John Wiley and Sons, Inc., New York, NY.

Cole, D.N. 1993. Minimizing conflict between recreation and nature conservation. Pages 105-122 *in* Smith, D.S., and P.C. Hellmund, eds. *Ecology of Greenways: Design and Function of Linear Conservation Areas*. University of Minnesota Press, Minneapolis, MN.

Cole, D.N. and S.F. McCool. 2000. Wilderness visitors, experiences, and visitor management. *U.S.D.A. Forest Service Proceedings* RMRS-P-15-Vol-4.

Collins, J.M. 1974. *Valley of the Spirits: the Upper Skagit Indians of Western Washington.* University of Washington Press, Seattle, WA.

Cox, J. 1991, *Landscaping with Nature*. Rodale Press, Emmaus, PA.

Daubenmire, R. 1970. *Steppe Vegetation of Washington*. Washington State University Cooperative Extension, Pullman, WA.

Ferguson, B.K. 1998. *Introduction to Stormwater: Concept*, *Purpose*, *Design*. John Wiley and Sons, Inc., New York, NY.

Fitter, A.H., and R.K.M. Hay. 1987. *Environmental Physiology of Plants*. Academic Press Limited, London, U.K.

Forman, R.T.T. 1995. *Land Mosaics: the Ecology of Landscapes and Regions*. Cambridge University Press, Cambridge, U.K.

Franklin, J.F., and C.T. Dyrness. 1988. *Natural Vegetation of Oregon and Washington*. Oregon State University Press, Corvallis, OR.

Franz, E.H. 2001. Ecology, values and policy. *BioScience* **51**:469-474.

Freyfogle, E.T. 2004. Conservation and the lure of the garden. *Conservation Biology* **18**:995-1003.

Harding, J.A., W.T. Borrie, and D.N. Cole. 2000. Factors that limit compliance with low-impact recommendations. *U.S.D.A. Forest Service Proceedings* RMRS-P-15-Vol-4.

Higgs, E.S. 1991. A quantity of engaging work to be done: ecological restoration and morality in a technological culture. *Restoration and Management Notes* **9**:97-104.

Higgs, E.S. 1997. What is good ecological restoration? *Conservation Biology* **11**:338-348.

Hitchcock, C.L., and A. Cronquist. 1973. *Flora of the Pacific Northwest*. University of Washington Press, Seattle, WA.

Hobbs, R.J., and Harris, J.A. 2001. Restoration ecology: repairing the Earth's ecosystems in the new millennium. *Restoration Ecology* **9**:239-246.

Kaplan, S. 2000. Human nature and environmentally responsible behavior. *Journal of Social Issues* **56**:491-508.

Kruckeburg, A.R. 1996. *Gardening with Native Plants of the Pacific Northwest*. University of Washington Press, Seattle, WA.

Leopold, A. 1966. *A Sand County Almanac*. Oxford University Press, Inc., New York, NY.

Lesica, P., and F.W. Allendorf. 1999. Ecological genetics and the restoration of plant communities: mix or match? *Restoration Ecology* **7**:42-50.

Louter, D. 1998. *Contested Terrain: North Cascades National Park Service Complex, an Administrative History*. National Park Service, Seattle, WA.

Louter, D. 2006. *Windshield Wilderness: Cars, Roads, and Nature in Washington's National Parks*. University of Washington Press, Seattle, WA.

Mack, R.N. 2005. *Community Ecology: the Web of Life*. Washington State University, Pullman, WA.

MacLennan, P. 2000. Visitor information as a management tool. *Science and Research Internal Report 180*. Department of Conservation, Wellington, N.Z.

Matthews, D. 1999. *Cascade-Olympic Natural History*. Raven Editions, Portland, OR.

McDonough, W., and M. Braungart. 2002. *Cradle to Cradle: Remaking the Way We Make Things*. North Point Press, New York, NY.

McHarg, I.L. 1992. *Design with Nature*. John Wiley and Sons, Inc., New York, NY.

Orr, D.W. 2002. *The Nature of Design: Ecology, Culture and Human Intention*. Oxford University Press, Inc., New York, NY.

Oskamp, S. 2000. Psychological contributions to achieving an ecologically sustainable future for humanity. *Journal of Social Issues* **56**:373-390.

Pojar, J., and A. MacKinnon. 1994. *Plants of the Pacific Northwest Coast*. Lone Pine Publishing, Vancouver, B.C.

Rochefort, R.M., and D.L. Peterson. 1996. Temporal and spatial distribution of trees in subalpine meadows of Mount Rainier National Park, Washington, U.S.A. *Arctic and Alpine Research* **28**:52-59.

Rochefort, R.M. and D.L. Peterson. 2001. Genetic and morphologic variation in *Phyllodoce empetriformis* and *Phyllodoce glanduliflora* (Ericaceae) in Mount Rainier National Park, Washington. *Canadian Journal of Botany* **79**:179-191.

Rochefort, R.M., R.L. Little, A. Woodward, and D.L. Peterson. 1994. Changes in sub-alpine tree distribution in western North America: a review of climatic and other causal factors. *The Holocene* **4**:89-100.

Rochefort, RM., and S.T. Gibbons. 1992. Mending the meadow: high-altitude meadow restoration in Mount Rainier National Park. *Restoration and Management Notes* **10**:120-126.

Rodiek, J.E. 2006. Landscape planning: its contributions to the evolution of the profession of landscape architecture. *Landscape and Urban Planning* **76**:291-297.

Rogers, E.B. 2001. *Landscape Design: A Cultural and Architectural History*. Harry N. Abrams, Inc., New York, NY.

Ruby, R.H., and J.A. Brown. 1986. *A Guide to Indian Tribes of the Pacific Northwest*. University of Oklahoma Press, Norman, OK.

Society for Ecological Restoration International Science and Policy Working Group. 2004. *The SER International Primer on Ecological Restoration.* Society for Ecological Restoration International, Tucson, AZ.

Tabor, R., and R. Haugerud. 1999. *Geology of the North Cascades: A Mountain Mosaic*. The Mountaineers, Seattle, WA.

Temperton, V.M., R.J. Hobbs, T. Nuttle, M. Fattorini, and S. Halle. 2004. Introduction: why ecosystem assembly rules are important to the field of restoration ecology. Pages 1-8 *in* Temperton, V.M, R.J. Hobbs, T. Nuttle, and S. Halle. 2004. *Assembly Rules and Restoration Ecology*. Island Press, Washington, D.C.

Thompson, J.W., and K. Sorvig. 2000. *Sustainable Landscape Construction: A Guide to Green Building Outdoors*. Island Press, Washington, D.C.

U.S. Department of Transportation, Federal Highway Administration, Region 8. 1970. *Plans for Proposed Washington F.H. Project 32-2 (11) and Washington F.A.P. Project F-052-2 (15), North Cross-State Highway*. NOCA 168 41917. National Park Service Technical Information Center, Denver, CO.

U.S. Geological Survey. 1963. *Ross Dam Quadrangle, Washington*. DMA 1781 NE-SERIES V891. U.S. Geological Survey, Denver, CO.

Van der Ryn, S., and S. Cowan. 1996. *Ecological Design*. Island Press, Washington, D.C.

VanDerZanden, A.M. 2003. *Hardscapes for Sustainable Landscapes.* Oregon State University Extension Service, Corvallis, OR.

VanDerZanden, A.M., and J. McNeilan. 2002. *Basic Design Concepts for Sustainable Landscapes*. Oregon State University Extension Service, Corvallis, OR.

VanDerZanden, A.M., and J. McNeilan. 2002. *Plant Selection for Sustainable Landscapes*. Oregon State University Extension Service, Corvallis, OR.

Washington State Department of Transportation. 1972. North Cascades Highway Dedication Issue. *Washington Highways,* September 1972, pages 1-24.

Watson, A.E. 2000. Wilderness use in the year 2000: societal changes that influence human relationships with wilderness. *U.S.D.A. Forest Service Proceedings* RMRS-P-15-Vol-4.

Weisberg, S., J. Reidel, T. Johannessen, and W. Scherrer. 1993. *Sharing the Skagit: an Educator's Guide to the Skagit River Watershed*. North Cascades Institute, Sedro-Woolley, WA.

Wenz, P.S. 2001. *Environmental Ethics Today*. Oxford University Press, New York, NY.

White, P.S. and A. Jentsch. 2004. Disturbance, succession, and community assembly in terrestrial plant communities. Pages 342-366 *in* Temperton, V.M, R.J. Hobbs, T. Nuttle, and S. Halle. 2004. *Assembly Rules and Restoration Ecology*. Island Press, Washington, D.C.

Whitney, S.R., and R. Sandelin. 2003. *Field Guide to the Cascades and Olympics*. The Mountaineers Books, Seattle, WA.

Zolbrod, A.N., and D.L. Peterson. 1999. Response of high-elevation forests in the Olympic Mountains to climatic change. *Canadian Journal of Forest Research* **29**:1966-1978.

