Providing Connections: A Wetland Boardwalk

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Abstract

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As part of their Northwest Stream Center located in Snohomish County, Washington, Adopt-a-Stream Foundation plans to add a boardwalk route through the wetland site adjacent to their building to provide an outdoor learning area for wetland education. This report is the culmination of my site inventory, research, process and design proposal for this boardwalk route that combine to fulfill my capstone project for the Master of Landscape Architecture program at the University of Washington. The site inventory covers the watershed, hydrology, soil, vegetation, wildlife, human interest, and potential concerns. Vegetation and experiential maps are included as is a plant list, and site photos. Historic background of the area and regulatory implications are discussed. Literature review provides background into design theory for a route that tells the story of this landscape, while allowing a provocative wetland experience. Budget, visitor needs and environmental impact are considered in the design, as is optimizing experience through storytelling, variety, views, beauty, the sublime, mystery, and engagement of the whole person. Precedent studies of three Seattle area parks, Mercer Slough Nature Park, Rotary Community Park, and North Creek Park, inform the design. These parks successfully combine human and wildlife activities into multiple-use landscapes of environmental education and recreation, while maintaining wetland ecosystem function and habitat value. The design concept, An Interstitial Space that Provides Connections, is guided by principles which include connecting humans to nature, connecting humans to environmental education, enabling protection and stewardship, and designing for multi-functional landscapes and regional networks. Based on literature review, precedent studies, site inventory and analysis, four alternative design scenarios are shown each with an emphasis on one of the following areas: budget, visitor needs, environmental impact, and optimizing experience. A design is proposed that uses a more balanced approach. The proposed boardwalk includes viewpoints, seating, gathering spaces, viewing blinds and a front entry. Reflections of the process and lessons learned on project communication, site inventory techniques, site experience, and wetland ecosystem appreciation are included.

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PREFACE

The Northwest Stream Center is an environmental educational center located in McCollum Pioneer Park, Snohomish County, Washington. It is run by the Adopt-a-Stream Foundation and is dedicated to teaching about wetland ecology; stream, salmon and other wetland wildlife habitats; stream habitat restoration and stewardship. Within the 20 acres of property they lease from the Snohomish County Parks Department, the foundation wants to add a boardwalk route through the wetland site behind their building in order to provide an outdoor learning experience to their program. I became aware of this project in 2009 when attending the University of Washington in the Restoration Ecology Capstone Program. I contacted Tom Murdoch the center's director in the spring of 2011 to offer my volunteer efforts for a summer internship. He suggested I consider doing the wetland site inventory of plant communities, wetland types, habitat structures, and other items of interest to humans for the purposes of the educational viewing that could be provided by a boardwalk through the site. It began in July 2011 as an internship with two other University of Washington Landscape Architect students, Sam McIntyre and Minsoo Doo. Together we determined a methodology for measuring and mapping the area into grid sectors, and began the inventory. I took field notes and photos of all sectors. In August, I continued the inventory project alone, and Tom suggested I design the potential route for the boardwalk when I was done with the inventory (Murdoch personal communication 2011). This project became my thesis as a professional project for my Master of Landscape Architecture degree. The following report is the culmination of my on-site inventory, research, process and design proposal that combine to fulfill my capstone project for the Master of Landscape Architecture program at the University of Washington.

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who gave me encouragement to do the project (and to get it done),
and to the Landscape Architecture Department
who taught us to see the larger landscape.
And of course many thanks to the Adopt-a-Stream Foundation
for letting me spend time at such a wonderful place!

DEDICATION

This project is dedicated to my family from whom
I receive much love and support,
and to Lady Hanson who kept me
company through many long nights to get this done.

1.0 INTRODUCTION

For centuries, farmers have drained wetlands to convert them into productive agricultural land (Biebighauser 1-2, 7). Wetland drainage was common practice in the United States in the latter 1800s, not only for agriculture, but for the sake of the community as a whole since wetland was considered "worthless swampland" that harbored diseases and dangerous animals (Biebighauser 8-9). Now wetland conservationists understand the value of wetlands in the landscape. They provide habitat for fish, birds, and other wildlife. They help improve water quality, replenish groundwater, provide stormwater retention, as well as other ecosystem functions (Biebighauser 110).

Even though we have regulations that protect wetlands, biodiversity and endangered species, we continue to lose wetlands and wildlife habitats to urban development (Santelmann and Larson 717; Stokes et al. 451). In a study by Joan Iverson Nassauer, she found a correlation between how attractive the public perceived a wetland to be, and how well the wetland restoration survived human behavior, demonstrating how important cultural values are in the absence of environmental knowledge (" Monitoring" 756-7, 763). Nassauer felt that we either need to design wetland restoration sites to be more attractive to people, or we need to educate them on wetland functions ("Monitoring" 757-8, 763-4). When planning directors in the greater Seattle area were interviewed in a study through the University of Washington, it was found that the values of the local community and their environmental knowledge was important to local land use planning decisions, and that it is important not only to educate the community on decisions that can affect the environment, but the planning departments, developers and local officials as well (Stokes et al. 456-7, 459). Richard Louv, chairman of the Children and Nature Network, believes that people can't value what they don't know. Louv feels there is a disconnect between humans and nature, as students now are more apt to learn their environmental lessons on the computer, rather than spending enough time outdoors to form the connections needed to appreciate and value nature (1, 134-5, 137, 159). This appreciation is formed through experiencing the outdoors firsthand and relating education to personal experience. This creates a more profound impression for students and a stronger connection to the environment (Louv 147, 223, 269), (Tilden 11, 13, 14, 27, 36). The National Park Service believes that "through interpretation, understanding; through understanding, appreciation; through appreciation, protection" (National Park Service n. pag.) They believe that this can occur by spending time outdoors in parks and experiencing what they have to offer (Tilden 34, 38, 88). In addition, Louv and Joan Ehrenfeld felt that we need to bring humans and nature together, as this would provide health benefits to both while fostering environmental ethics (Louv 3, 36, 353; Ehrenfield 731), although Ehrenfeld had some concerns that this would require some concessions between environmental health and human access to nature, as what is best for one is not necessarily optimal for the other (719, 731).

Joan Iverson Nassauer and Joan Ehrenfeld each determined that through the use of interdisciplinary collaborations, natural habitats can be combined with human use

landscapes to form regional systems that improve biodiversity and connect humans to nature in positive ways (Ehrenfeld 730-1) ("Landscape" 677-8). This is what the Adopt-a-Stream Foundation wants to do on the 20-acre property in the southeast portion of McCollum Pioneer Park that they lease from Snohomish County Parks and Recreation.

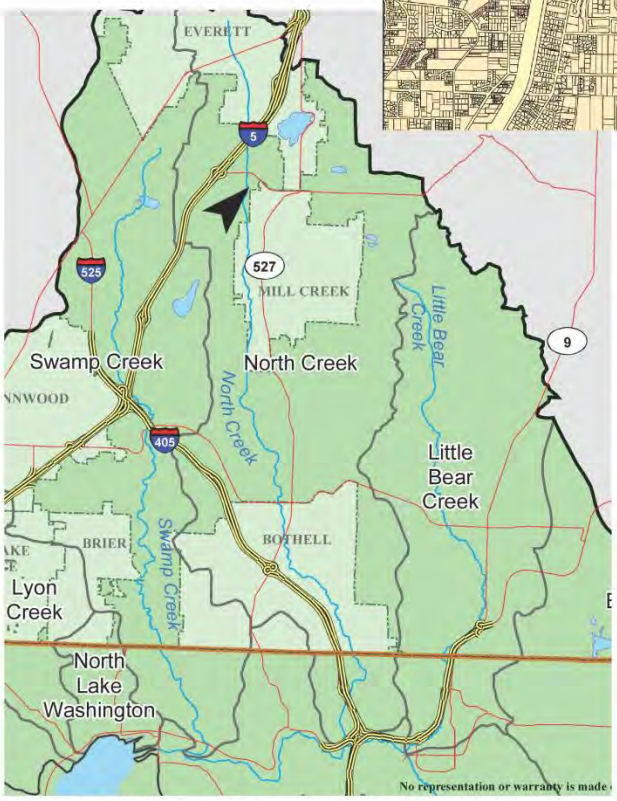


Figure 1.1: McCollum Pioneer Park in Snohomish County, Washington, and the Sammamish River Watershed (Snohomish County Public Works Surface Water Management 2005, and altered by this author)