APPENDIX

Appendix A. Vegetation zones in the North Cascades region

Figure A1. Vegetation gradient from west-side montane forest to alpine tundra. Ruth Creek Valley, Mount Baker Wilderness. Traci M. Degerman, 2001

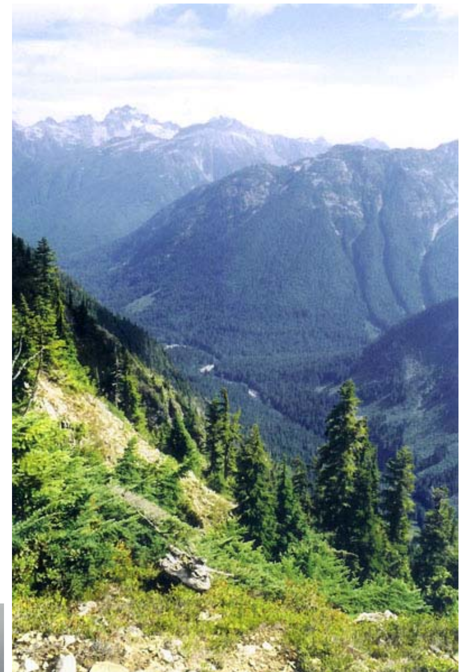


Figure A2 [above]. The Chilliwack River Valley (c. 2,600'), as viewed from Copper Ridge (c. 5,000'). North Cascades National Park. Traci M. Degerman, 2001

Figure A3 [left]. Subalpine parkland community type. Skyline Divide, Mount Baker Wilderness. Traci M. Degerman, 2001

Figure A4. East-side montane forest-to-alpine gradient. Early Winters Creek Valley, Pasayten Wilderness. Traci M. Degerman, 2006

Appendix B. The location of North Cascades National Park Service Complex and Diablo Lake Overlook

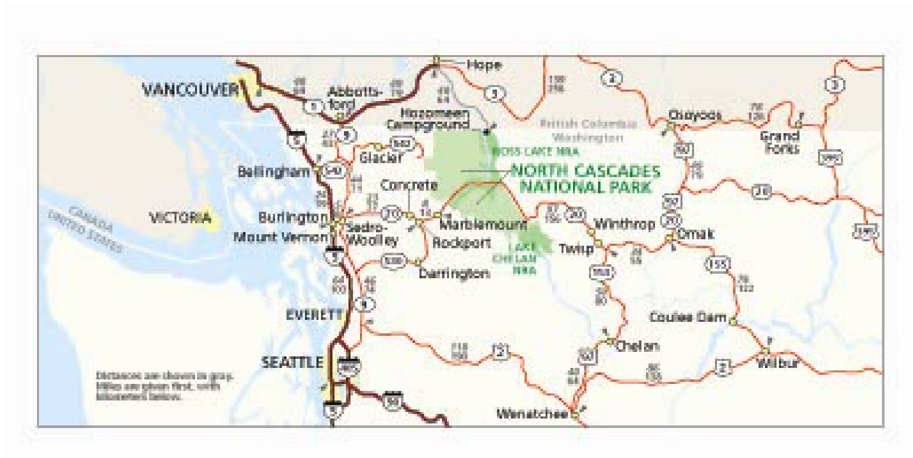
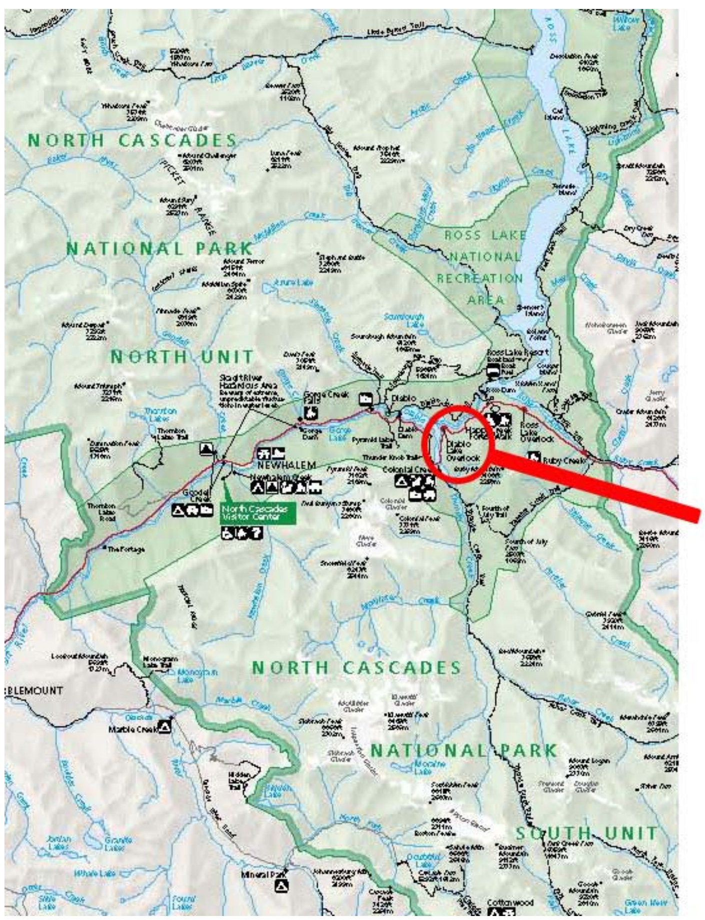


Figure B1. National Park Service maps showing the location of NOCA in Washington state (above) and the park complex's roads and named topographic features (below). Highlight marking the location of Diablo Lake Overlook was added by the author.



Location of Diablo Lake Overlook

Figure B2. Diablo Lake Overlook as viewed from the cliff to the southeast. Traci M. Degerman 2004

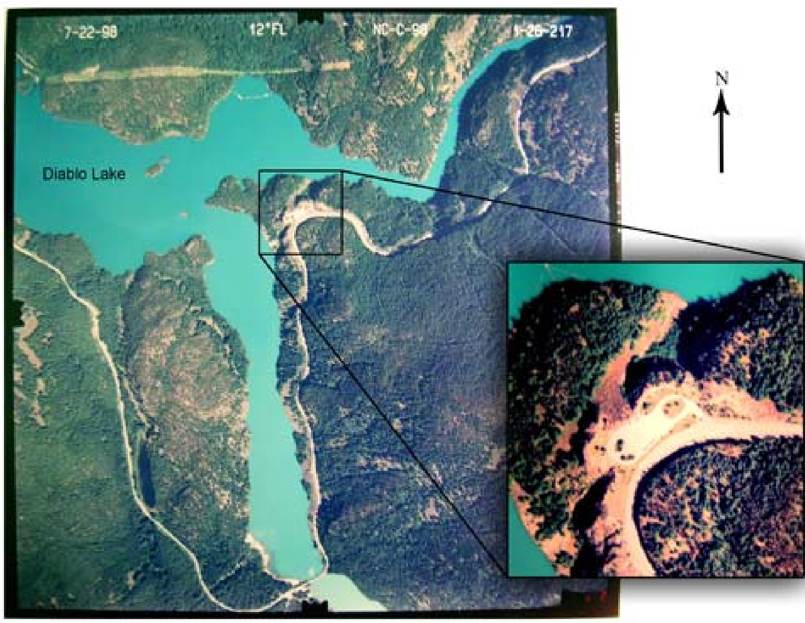


Figure B3 [above]. Aerial view of the overlook and vicinity (inset: a magnified, high-contrast view of the overlook). Original photograph provided by the National Park Service; photo illustration by Traci M. Degerman

Figure B4 [left]. The overlook as viewed from the west. Traci M. Degerman, 2004

Appendix C. Existing site features at Diablo Lake Overlook

Figure C1 [above]. Stone cliff exposed by the highway cut. The cliff wall, interspersed with bands differing in mineral composition, is remarkably beautiful. Traci M. Degerman, 2004

Figure C2 [above, left]. Looking northeast across the overlook parking lot. Traci M. Degerman, 2007

Figure C3 [above, right]. Toilet facilities at DLO, as seen from the cliff to the east. Traci M. Degerman, 2004

Figure C4 [right]. DLO toilet buildings and landscaping, completed in 2004. Traci M. Degerman, 2007

Figure C5 [above]. View from the northwest corner of DLO; this is the proposed site for an alpine/subalpine interpretive garden in the rehabilitation plan. Traci M. Degerman, 2004

Figure C6 [below]. Geological display and interpretive signs at the western end of the overlook; this is the proposed site for the interpretive shelter in the rehabilitation plan. Traci M. Degerman, 2007

Figure C7 [above]. Geological display area as seen from the east; the proposed interpretive shelter would be located on the left side of this open area. Traci M. Degerman, 2004

Figure C8 [below]. Commemorative signs at the eastern end of DLO; a proposed picnic area is located here in the rehabilitation plan. Traci M. Degerman, 2007