Location of McCollum Pioneer Park in Snohomish County, Washington

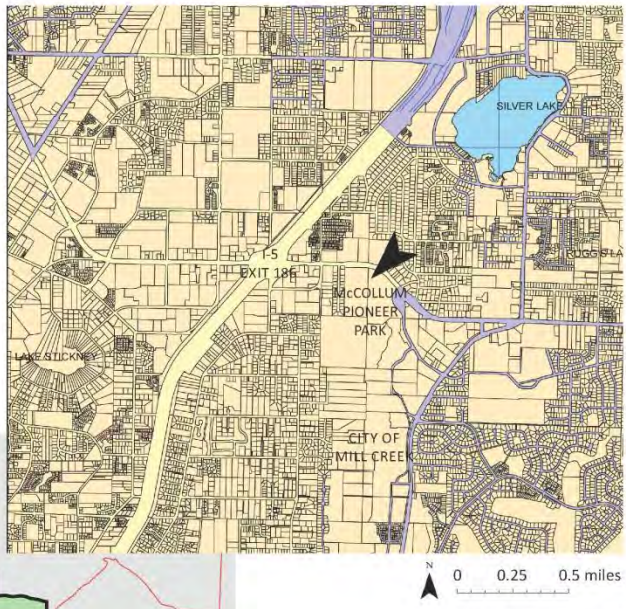


Figure 1.2: Location of McCollum Park east of Interstate 5 in Snohomish County (Data source: Snohomish County 2003)

Here they have built their Northwest Stream Center which provides education on streams, rivers, wetlands, associated wildlife and their habitats, stewardship and enhancement. Located between Everett and Mill Creek in Snohomish County, Washington (figure 1.1 and 1.2), this site contains a large, undeveloped forested wetland south of the center's building.

Currently the Adopt-a-Stream Foundation plans to develop a boardwalk route that extends south from their learning center building into this wetland. This area will be used as an outdoor wetland teaching facility that allows limited access on a boardwalk route, while protecting the delicate wetland habitat and ecosystem functions of the area. The foundation thinks the proposed boardwalk will help bring wetland awareness and understanding to students and visitors, and facilitate the formation of connections between humans and nature, and between professional disciplines (Murdoch, personal comm. 2011) (Adopt-a-Stream n.pag. "Elevated").

In the following section of this paper, 2.0 History, I provide the historical background of McCollum Pioneer Park, North Creek, the Northwest Stream Center and its plans for the near future.

In section 3.0 Site Inventory, I present what I found through researching available data on the watershed and soil, and from my field notes and my photos taken during a grid by grid search of the site, at times with the assistance of two other landscape architect students, Minsoo Doo and Sam McIntyre when taking the measurements. The site findings are separated into hydrological inventory, vegetation inventory, wildlife inventory, other human interest, and inventory of potential concerns.

In section 4.0 Project Considerations, I discuss the project parameters that were given to me by the director of the Northwest Stream Center, Tom Murdoch, and regulatory implications that pertain to this type of project.

Section 5.0 Design Literature Review relays information on design theory that provides background into what enables a boardwalk route to better tell its story while providing the visitor with a provocative experience of a wetland.

The precedents are presented in section 6.0 and include the following three sites in the Seattle, Washington metropolitan area: Mercer Slough Nature Park in Bellevue, Rotary Community Park in Woodinville, and North Creek Park and Water Retention Facility in Mill Creek. These sites were chosen for their wetland function, educational opportunities, boardwalk designs, and their successful coupling of nature and human activities.

Section 7.0 Design Concept uses four principles to develop the concept of using interstitial spaces to provide connections. The principles include connecting humans to nature, humans to environmental education, enabling protection and stewardship, while providing multi-functional landscapes and regional networks.

Section 8.0 Design Process explains how the above mentioned research information and precedent sites can be combined with the inventory of the wetland site at McCollum Pioneer Park to develop boardwalk routes that are examples for each of the following individual design emphasis: budget focus, visitor needs focus, environmental impact focus, and a focus on optimizing the experience.

Section 9.0 Proposed Design takes attributes of each of the four alternatives from section 8.0 to provide a more balanced design proposal for the Northwest Stream Center boardwalk route.

Section 10.0 Conclusions and Reflections discusses what I learned from this project about project communication, clarifying directions, site inventory techniques, design theory combined with site experience, and appreciation of wetland ecosystems.

2.0 HISTORICAL BACKGROUND

The Northwest Stream Center in Snohomish County, Washington, is located in the southeast area of McCollum Pioneer Park where they lease 20 acres from Snohomish County Parks and Recreation (Snohomish County Parks & Recreation, "McCollum Pioneer Park" n. pag.; Murdoch pers. comm. 2011). The west border of the property is North Creek and the north border is the parking lot of their building. To the east is another privately-owned forest which continues from the Parks Department land. The east border extends approximately one thousand feet south, without a fence line, from the southeast corner of the plant nursery to a marker just south of Sitka Creek which crosses the property at the southeast corner. From this corner the property line heads west to North Creek in line with a private resident's chain link fence just beyond the west bank of North Creek. South of the leased property, the wetland forest continues through a conservation area (Murdoch, pers. comm. 2011).

Just prior to the **1900s**, the area was logged and became known as Emander, a name derived from the initials of the logging company (Snohomish County Parks & Recreation, "History" n. pag.). At this time, much of North Creek was straightened to allow passage of large old growth timber from the area down to Lake Washington (WSDOE "Publ. 07-10-061" n. pag.). In the **1920s**, after it was logged and platted, settlers moved into the area. In the **1930s**, it was used as a gravel mine to provide materials for the construction of Paine Field Air Base. Once the gravel was removed, the site became a dumping ground during the **1940s** (SCPR "History" n. pag.). In the **1960s,** volunteers from the South End Federated Clubs built an outdoor picnic shelter, and a parking lot was put over part of the wetland (Enterprise staff n. pag., SCPR "History" n. pag.). The park was formally dedicated in **1964** as J. E. (Ed) McCollum Pioneer Park after the county commissioner, and the pool was built in **1968** (SCPR "History" n. pag.).

In the **1970s,** North Creek, including the McCollum Park stretch, had significant populations of salmon and trout (Sheets n. pag.). During the **1980s**, development increased in Snohomish County to the point that the county created a stormwater department in **1988** due to the loss of wetlands in the area. The wetland loss also affected the area's stream flow patterns with water rushing through in the winter, then some streams so low in the summer that it damages fish spawning habitat, as has been the condition of North Creek since **1987** (Sheets n. pag., Dietrich n. pag.). Commenting on the once significant salmon population in the segment of North Creek that flows through McCollum Park, Tom Murdoch the director at the Northwest Stream Center said, "Now you're lucky if you see two or three" (Sheets n. pag.).

In the early **1980s,** the Parks Department built their headquarters at the McCollum Park site. The Adopt-a-Stream Foundation was established by Tom Murdoch there in **1981** as a Snohomish County program to raise public awareness of the streams and rivers in the county. However, since 1984, the buildings have been occupied by the Washington State University Cooperative Extension where they use them as offices and classrooms. In **1985** the Adopt-a-Stream Foundation broke from the county and became a non-profit foundation with a mission "to teach people how to become

stewards of their watersheds" (Rathbun n. pag., Adopt-a-Stream Foundation n. pag., Pemberton-Butler n. pag.).