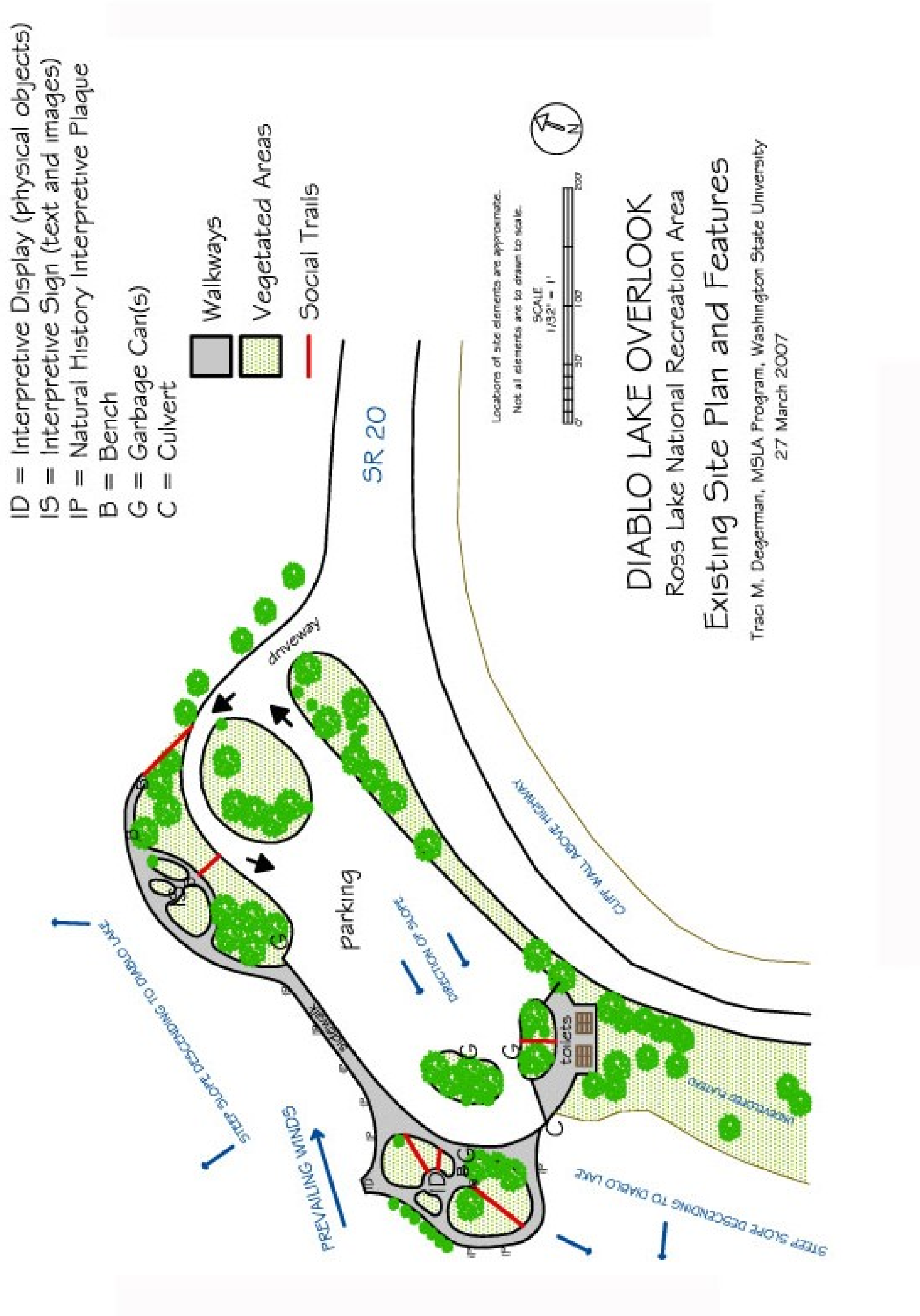
Figure C9. Undeveloped plateau south of DLO; this area remains as-is in the proposed rehabilitation plan. Traci M. Degerman, 2004

Appendix D. Problem areas at Diablo Lake Overlook

Figure D1. Vegetation overgrowing the landscape elements near the east end of DLO. Traci M. Degerman, 2004-2007

Figure D2. Social trails and tire tracks in the planting islands at DLO. Site protection features such as stone walls and high curbs are proposed in the rehabilitation plan as a means for eliminating such visitor impacts.
Traci M. Degerman, 2004-2007

Appendix E. Planview of the current layout at Diablo Lake Overlook



Appendix F. Master plan and site details for the Diablo Lake Overlook rehabilitation design

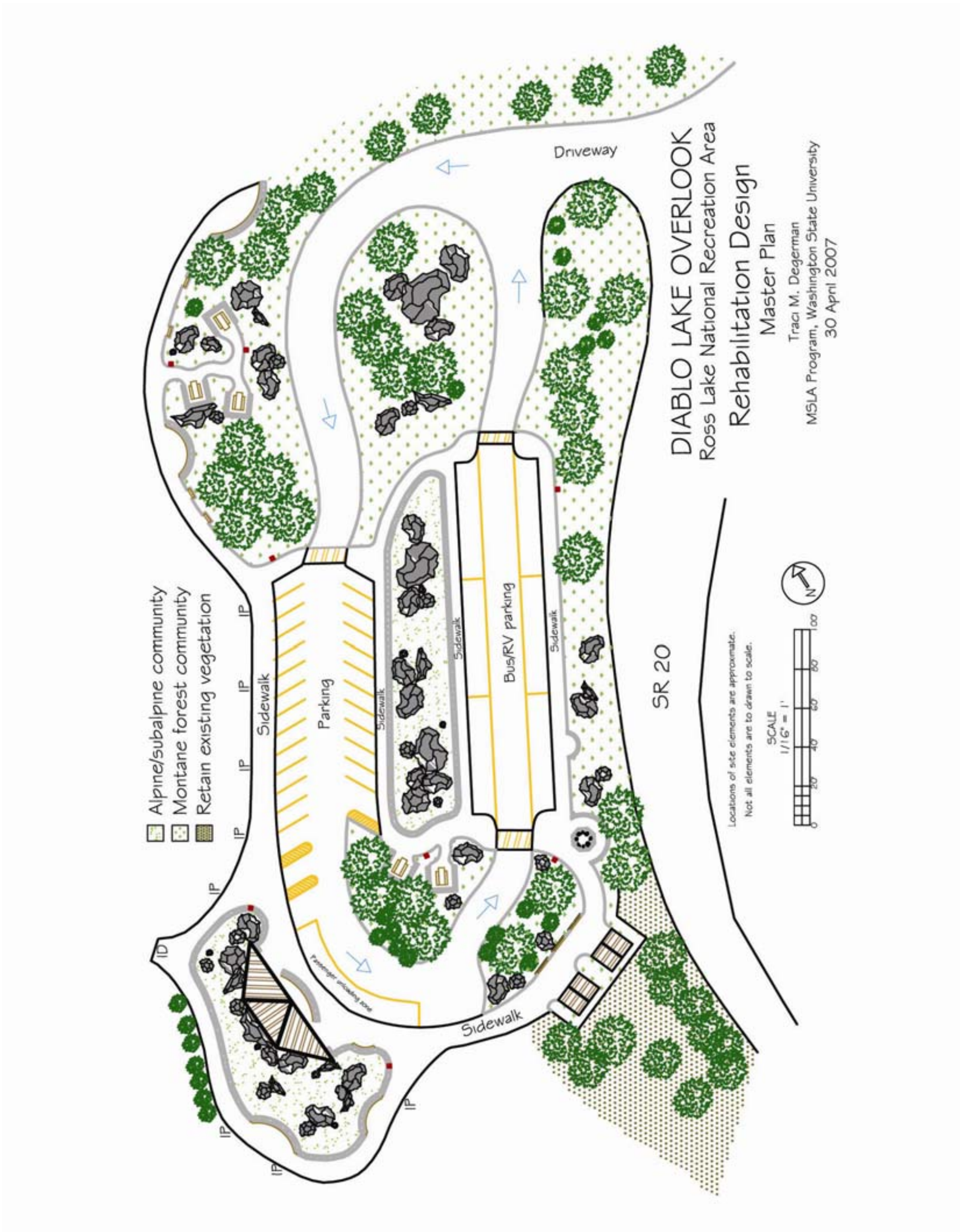


Figure F1. Master plan of proposed rehabilitation design for Diablo Lake Overlook