In the **1990s**, the dump at McCollum Park was capped with a high-density polyethylene liner and at least 18 inches of soil. A gas incinerator system was also installed. In **1992** the Snohomish County Parks and Recreation allowed the Adopt-a-Stream Foundation to take out a long-term lease of the southeast 20-acre area of McCollum Pioneer Park to develop the Northwest Stream Center (AASF n. pag.). The county began to renovate the park ball fields, pool facility, and landscape in **1994** and built a Community Transit Park and Ride facility in the northeast section of McCollum Park (SCPR "History" n. pag.).

While the park was being renovated, Adopt-a-Stream removed the large 4-acre gravel parking lot left behind by the Parks Department and then worked to restore the wetlands. They formed a bioswale southeast of the current parking lot which takes stormwater runoff from the parking lots and buildings located there. They dug two ponds south of the buildings which filled with ground water. One serves as a detention pond for water from the bioswale (photo 2.1) and the other (photo 2.2) provides habitat for a family of ducks, frogs and other wildlife, (Pemberton-Butler n. pag., Dietrich n. pag.).

In **1998**, Adopt-a-Stream Foundation began construction of their Northwest Stream Center at the site of the old Parks Department headquarters, south of the park buildings, which are being used by the WSU Extension office (SCPR n. pag.). Now completed, the center's building (photo 2.3) contains a theater, meeting room, library, offices, gift store and other facilities. Construction then began, in **2007**, on a 200-foot long trout stream exhibit (photo 2.4). The exhibit now includes a 6-foot pool, and a viewing window. It uses water from the nearby duck pond to circulate through the manmade stream exhibit, and soon it will also display educational signs explaining fish habitat (Enterprise staff n. pag., Murdoch pers. comm. 2011).

Photo 2.1: Bioswale/detention pond (Hanson 2011)

Photo 2.2: Duck pond (Hanson 2011)

Photo 2.3: Northwest Stream Center (Hanson 2011)

Photo: 2.4: Trout stream exhibit (Hanson 2011)

In the meantime, the Adopt-a-Stream Foundation partnered with Snohomish County Parks and Recreation to develop the North Creek Greenway project. The purpose of the project is to protect salmon and other wildlife habitat along the creek by purchasing conservation easements in some segments, and preserving the habitat along the route between McCollum Park, through Mill Creek and south to Thrasher's Corner Park in Bothell, Washington (Vinluan n. pag., AASF n. pag.). In the following section, 3.0 Site Inventory, I will discuss the North Creek habitat conditions that were inventoried and reported in 2001 for King County. Although North Creek itself forms the west border of the McCollum Pioneer Park site, the current boardwalk route planned for the Northwest Stream Center will not be directly connected to the North Creek Greenway project route. In section 6.0, I will discuss some of the above mentioned research information with the North Creek Park precedent site, as it is part of this greenway project. In section 8.0 Design Scenarios, this will be combined with the inventory of the McCollum Pioneer Park wetland site to develop boardwalk alternatives that are examples of each scenario.

3.0 SITE INVENTORY

The following site inventory consists of two parts. The first part is based on a review of available data and maps of the North Creek watershed, its overall habitat conditions and soils. While I did not do an actual wetland delineation as established by the Department of Ecology and the Department of Fish and Wildlife, in the second part I discuss the on-site information collected from my field notes and the photographs I took throughout the course of the site inventory process. Together they show the characteristics of the site for the purposes of viewing by visitors who will use the proposed boardwalk.

While wetlands are areas that have standing water, they are more than just wet soil. Wetlands are determined by the following three basic features: hydrology, soil, and vegetation (Mitsch and Gosselink 28-9, 35). In wetlands, shallow water or saturated soil is present for a significant period of time during the vegetation growing season. Often wetlands can be found in areas of transition between terrestrial and aquatic habitats and are affected by both. Soil conditions, another feature, are due to the presence of water for longer durations which causes soils to become "hydric" or more anaerobic due to the low levels of oxygen (Mitsch and Gosselink 108-9, 164). Vegetation is the third feature, as plant roots need to be able to function with the extended period of water and low levels of soil oxygen that comes with wetlands (Mitsch and Gosselink 108-9, 173).

3.1 Watershed

The site where the Northwest Stream Center is located has North Creek as its west boundary. North Creek watershed is a subarea of the Sammamish watershed between the Swamp Creek and the Little Bear Creek subareas as shown earlier in the map of figure 1.1 (Snohomish County Public Works Surface Water Management n. pag.). The head waters of North Creek are located by the Everett Mall shopping center in Everett, Washington, west of Interstate 5 where there once was both forested, and open wetlands (Fevold et al. 5). From there the 13-mile creek heads south and runs through McCollum Park and then cuts into the west border of the recently developed city center of Mill Creek (City of Mill Creek n. pag.). This newly developed area includes native plants and protected wetland conservation easements as part of the North Creek Greenway project that Snohomish County Parks and Recreation and the Adopt-a-Stream Foundation worked together to establish (Adopt-a-Stream n. pag., Bach n. pag.). North Creek crosses 164th Street and then goes into another protected wetland nature area found at North Creek Park. North Creek Park will be discussed later as a precedent site in section 6.0. From North Creek Park, the creek heads south and goes through the Thrasher's Corner Park, another wetland. As part of the North Creek Greenway project, acreage is planned to be preserved north of this wetland, as there is a healthy salmon habitat here (Vinluan n. pag.).

North Creek continues through urbanized areas and then flows through the restoration segment of the University of Washington Bothell campus, before it merges

with the Sammamish River. The campus has 58 acres of restored wetlands and channels (Society of Wetland Scientists 14). The North Creek Greenway is planned to be a regional system that will connect the Burke-Gillman Trail that goes through this campus area to the Snohomish County Regional Interurban Trail in Everett. The greenway route will use boardwalks through wetland areas, and when the project is completed, will provide salmon habitat from both sides of the creek for the entire length of North Creek (Vinluan n. pag.), (SCDPW "Trail #RC1546 n. pag, SCDPW "North Creek Trail" n. pag.).

In 2001, the Water and Land Resources Division of King County Department of Natural Resources prepared a habitat inventory of North Creek, Swamp Creek and Little Bear Creek, which are three tributaries of the Sammamish River (figure 1.1). North Creek was assessed as far north as McCollum Park which was labeled segment number 13 (Fevold et al. 31). Map 9 of their report (figure 3.1) shows their overall assessment of the salmon habitat in the Mill Creek area including the McCollum Park site (Fevold et al. 43). The habitat quality index is rated high through McCollum Park and south to 164th Street SE in Mill Creek. However, other segments of North Creek are rated lower due to the lack of complex habitat needed for salmon populations (Fevold et al. 38-9, 61). Since the 1960s, sockeye and kokanee salmon have used the south end of North Creek as a spawning area. Coho and Chinook also use North Creek (Fevold et al. 1, 5). During the assessment period, juvenile salmon were seen in North Creek, but not in the northern segments such as McCollum Park. Freshwater mussel beds, however, were found in the segment containing McCollum Park (Fevold et al. 39). According to King County's Water and Land Resources Division website, while the North Creek Subarea has salmon such as Chinook, sockeye and kokanee, as well as Coho and steelhead trout, altered hydrology, fish barriers and low channel complexity are problems for salmon habitat here (KCWLRD *Water Quality Monitoring n. pag*). In addition, due to leaking septic tanks, pet waste, washing cars, fertilizers and other chemicals, there are unacceptable levels of fecal coliform bacteria, lead, mercury and copper in North Creek which pose health problems for both fish and humans (Bach n. pag.).

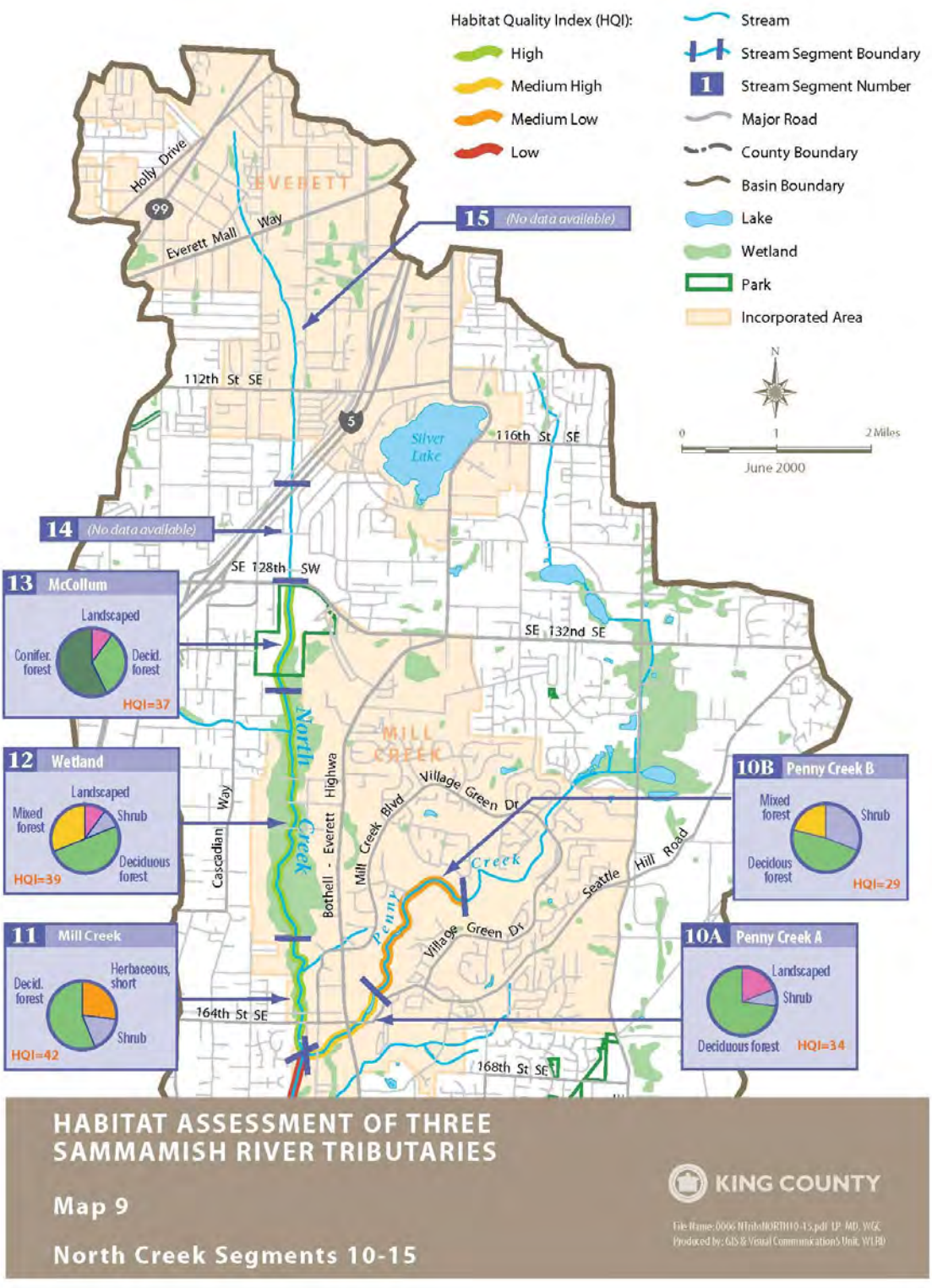


Figure 3.1: Habitat Assessment Map 9 of North Creek Segments #10-15 (Fevold et al. 43)

3.2 Soils

Wetland soils are formed in areas where water is present for a sufficient amount of time to produce anaerobic conditions (Mitsch and Gosselink 164). Wetland soils can be organic or mineral soils. Organic soils act like sponges to hold water and can slow the flow of stormwater. They also hold minerals in organic forms that plants can't access (Mitsch and Gosselink 166). Mineral soils are also found in wetlands, but contain characteristics that occur due to the anaerobic conditions found in there. Gleying is one characteristic that occurs due to water saturation causing a chemical reaction. This reaction reduces iron and manganese to soluble forms that leach out of the soil leaving behind the gray color of the matrix (Mitsch and Gosselink 169). Mineral soils that are flooded seasonally contain orange to reddish-brown oxidized iron or manganese spots, as well as streaks called "mottles" or "redox concentrations" that leave behind insoluble minerals (Mitsch and Gosselink 170).

The soils of this wetland site are Everett gravelly loam (0-8% slopes), McKenna gravelly silt loam (0-8% slopes), Mukilteo muck (0-1% slopes), and Xerorthents (level) (U.S. Dept. of Agriculture Soil Conservation Service 6, 20, 30-32, 60). Everett gravelly sandy loam, with 0-8% slopes, is very deep, somewhat excessively drained soil on terraces and outwash plains, and was formed in glacial outwash. Permeability of this soil is rapid, available water capacity is low, runoff is slow, and the water erosion hazard is slight. Douglas-fir is the main woodland species of this soil type which is suitable for year-round logging and urban development. This soil also provides rock for road construction, or in this case, gravel for the construction of Paine Field (USDASCS 20, SCPR "History" n. pag.).

McKenna gravelly silt loam, with 0-8% slopes, is moderately deep and poorly drained. It is found in depressional areas and drainage ways on till plains, and was formed in glacial till. Permeability and runoff of this soil is slow, and the erosion hazard is slight. A seasonal perched water table is at a depth of 0-6 inches, and ponding can occur from November to April limiting building or the use of septic tanks. Unpaved roads and trails are soft and useless when wet, and equipment used at this time can compact soil and damage tree roots. A boardwalk would be a good choice for this type of soil, but a composting toilet or septic system restroom would not. Red alder and western redcedar are the main woodland species but are often subject to windthrow

Photo 3.2: Site soil (Hanson 2012)

Photo 3.3: Windthrow sector 332 (Hanson 2012)

here as seen in photos 3.2 and 3.3 (USDASCS 30). The red alder tree roots are shallow in this soil and the water ponds here. Several red alder trees fell in sectors 332 and 340 during a windy winter storm late January 2012.

Mukilteo muck is very deep, very poorly drained soil, with a high water capacity, moderate permeability and is found in depressional areas with slopes of 0-1%. Formed mainly from sedges, it is a classic organic hydric soil. Sedges and rushes are the dominant plant species in this soil. The water table is at or near the surface from October to May as runoff is ponded. Not usable for urban development or septic systems, it is mainly used for cropland such as blueberries, pasture and wildlife habitat (USDASCS 31-2, Dept. Natural Resources 139).

Xerorthents consist of areas where the surface layer, subsoil, and substratum have been greatly disturbed or replaced with other soil material. Included in this soil are small areas of Alderwood, Tokul, and Indianola soils, as well as potential debris. This type is used mainly for unpaved parking areas, fill sites, and athletic fields which have all been present at McCollum Pioneer Park (USDASCS 60). A quick view of the soil characteristics and their associated vegetation is found in table 1.