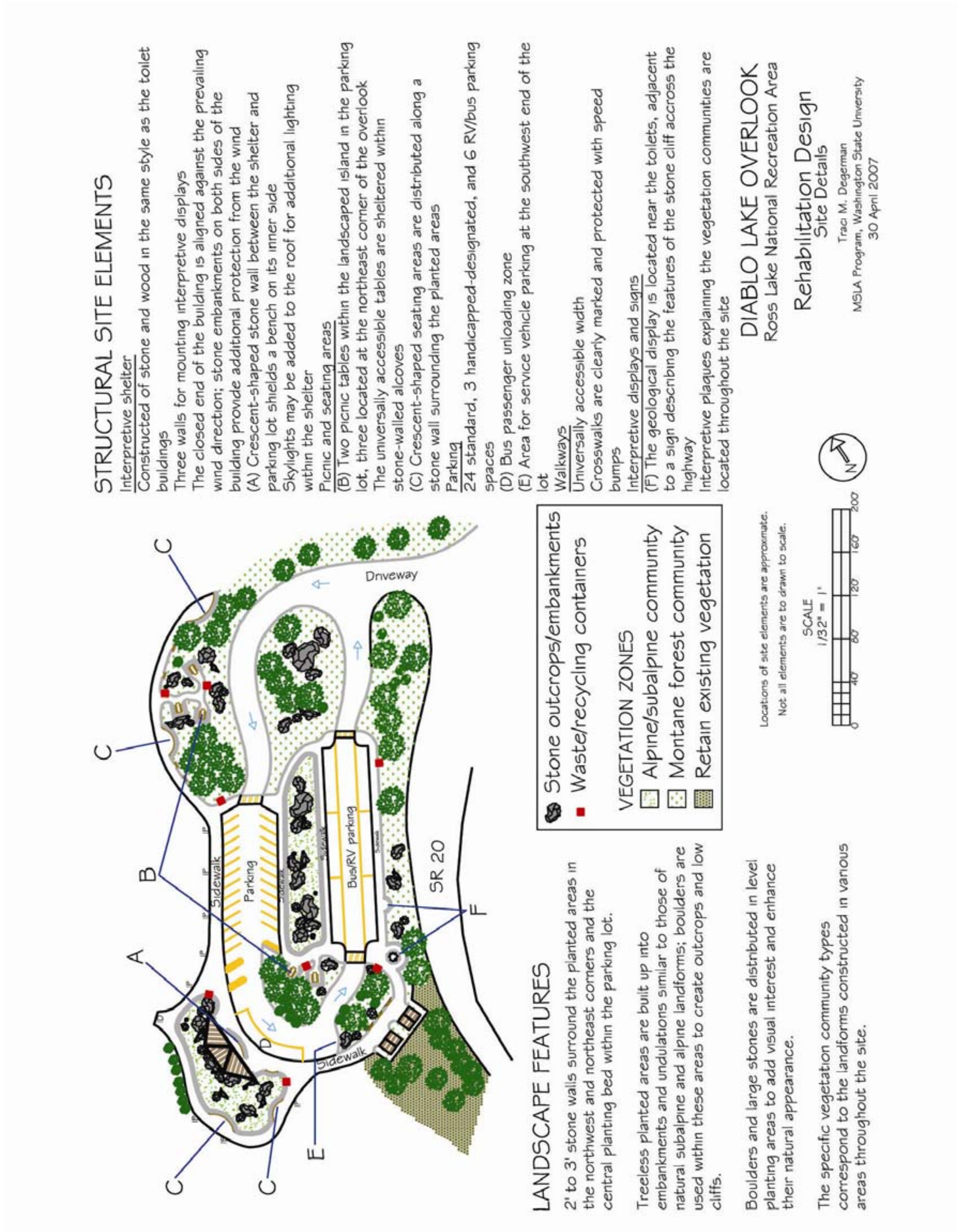
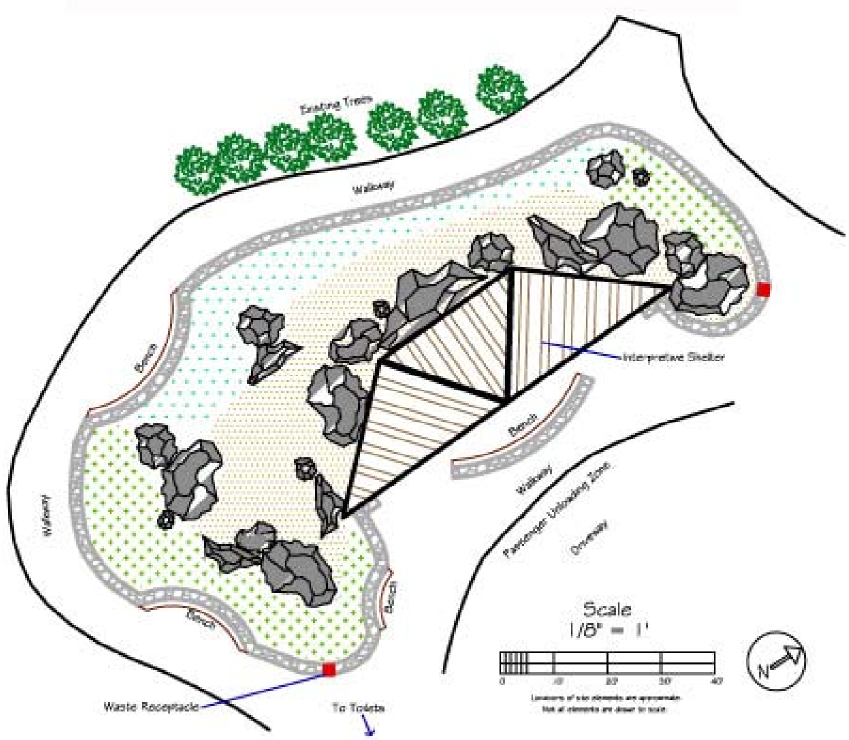


Figure F2. Site detail plan for proposed Diablo Lake Overlook rehabilitation design

Appendix G. Planting plans for the Diablo Lake Overlook rehabilitation design



Alpine Habitats Represented in the Interpretive Garden

Fellfield
Rocky slopes and plateaus characterized by coarse, shallow soils. Vegetation is sparse, patchy, and dominated by low-growing herbaceous plants, grasses, sedges and rushes. Potentially suitable species on the current NOCA propagation list include:
Carex nigricans, Festuca viridula, Luetkea pectinata, Luzula sp., Phleum alpinum, and Potentilla flabellifolia.

Heath
Undulating slopes and plateaus dominated by low, spreading shrubs interspersed with herbaceous plants, grasses and sedges. Potentially suitable species on the current NOCA propagation list include:
Cassiope mertensiana, Festuca viridula, Leutkea pectinata, Phyllodoce empetriformis.

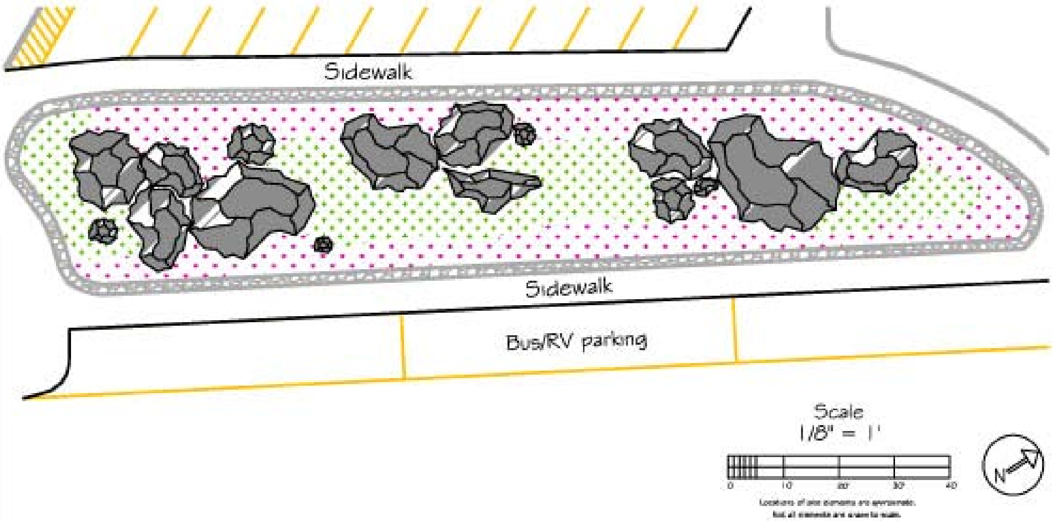
Snowbed meadow
Seasonally wet swales and depressions dominated by herbaceous plants, sedges, and rushes. Potentially suitable species on the current NOCA propagation list include:
Carex spectabilis, Erigeron peregrinus, Luetkea pectinata, Luzula sp..

Notes:
-Actual species included in the plantings, and their assembly patterns, will be determined through surveys of natural communities in these habitat types.
-A crushed rock mulch of native stone should be used where needed to cover bare areas of earth. Rock is preferable to organic mulch in these areas for its appearance and durability.

DIABLO LAKE OVERLOOK
Ross Lake National Recreation Area
Rehabilitation Design
Alpine Interpretive Garden Planting Plan

Traci M. Degerman
MSLA Program, Washington State University
30 April 2007

Figure G1. Planting plan for the Diablo Lake Overlook alpine interpretive garden



Subalpine Habitats Represented in the Interpretive Garden

Herbaceous Meadow
Moderately undulating and characterized by dense, continuous plant cover consisting primarily of forb species, with scattered grasses, sedges, and patches of low- to mid-sized shrubs. Spectacular spring and summer flower displays. Potentially suitable species from the current NOCA propagation list include:
Carex spectabilis, Erigeron peregrinus, Festuca viridula, Hieraceum gracile, Leutkea pectinata, Potentilla flabellifolia, Spirea betulifolia, Vaccinium membranaceum.

Heath
Undulating slopes and plateaus dominated by low, spreading shrubs interspersed with herbaceous plants, grasses and sedges. Potentially suitable species from the current NOCA propagation list include:
Carex nigricans, Cassiope mertensiana, Festuca viridula, Leutkea pectinata, Phyllodoce empetriformis, Spirea betulifolia, Vaccinium membranaceum.

Notes:
-Actual species included in the plantings, and their assembly patterns, will be determined through surveys of natural communities in these habitat types.
-A crushed rock mulch of native stone should be used where needed to cover bare areas of earth. Rock is preferable to organic mulch in these areas for its appearance and durability.