SOIL INVENTORY				
Soil Name	**Everett gravelly sandy loam**	**McKenna gravelly silt loam**	**Mukilteo muck**	**Xerorthents**
Unit #	17	32	34	82
Slope	0-8%	0-8%	0-1%	level
Characteristics	excessively drained	in depressional areas, formed in glacial till, poorly drained & ponding	organic material from sedges in depressional areas	surface layer,sub-soil & substratum greatly disturbed or replaced
Permeability	rapid	slow	moderate	highly variable
Water Capacity	low	moderate	high	highly variable
Use	woodland urban development rock source logging	woodland & pasture	wildlife habitat pasture	unpaved parking athletic fields & fill
Main Tree Species	Douglas-fir	red alder western redcedar	none	conifers
Limited Tree Species	western hemlock western redcedar red alder	western hemlock	none	variable
Common Understory	salal bracken fern red huckleberry Oregon grape	western sword fern red huckleberry Oregon grape native blackberry	sedges & rushes	variable

Table 1: Soil Inventory (information from the U.S. Dept. of Agriculture Soil Conservation Service 1983: 6, 20, 30-2, 60; Dept. of Natural Resources 139).

3.3 On-site Inventory and Characterization

At this point I begin the inventory based on the information I collected from field notes and photographs of the site during this inventory process. From this information I developed a vegetation map to express spatially the vegetation of the site. Then I drew an experiential map that reflects my personal experience of the site, my encounters with wildlife and other objects not on the vegetation map.

3.3.1 Methods

The on-site inventory process started in July 2011 as a volunteer project for a summer internship. Sam McIntyre, Minsoo Doo and I, students in the University of Washington Landscape Architecture Program, worked together to set up a methodology for measuring and mapping the wetland area into grid sectors. The sectors we used were 30 x 30 feet in the northern half of the property, and either 30 x 30, or 30 x 60 feet in the southern half of the property and were measured from transect lines (figure 3.4). We ran a north to south line beginning at the end of the plant nursery fence as we were told it formed part of the east border of the property. This section of fence was only 75 feet long so the rest of the border we lined up with a compass as best as we could. A professional would be needed if the actual border were to be determined. We set up another north to south line that ran along the west side of the duck pond south from the trout stream display. We did this to break up the site width, maneuver around the ponds and give us a line from which to measure when we headed west to the irregular edge of North Creek which borders the west side of the site. The west side analysis also included the west bank areas of North Creek. The east side analysis may have included some area just over the boundary as a very large red alder tree fell onto the boundary line rope altering it a bit. However, it appears more likely our line veered slightly westward as we moved farther south. The wetland forest just continues past the edge of the property and the property line is not clear in the south. The actual site boundary should be determined professionally if use of the east edge of the property is needed in the south, particularly through this section as it is difficult to access. The sectors were numbered from 1-520 (figure 3.4) and were later used to develop site maps showing locations of water, vegetation types and other details. The on-site inventory consisted of noting vegetation (canopy, mid-canopy, shrubs, understory, invasive plants), hydrology (ponds, standing water, mud, flowing water, creeks), wildlife (seen or evidence), habitat features, and other characteristics that might be of interest to visitors for educational purposes that could be accessed by a boardwalk through the site. I wrote the field notes and took the photos of all sectors, and this is what I used to compile the on-site inventory. When the internship was over in August 2011, I continued the inventory alone. My husband Mark Hanson assisted on occasion with the sector measurements and these days are marked in the field notes of Addendum A. I took several photographs of each sector and they are now on file at the Adopt-a-Stream Foundation office.

Figure 3.4: Site inventory grid (Hanson 2012), (photo: City of Mill Creek "2007 Aerial")

3.4 Hydrological Inventory

According to the Snohomish County GIS data, almost 75% of the area of McCollum Pioneer Park that the Adopt-a-Stream Foundation leases is wetland as seen on the site map (figure 3.5) (Snohomish County Dept. Info. Services n. pag). During the inventory, I observed and noted hydrological conditions for each sector.

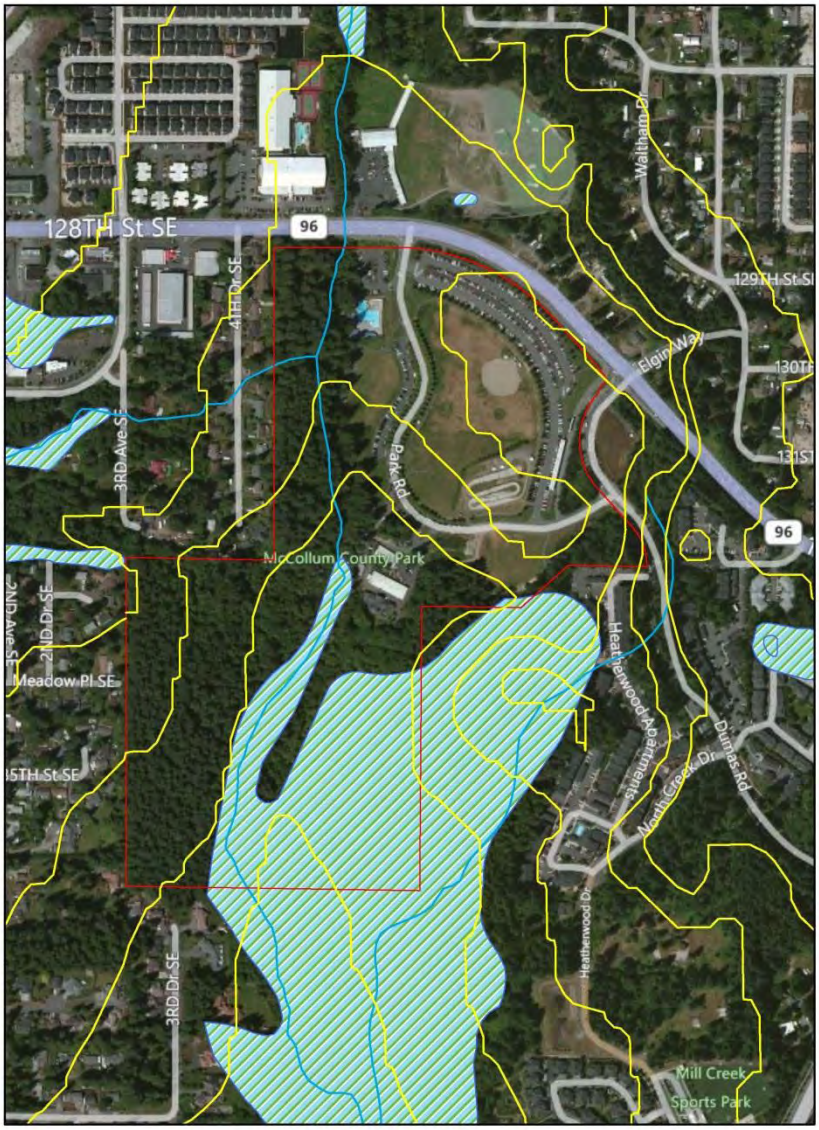


Figure 3.5: McCollum Pioneer Park Map (data source: Snohomish County Dept. Info. Services 2003)

West of North creek, which is the west border of the Northwest Stream Center site, is another forested area also owned by the Snohomish County Parks Department. I observed the water level of North Creek to fluctuate from time to time depending on precipitation, seasonal conditions, and actions by the City of Everett to pump water from two underground wells into the creek. They do this between May 1 and November 15 when it is dry in order to keep water in the creek (Sheets n. pag., Murdoch pers. comm. 2011, City of Everett Public Works Dept. n. pag.). In photos 3.6-3.7 are

Photo 3.6: North Creek low water flow June 24, 2011 (Hanson 2011)

Photo 3.7: North Creek high water flow on Sept. 16, 2011 (Hanson 2011)

Photo 3.8: Floodplain of North Creek building up sand and rocks (Hanson 2012)

Photo 3.9: Sitka Creek (Hanson 2012)

Photo 3.10: Sitka Creek (Hanson 2012)

examples of low and high flow conditions of the creek. During the higher flow periods, rock and gravel piles up along the creek bank in places (photo 3.8). The flow rate of North Creek is monitored by King County Water and Land Resources Division near the King/Snohomish County line (KCWLRD “Hydrologic” n. pag.). The most recent data results for a one-year period run from October 2009 to September 2010. During this

period, November 2009 was the highest recorded monthly average flow rate with 126.05 cfs (cubic feet per second), while July 2010 and August 2010 were the lowest with 21.37 and 21.47 cfs (KCWLRD "Hydrologic Info." n. pag.). In the following table (table 2) are the monthly flow rates for this one year time period.