DIABLO LAKE OVERLOOK
Ross Lake National Recreation Area
Rehabilitation Design
Subalpine Interpretive Garden Planting Plan
Traci M. Degerman
MSLA Program, Washington State University
30 April 2007

Figure G2. Planting plan for the Diablo Lake Overlook subalpine interpretive garden

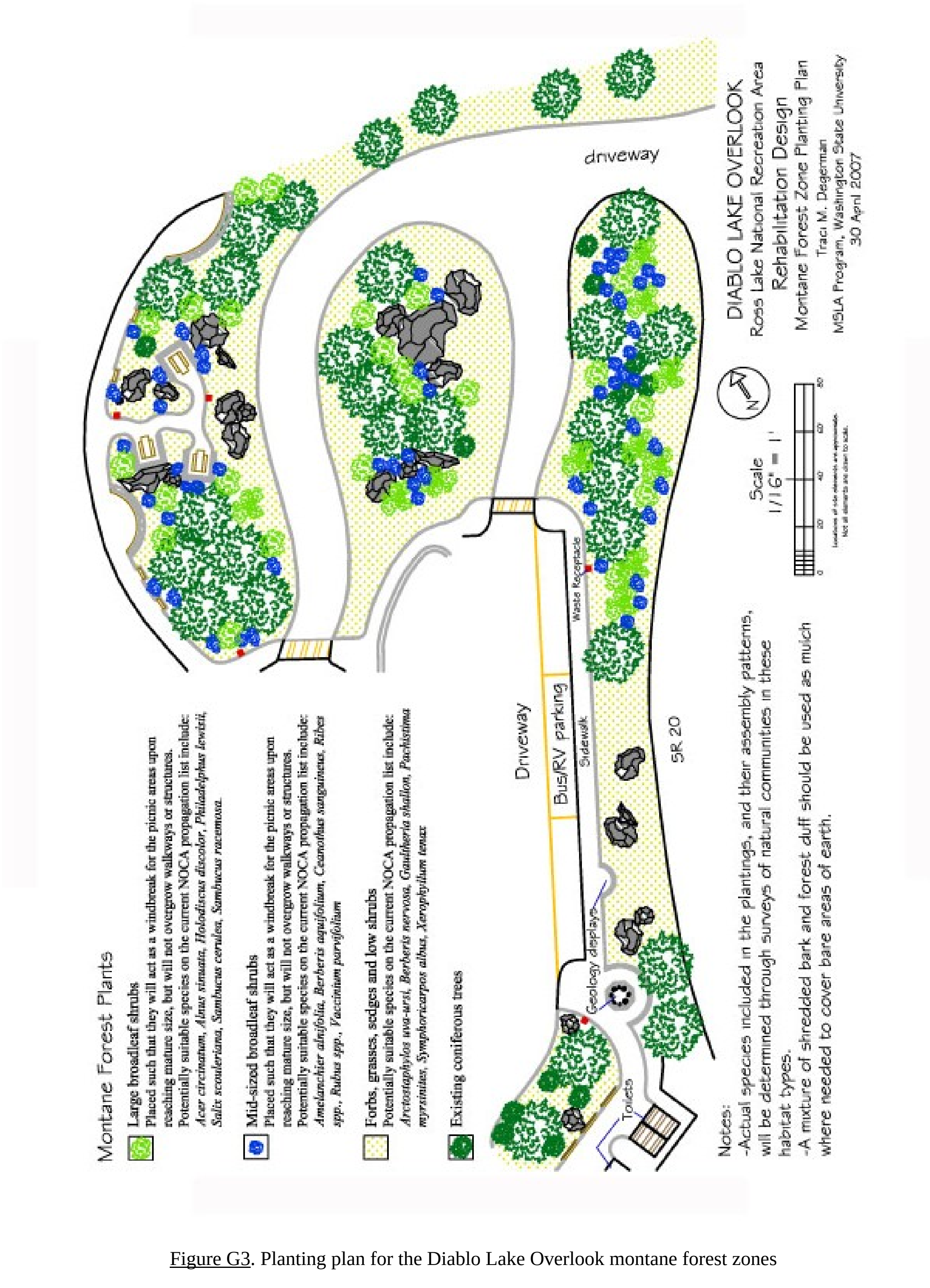
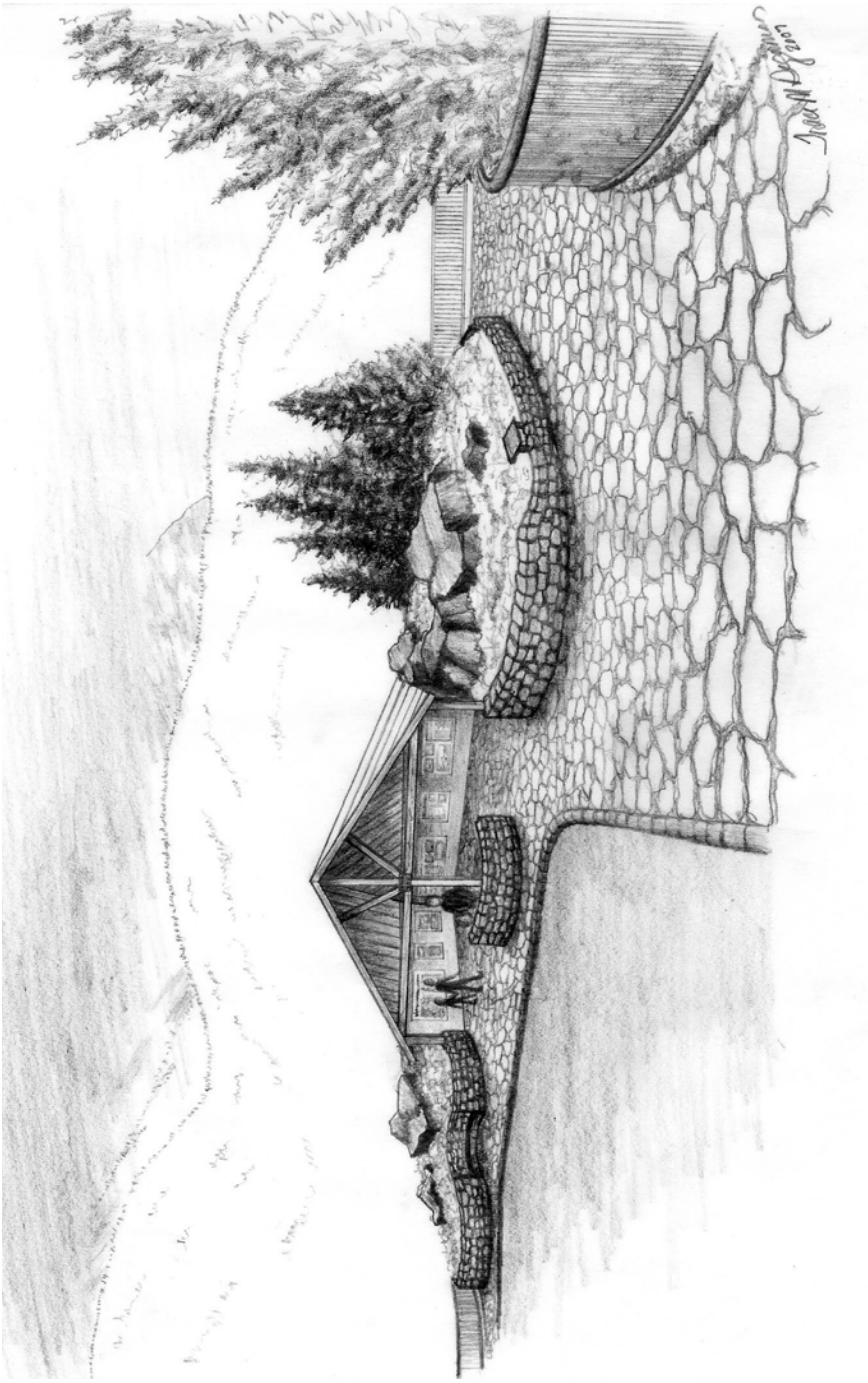


Figure G3. Planting plan for the Diablo Lake Overlook montane forest zones

Appendix H. Hand-drawn perspective illustration of the proposed Diablo Lake Overlook shelter and alpine interpretive garden.



Perspective illustration showing the proposed interpretive shelter and alpine interpretive garden, with stone walkways. Stone pavers are an aesthetically superior and regionally appropriate alternative to asphalt or concrete. Drawn by Traci M. Degerman, 2007

Appendix I. Plan drawings for the initial construction and design of Diablo Lake Overlook

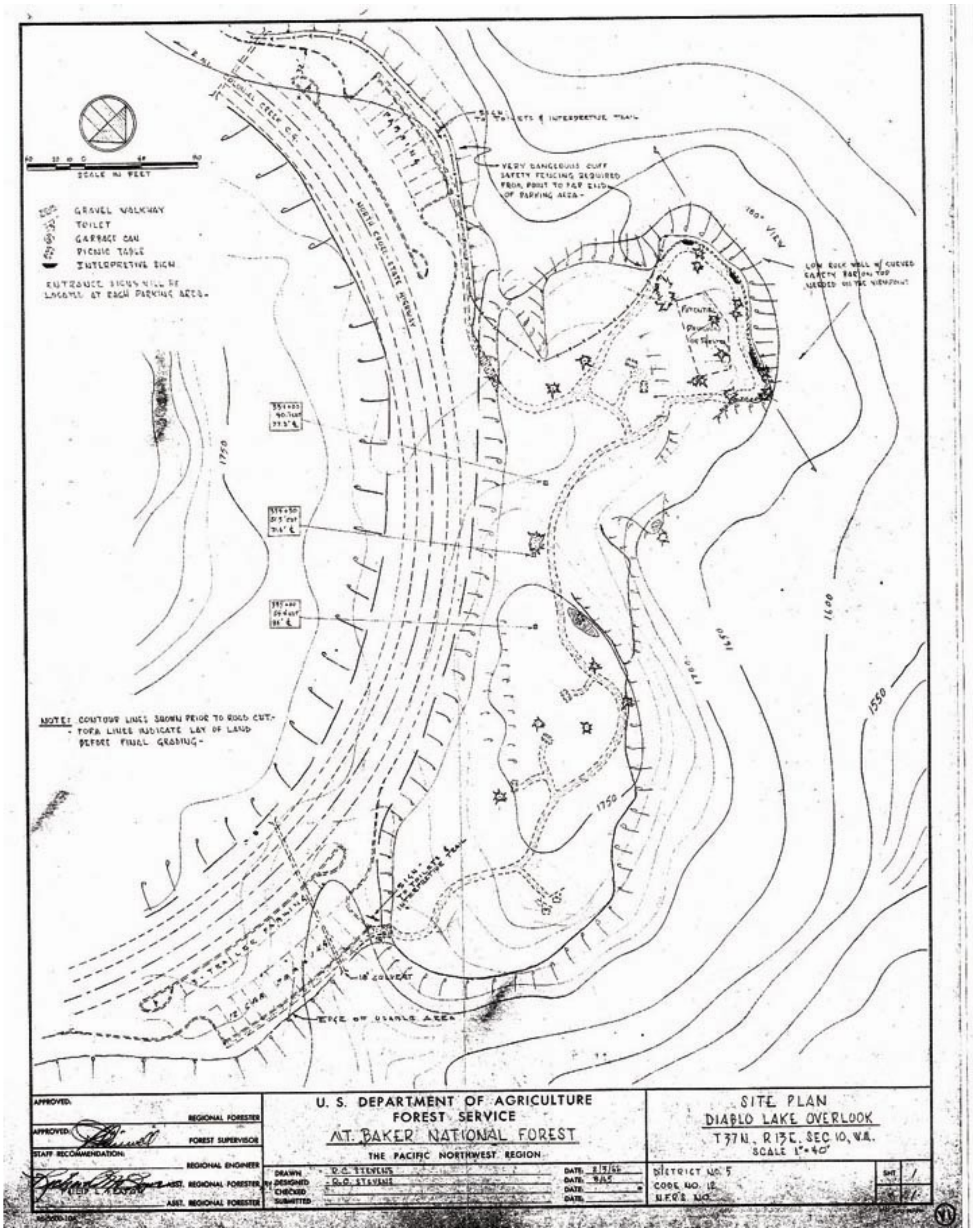


Figure I1. Site plan for Diablo Lake Overlook, dated 3 February 1966. Digital file created from a paper version stored in the North Cascades National Park Service Complex curatorial facility in Marblemount, Washington.

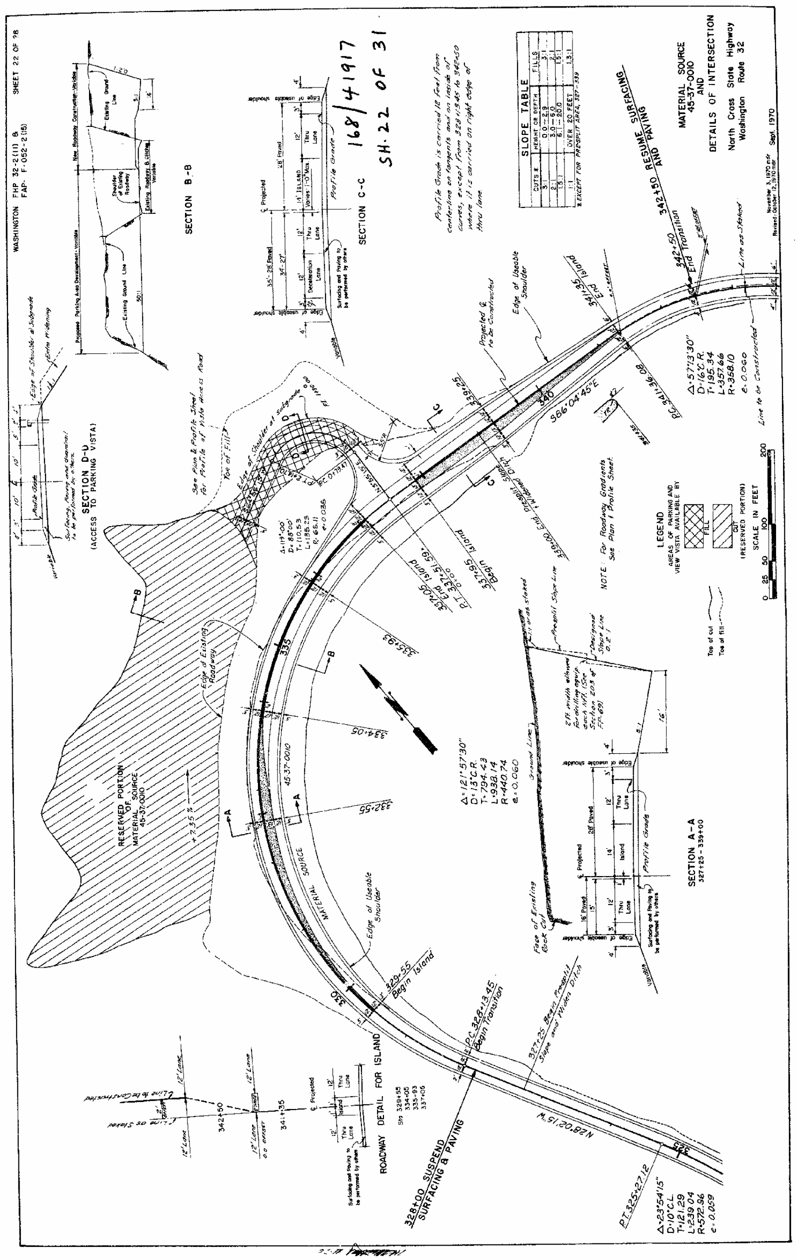


Figure I2**.** Engineering drawing for highway location and the proposed site for Diablo Lake Overlook, dated 3 November 1970. NPS document number: NOCA-168-41917[308158] pg. 22

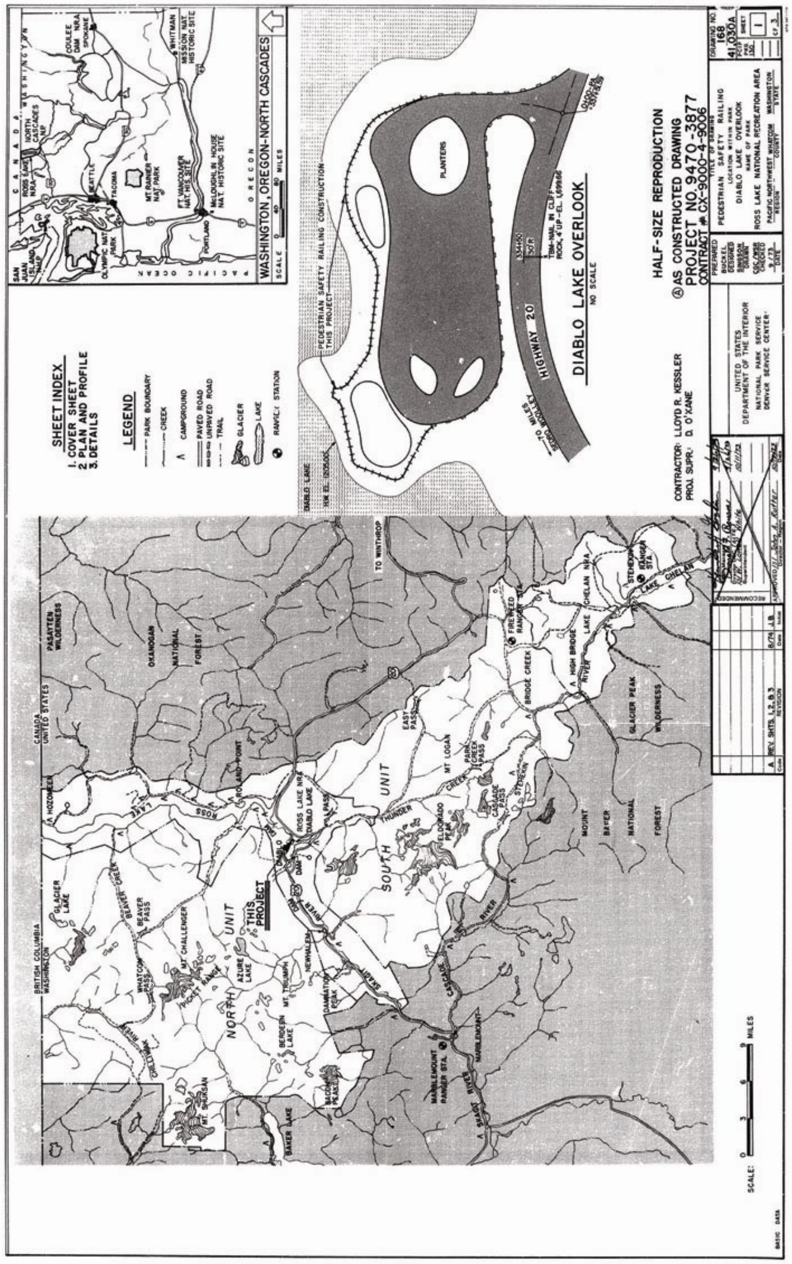


Figure I3. Construction drawing for Diablo Lake Overlook safety railing, dated 13 October 1973. NPS document number NOCA-168-41030A[308163], page 1