Monthly Flow Rate Results for North Creek				
Collection Date	Discharge (cfs)		Collection Date	Discharge (cfs)
Oct. 2009	57.82		Apr. 2010	50.34
Nov. 2009	126.05		May. 2010	41.48
Dec. 2009	61.87		Jun. 2010	52.57
Jan. 2010	97.59		Jul. 2010	21.37
Feb. 2010	58.92		Aug. 2010	21.47
Mar. 2010	52.83		Sept. 2010	44.32

Table 2: Monthly Water Flow Rate for North Creek (data source KCWLRD "Hydrologic Info.")

Sitka Creek (photos 3.9-3.10) flows through the southeast corner of the property. Its headwaters begin northeast of this site on the adjacent property and it flows year round (Murdoch pers. comm. 2011). It is shown just outside the property line in the map of the site (figure 3.5), but the on-site property marker shows it to be just inside the property line. Consequently, if boardwalk construction goes near the area, a professional should determine the true boundary of the site's southeast corner.

There are two ponds south of the Northwest Stream Center building constructed by Adopt-a-Stream after removing some of the Parks Department's former parking lot in 1995 (Pemberton-Butler n. pag., Murdoch pers. comm. 2011). One pond begins at the bioswale (photo 3.11) just east of the building that takes stormwater runoff from the parking lot and buildings, and then water flows south into the detention pond (photo 3.12) southeast of the Northwest Stream Center building. The other is the duck pond (photo 3.13). It is located southwest of the building and is sustained by the wetland. This pond is the source of water that cycles through the trout stream exhibit (photo 2.4), another project of the Adopt-a-Stream group (Murdoch pers. comm. 2011-12).

Photo 3.11: Bioswale

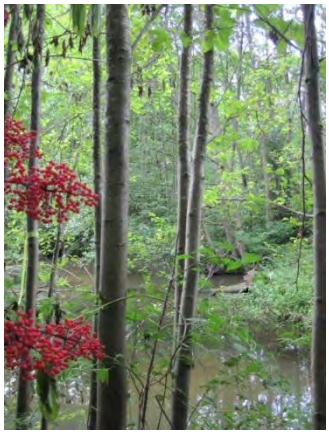


Photo 3.12: Detention pond

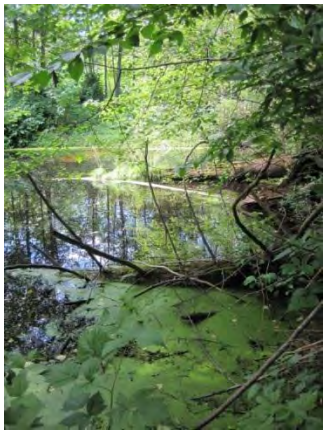


Photo 3.13: Duck pond

(3 photos by Hanson 2011)

There also are smaller ponds on the site connected to old drainage trenches dug years ago that still carry water (Murdoch pers. comm. 2011-2). One is found in the sectors 36, 253-255 south of the detention pond. A set of ponds at the end of a south flowing trench is located in sectors 275-6, 281-284, and another small one in sector 197. There is a much larger pond that takes up most of the 2 sectors 491-492 at about 50 x 60 feet, but whether it was manmade or from natural topography is unknown. The ponds are all located in the two inventory maps (figures 3.29 and 3.43). Most of the site, as seen in the site wetland map (figure 3.5), is considered wetlands and much of it has standing water year round (Murdoch pers. comm. 2011). My hydrological inventory of the site again is to determine the variety of wetlands for the purpose of public viewing.

Photo 3.14: Ducks in sector #254 (Hanson 2011)

Photo 3.15: Pond hidden in sector #283 (Hanson 2011)

Photo 3.16: Pond in sectors #491-2 (Hanson 2011)

3.5 Vegetation Inventory

Another feature of wetlands is vegetation. A way to determine wetland plant species is to identify them and look at their Wetland Plant Indicator Status as defined by the U.S. Fish and Wildlife Service (Cooke iii). If an area is dominated by hydrophytic plants, it is one indication that an area is a wetland (Mitsch and Gosselink 108-9). I did not do a wetland delineation as established by the Department of Ecology and used by Snohomish County (*Snohomish County Code* 540-542). However, I did provide a vegetation inventory table (table 3) that contains a list of the plants found at the site and the U.S. Fish and Wildlife Service plant indicator status for each as listed in the *Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon* edited by Sarah Spear Cooke (Cooke iii). The status symbols are listed at the end of the table, but they include obligate wetland species (OBL) indicating a >99% probability of wetland fidelity, facultative wet wetland species (FACW) with a 67-99% probability, facultative wetland species (FAC) with a 34-66% probability, facultative upland species (FACU) with a 1-33% probability, and obligate upland species (UPL) with a <1% probability of wetland fidelity, or those not generally found at wetlands (Cooke iii).

For the purposes of discussing the wetland vegetation types and habitats found at the site, I used the wetland classification system of the U.S. Fish and Wildlife Service (Cooke v). The habitats found on the site include dry forest or dry hummock areas, forested wetland, scrub-shrub wetlands, emergent wetlands and aquatic bed wetlands (Cooke v). I used these categories to prepare the vegetation inventory map (figure 3.29) as the first layer to show the vegetation types of each sector. I have also listed the vegetation inventory in table 3. In the following photos are examples of some the different types of plant communities found here (photos 3.17-3.22).

Photo 3.17: Dry forest of Douglas-fir, salal, Oregon grape, vine maple & sword ferns (Hanson 2011)

Photo 3.18: Forested wetland of western redcedar, moss & saturated soil (Hanson 2011)

Photo 3.19: Scrub-shrub wetland (Hanson 2011)

Photo 3.20: Scrub-shrub wetland (Hanson 2011)

Photo 3.21: Emergent wetland (Hanson 2011)

Photo 3.22: Emergent wetland (Hanson 2011)

Common understory plants such as spirea, twinberry or salmonberry, are indicated on the vegetation map to further determine the variety of wetlands found at the site, as are interesting shrubs and trees found in small quantities (photos 3.23-3.28).


Photo 3.23: Black cottonwood (Hanson 2011)


Photo 3.24: Spirea (Hanson 2011)


Photo 3.25: Pacific crab apple (Hanson 2011)


Photo 3.26: Devil's club (Hanson 2011)


Photo 3.27: Pacific willow (Hanson 2011)


Photo 3.28: Pacific ninebark (Hanson 2011)

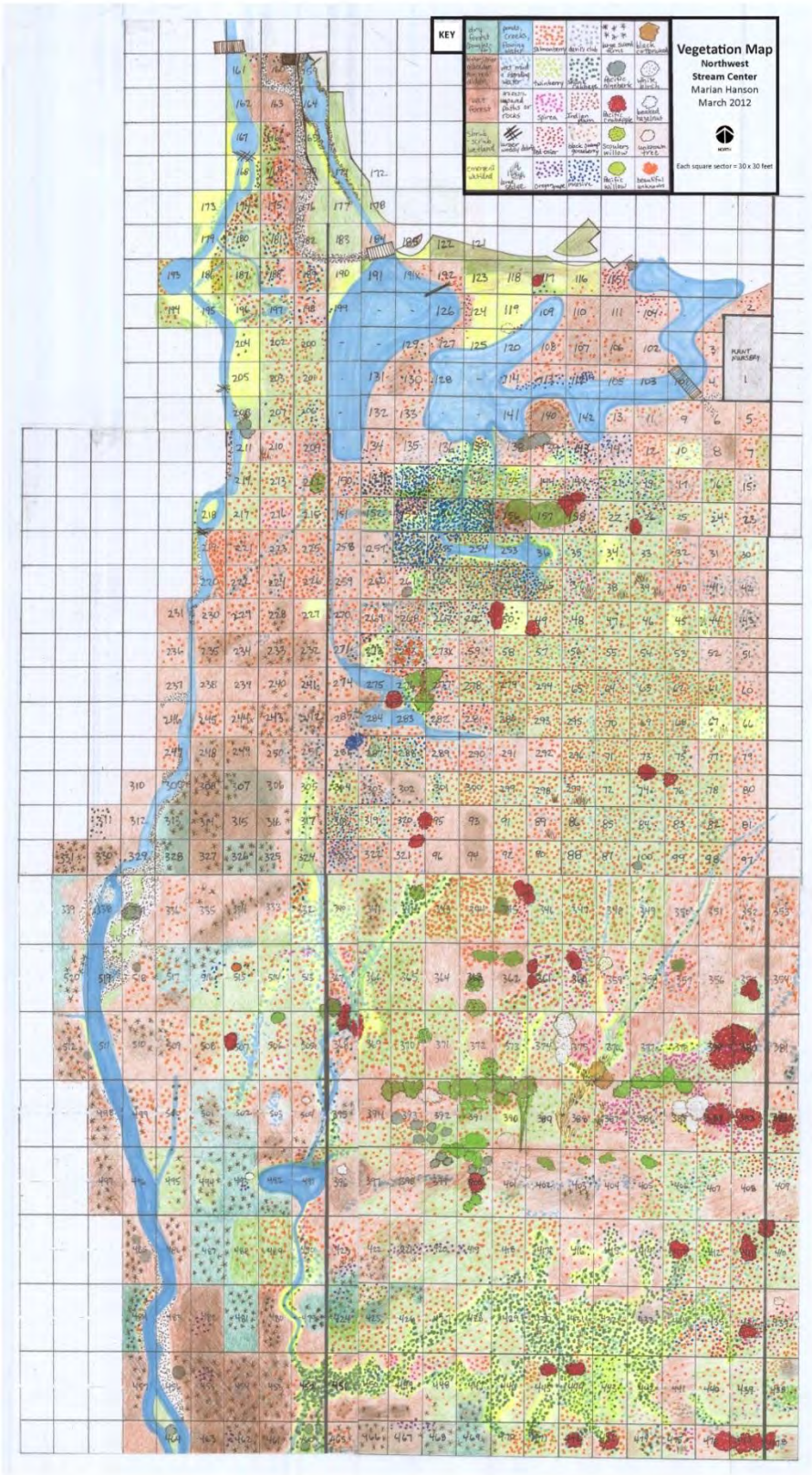


Figure 3.29: Vegetation Inventory Map (Hanson 2012) 0 90 feet

VEGETATION INVENTORY		Indicator	
Botanical Name	**Common Name**	**Status**	**Functional Value**
Tree Canopy:			
Alnus rubra	Red alder	FAC	N-fixing bacteria; cavity-nesting for birds & small mammals
*Betula papyrifera**	White birch	NI	
Picea sitchensis	Sitka spruce	FAC	Habitat for many species; predatory bird roost; deer browse shoots
Populus balsamifera ssp. trichocarpa	Black cottonwood	FAC	Shoreline stabilization, bees collect bud resin (antiseptic)
*Pseudotsuga menziesii**	Douglas-fir	NI	Naturally establishes after fires on wet sites & can live 1,000 years
Thuja plicata	Western red cedar	FAC	Undergrowth canopy; bird nest snag; hollow stumps for bears, raccoons & other wildlife
Tsuga heterophylla	Western hemlock	FACU	Habitat for fungal and animal species
Shrubs & Small Trees			
Acer circinatum	Vine maple	FAC	Bird nesting; browse for deer, squirrels, birds
Cornus stolonifera aka *C. sericea*	Red-osier dogwood	FACW	Songbird nesting; twig, foliage, fruit browse
Corylus cornuta var. californica	Beaked hazelnut	FACU	Nuts for squirrels, browse for deer; low nests
Gaultheria shallon	Salal	FACU	Fruit food for wildlife & humans; deer browse
*Holodiscus discolor**	Oceanspray	NI	(Planted by AAS)
Ilex aquifolium	Holly	FACU	Fruit for birds; an escaped ornamental plant
Lonicera involucrata	Black twinberry	FAC+	Deer browse; bear & birds eat berries; nest material for small mammals & birds
Mahonia nervosa aka *Berberis nervosa*	Dwarf Oregon grape	FACU	Birds eat fruits & deer browse
Malus fusca	Pacific crab apple	FACW	Herbivore browse & birds eat fruit; thickets provide escape & nesting for birds
Oemleria cerasiformis	Indian plum	FACU	Birds eat fruit, nesting for small songbirds
Oplopanax horridus	Devil's club	FAC+	Bears eat fruit; effective buffer prevents intrusion
Physocarpus capitatus	Pacific ninebark	FACW-	Twigs, buds & foliage browsed by herbivores
Ribes lacustre	Swamp gooseberry	FAC+	Wildlife and birds eat fruit
Rosa nutkana	Nootka rose	FAC	Fruit for wildlife & birds; food for browsers; thickets for bird nesting & escape
Rubus laciniatus	Evergreen blackberry	FACU+	Wildlife eat fruit; escape habitat; buffer; songbird nest sites; invasive non-native
Rubus procerus aka *R. discolor*	Himalayan blackberry	FACU(fac)	Wildlife fruit; escape habitat; songbird nest invasive non-native forms monocultures
Rubus parviflorus	Thimbleberry	FACU	Wildlife eat fruit, leaves & twigs for browse, cover & nesting
Rubus spectabilis var. spectabilis	Salmonberry	FAC+	Wildlife eat fruit; flowers for insects, bees & hummingbirds; browse for deer; songbird escape habitat & nesting
Rubus ursinus	Trailing blackberry	FACU	Low growing plant offers food for birds & small mammals
Salix lucida var.*lasiandra*	Pacific willow	FACW+	Erosion control, shades fish habitat
Salix scouleriana	Scouler willow	FAC	Most shade tolerant native willow
Sambucus racemosa ssp. pubens	European red elderberry	FACU	Fruit for birds & mammals; foliage & twigs for browsers

OBL= obligate wetland species, FACW = facultative wet wetland species, FAC = facultative wetland species
FACU = facultative upland species, UPL = obligate upland species, NI = no indicator status

Table 3: Vegetation Inventory of Site (part 1) (Info source: Cooke 1997, Pojar et al. 1994)