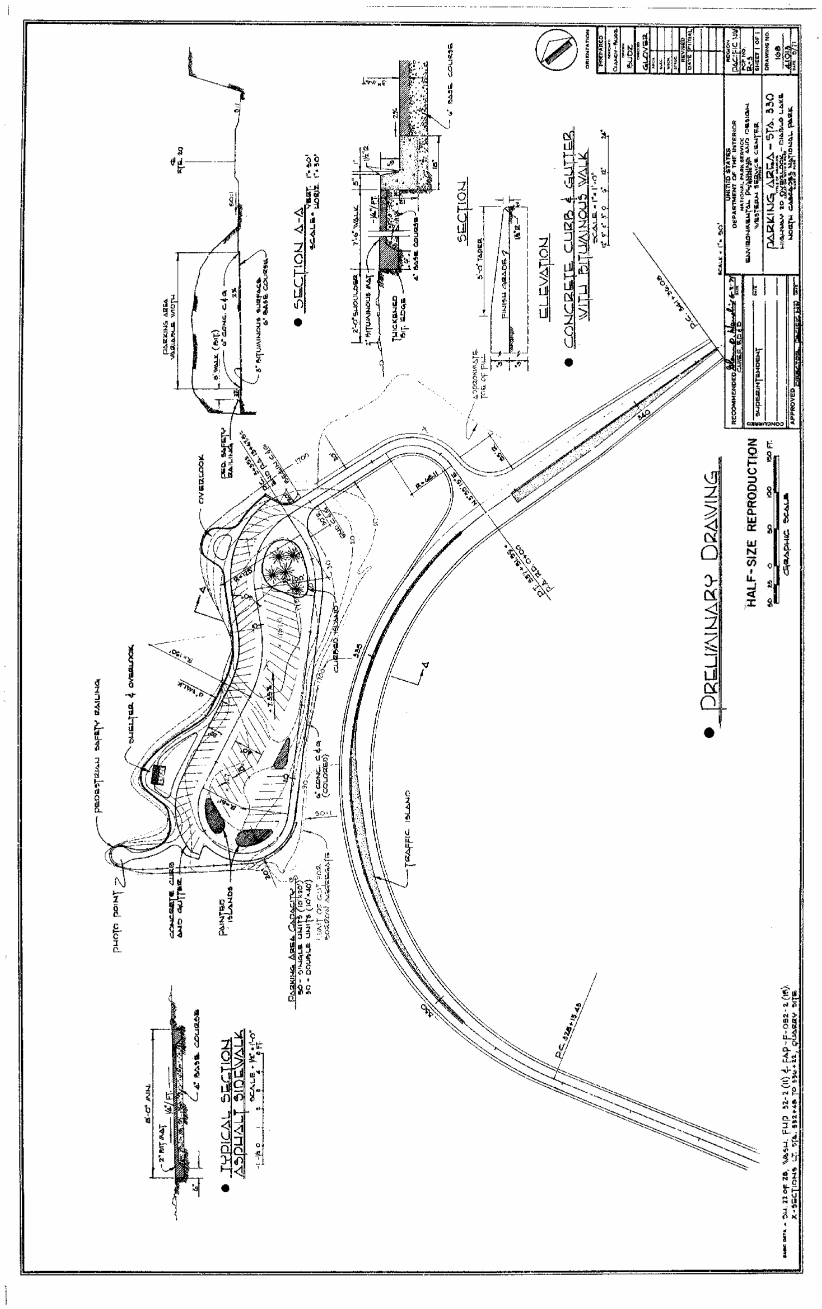


Figure I4. Construction drawing of a preliminary design for Diablo Lake Overlook, dated 2 June 1971. NPS document number NOCA-168-41013[308170]

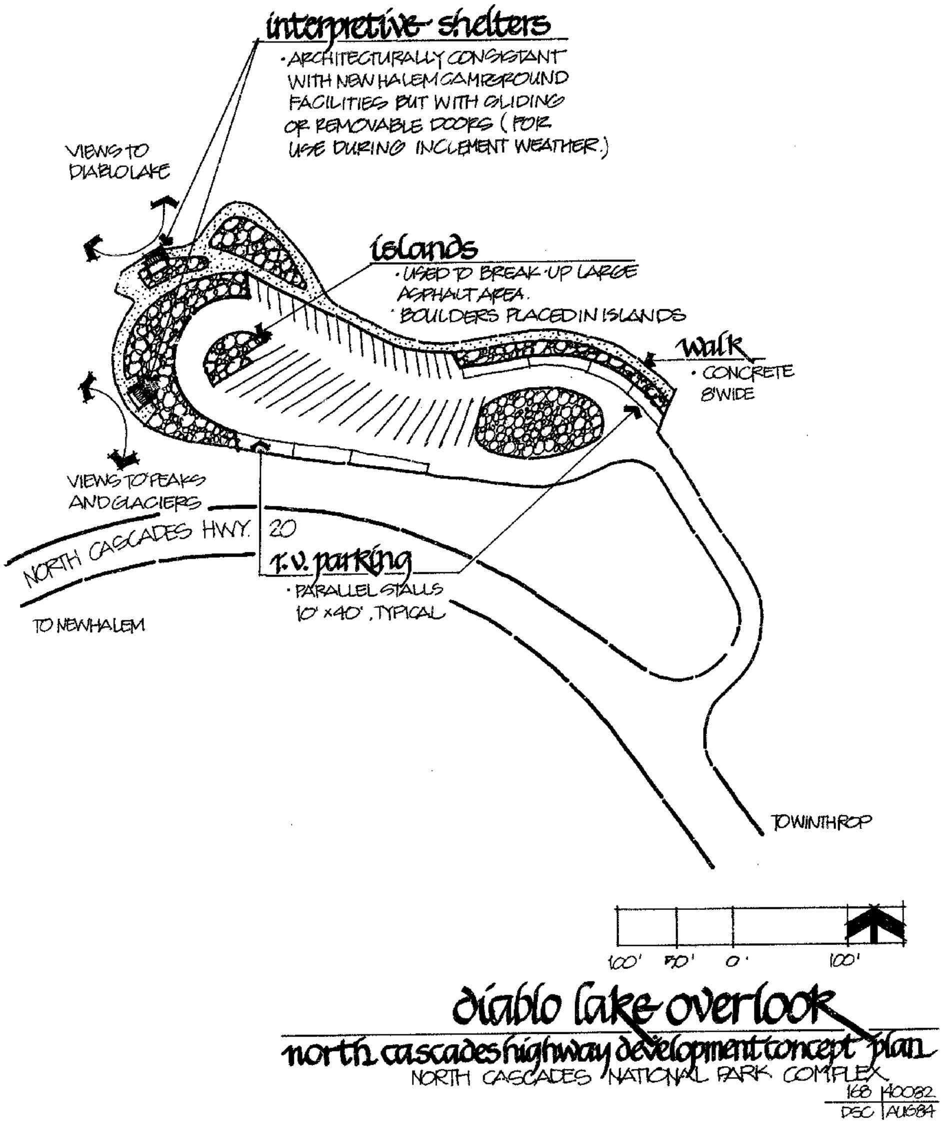


Figure I5. Conceptual diagram of a proposed design for Diablo Lake Overlook, dated August 1984. NPS document number NOCA-168-40082[308167

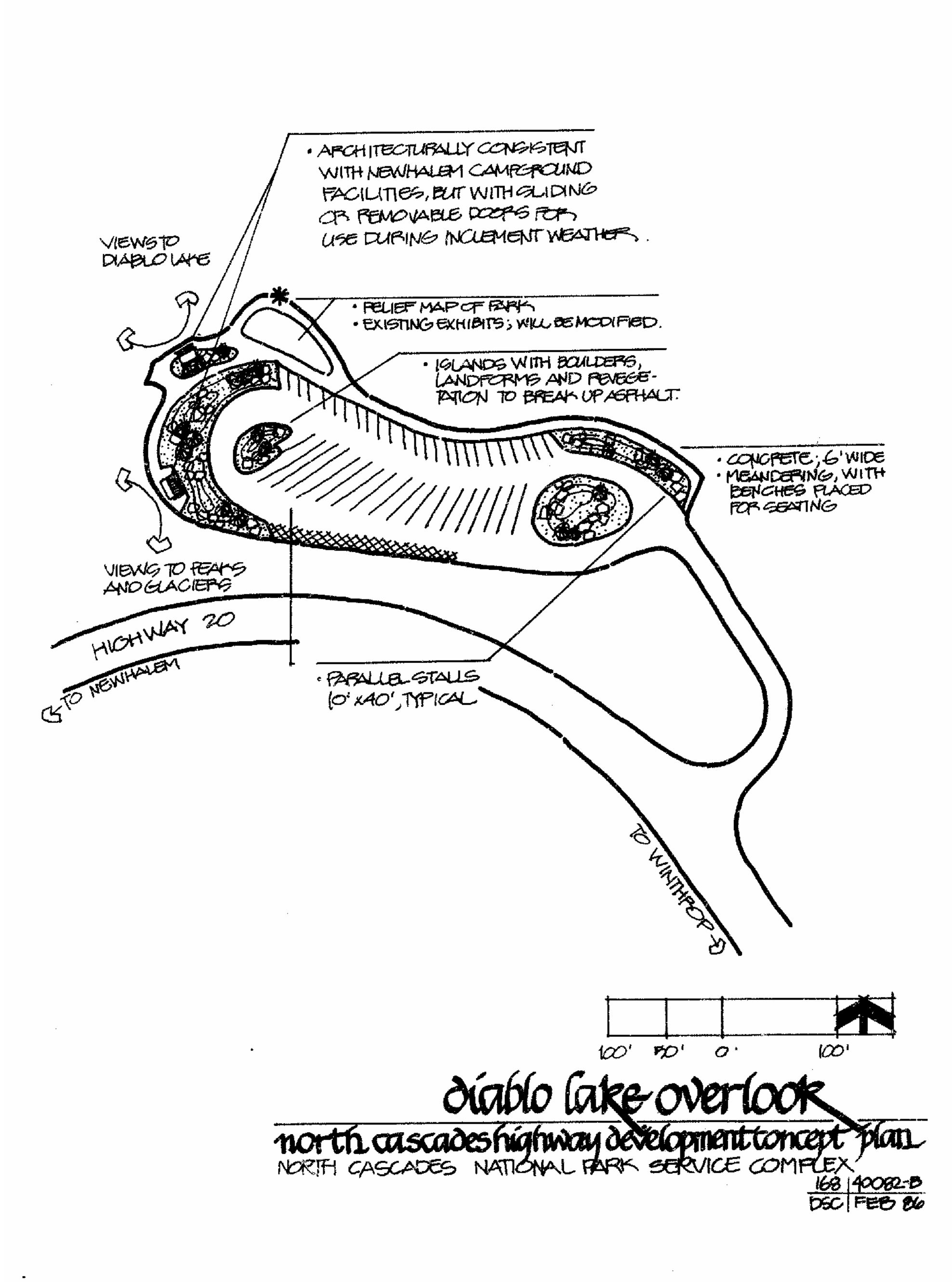
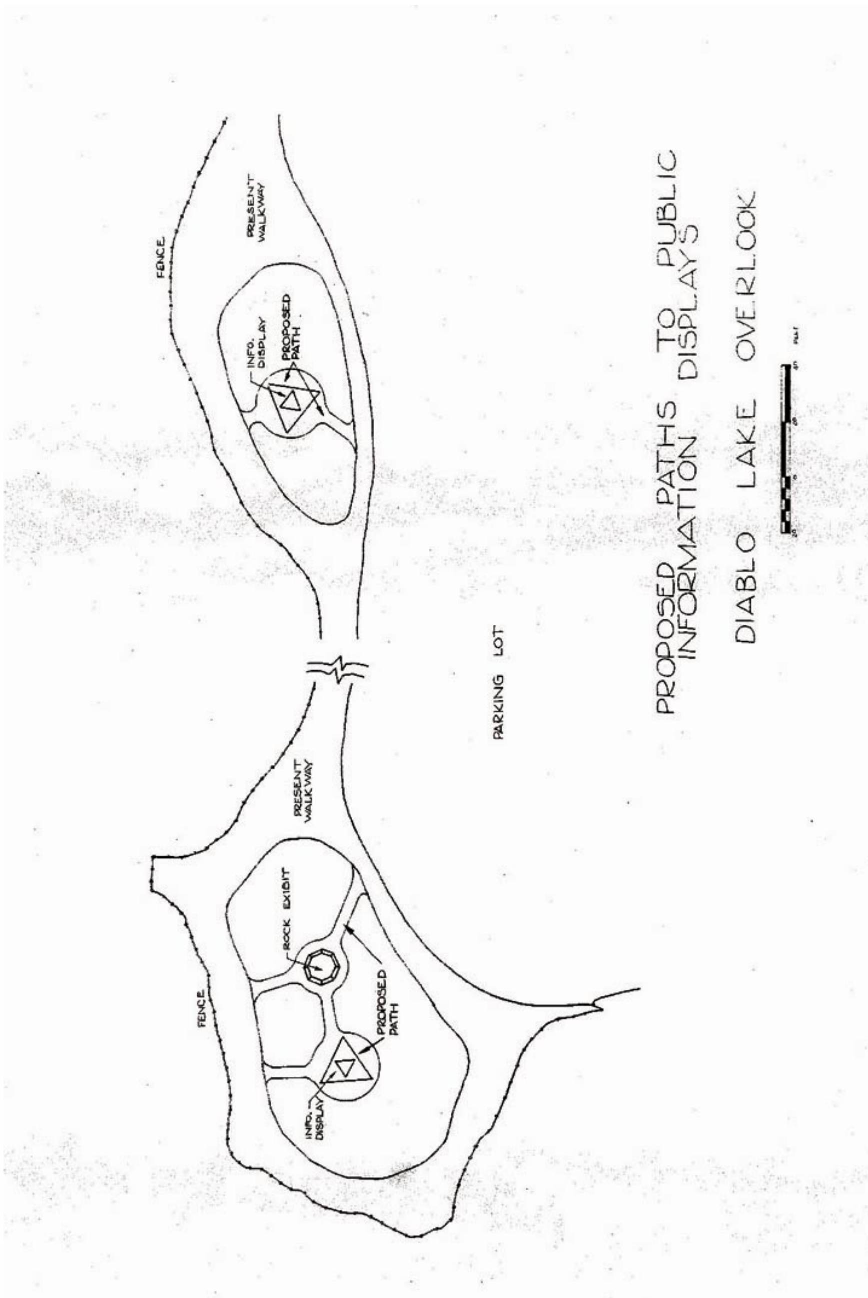
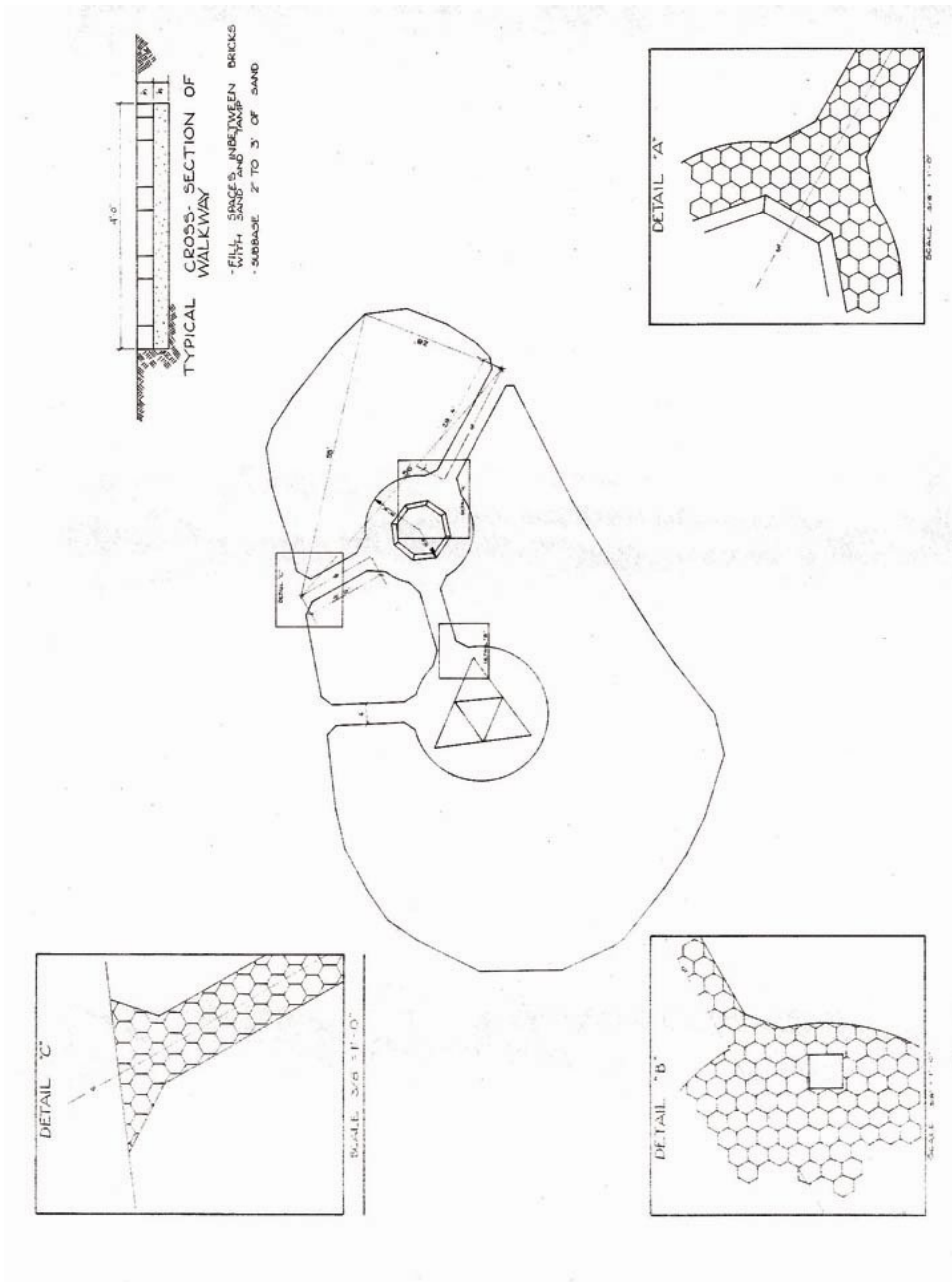


Figure I6. Conceptual diagram of a proposed landscape design for Diablo Lake Overlook, dated February 1986. NPS document number NOCA-168-40082B[308169]



<u>Figure I7</u>. Undated plan drawing of proposed interpretive displays at Diablo Lake Overlook. Digital file created from a paper version stored at the North Cascades National Park Service Complex curatorial facility in Marblemount, Washington.



<u>Figure I8</u>. Undated detail drawing of proposed interpretive displays at Diablo Lake Overlook. Digital image created from a paper version stored in the North Cascades National Park Service Complex curatorial facility in Marblemount, Washington.