VEGETATION INVENTORY continued		Indicator	
Botanical Name	**Common Name**	**Status**	**Functional Value**
Shrubs & Small Trees continued			
Spiraea douglasii	Douglas spirea	FACW	Escape & bird nesting; seed food for birds & small mammals; graze for herbiviores; inhibit other species survival
Vaccinium parvifolium	Red huckleberry	FACU	Fruit for songbirds, game birds, mammals;
Herbs			
Aster subspicatus	Douglas aster	FACW	
Cornus canadensis aka *C. unalaschkensis*	Dwarf dogwood or Bunchberry	FAC	Edible berries
Epilobium ciliatum aka E. watsonii	Watson willowherb	FACW	
Galium aparine	Cleavers bedstraw	FACU	
Geum macrophyllum	Largeleaf avens	FACW	Leaves & roots used by Native Americans
*Impatiens capensis or I. noli-tangere**	Spotted touch-me-not	FACW	
Iris pseudacorus	Yellow iris	OBL	Sediment retention, shoreline stabilization; improves water quality & wildlife refuge; attracts insects & birds; can be invasive
Lemna minor	Small duckweed	OBL	
Lotus corniculatus	Birdsfoot trefoil	FAC	Wildlife seed & browse; hosts nitrogen-fixing symbiotic bacteria aids nutrient cycling & erosion control, can become invasive
Lysichiton americanum	Skunk-cabbage	OBL	Deer, elk & bear eat leaves; wildlife eat roots; food & mating site for insects.
Maianthemum dilatatum	False lily-of-the-valley	FAC	Birds, hares & small rodents eat berries
Oenanthe sarmentosa	Water-parsley	OBL	Enables sediment settling; good for wetland restoration but resembles very poisenous water hemlock
Ranunculus repens var. repens	Creeping buttercup	FACW	Native to Eurasia, it freely invades meadows
Solanum dulcamara	Bittersweet (climbing) nightshade	FAC+	Birds eat berries; Eurasian species common to the Pacific Northwest
Tolmiea menziesii	Piggy-back plant	FAC	
Urtica dioica ssp. *gracilis var. lyallii*	Stinging nettle	FAC+	Native Americans used for cords; can be eaten if cooked
Rushes, Sedges, Grass			
Juncus effusus	Soft rush	FACW	Muskrats feed on rootstalks; shelter for wetland birds
Scirpus microcarpus	Small-fuited bulrush	OBL	Nesting material & food for wildlife
Phalaris arundinacea	Reed canary grass	FACW	Pasture grass in wet agricultural areas; cover by wildlife; invasive non-native
Ferns			
Blechnum spicant	Deer fern	FAC+	Winter food for deer & elk
Dryopteris expansa	Spreading wood fern aka shield ferns	FACU	
Polypodium glycyrrhiza	Licorice fern	FACU	Epiphyte on trees & logs
Polystichum munitum	Sword ferns	FACU	
Pteridium aquilinum var. pubescens	Bracken fern	FACU	Can form thicket-like cover for songbirds & small mammals
Equisetum arvense	Common horsetail	FAC	

OBL= obligate wetland species, FACW = facultative wet wetland species, FAC = facultative wetland species FACU = facultative upland species, UPL = obligate upland species, NI = no indicator status

Table 3: Vegetation Inventory of Site (part 2) (Info source: Cooke 1997, Pojar et al. 1994)

3.6 Wildlife Inventory

Throughout the Northwest Stream Center wetland wildlife, signs of wildlife, and wildlife habitat are present. The site offers water in many forms. A variety of food is available including many edible berries, browse for herbivores, flowers for insects, insects and small animals for carnivores. Plant species with berries and fruit are found in most of the sectors including, salmonberry, red huckleberry, red elderberry, twinberry, Oregon grape, Pacific crab apple, salal, Indian plum, Devil's club, black swamp gooseberry, native trailing blackberry, Nootka rose, thimbleberry, bunchberry dwarf dogwood, Himalayan blackberry, bittersweet nightshade and false lily-of-the-valley (Cooke 140, 190) and (Pojar et al. 82, 85, 103, 320, 325).

Many bird species live in this area. I saw pileated wood peckers, crows, blue jays, robins, hummingbirds, chickadees, bushtits and even barred owls here, and heard many species of song birds in the trees, along the creek and in more open meadows and scrub-shrub areas. I watched for months as three young ducklings grew up together while their mother carefully kept an eye on them.

Frogs could be heard throughout the site, and garter snakes crossed the gravel paths and were in the buttercup meadow south of the building. Flies, water skippers and dragonflies were common above North Creek and the two ponds near the buildings, while isolated pockets of mosquitoes were scattered around the site. Bees, butterflies, and moths were observed in the open sunny grassy areas.

Woody debris of various types are located in many areas of this landscape. Large woody debris provides habitat structures such as tree snags for birds, hollowed out stumps for nesting and refuge, rotting wood for plants and insects, and large woody debris for fish habitat along the creek. Animals such as beaver and woodpeckers have left their marks on the wood as well. One may have been made by bear claws on a tree (Moskowitz 239).

Deer, beaver and raccoons leave tracks in the mud along the southwest edge of the duck pond (Moskowitz 66, 69). Holes dug by animals range in size from 1 inch to 1 ½ feet. I have found bird nests made of sticks, grass and even a small one in a salmonberry shrub made entirely of moss.

Beaver activity seems to congregate near the north area of North Creek, and just south of the detention pond. They have cut trees and made dams in the creek. They trampled skunk cabbage and left footprints in the mud. Some trees are missing bark.

Habitat structures such as ponds, trees, birdhouses, and nesting material are also available at the site. The experiential map (figure 3.43) shows the location of animal sightings and signs, some habitat features, and other things found or experienced on the site. The following photos contain examples of wildlife, signs of wildlife activity and habitat features.

Photos 3.30-3.38
Wildlife & their habitats are scattered throughout the site (photos by Hanson 2011)
Duck pond with duck log and the duck; barred owl, beaver teeth marks, deer track, wood pecker holes, salmon habitat, tree snag, garter snake, and a large yellow snail (Hanson 2011).

Photo 3.39: Frogs are heard in many sectors (Hanson 2011)

Photo 3.40: 1 ½ foot hole under a log (Hanson 2011)

Photo 3.41: Small bird nest in a fern (Hanson 2011)

Photo 3.42: Possible bear claw marks (Hanson 2011)

WILDLIFE					
ANIMALS	**SEEN**	**HEARD**	**ACTIVITY**	**SIGNS**	**SECTORS**
Bear				old claw marks in tree	16
Beaver				cut tree, tooth marks,dams,	8, 10-11, 19, 25, 36, 113-14, 123,
				tracks & trampled plants	141-13, 156-7, 167-8, 179, 193-4
Bees	X	X	buzzing around sedum flowers in trays		121, 118, 119, 272
Birds (misc.)	X	X	sing & fly	nests, eggs, flash of color	81, 312, 325
Bushtit bird	X		hopping in a circle around me		10, 297, 312, 390
Blue jays	X	X	sassy		196, 233, 248, 340
Brook lamprey	X				214, 218
Butterflies	X				118, 121
Crows	X	X	noisy	large flock	422, 424
Deer				tracks in mud	209, 212
Dragonflies	X		hovering around the ponds & creek		123, 125, 283
Ducks	X	X	mother raising her young (attentive)		126-7, 137, 146-7, 180, 254-5, 271,
					274
Flies	X		pestering		118, 119, 120, 131, 272
Frogs	X	X	hopping		2, 113-4, 137-8, 152, 174-5, 180,
					186-7, 191, 195, 200, 205-6, 261,
					272, 283, 286, 301, 304, 334-5, 388
Humans	X		camping	garbage,artwork,tarps,pots	52, 94, 306-7, 314-5, 342, 396,
					403, 449-50, 480, 486
Hummingbirds	X		flying		206
Moles				mounds & holes	131, 164, 166, 189, 198, 222
Mosquitoes	X		pestering		2-4, 11, 91, 93, 96, 108, 112-3,
					118-19, 127, 134, 138, 148, 152,
					192-3, 218, 236, 291, 303-4, 313,
					319, 400, 426
Moths	X		flying		118, 119
Mouse	X		hiding		160
Owls	X	X	sleeping, watching, fighting w/another		52, 109, 127, 353, 380, 500
Robins	X	X	singing, eating red elderberries		130, 239, 272, 283, 297-8
Snake	X		looking for slugs under plant trays		121, 123, 206
Songbirds	X	X	singing, eating red elderberries		many areas
Squirrels	X	X	in trees & crossing bridge		402, 422
Water skipper	X				101, 112-3, 127, 199, 205, 218,
					235-6
Woodpeckers	X	X	calls & pecking on wood		67, 107, 189, 194, 197, 228, 249,
					269, 273, 300-1, 316, 366, 388,
					396, 438, 440, 443
Yellow jacket	X		aggressive when home stepped on		34, 467

Table 4: Wildlife Inventory of Site (Hanson 2012)

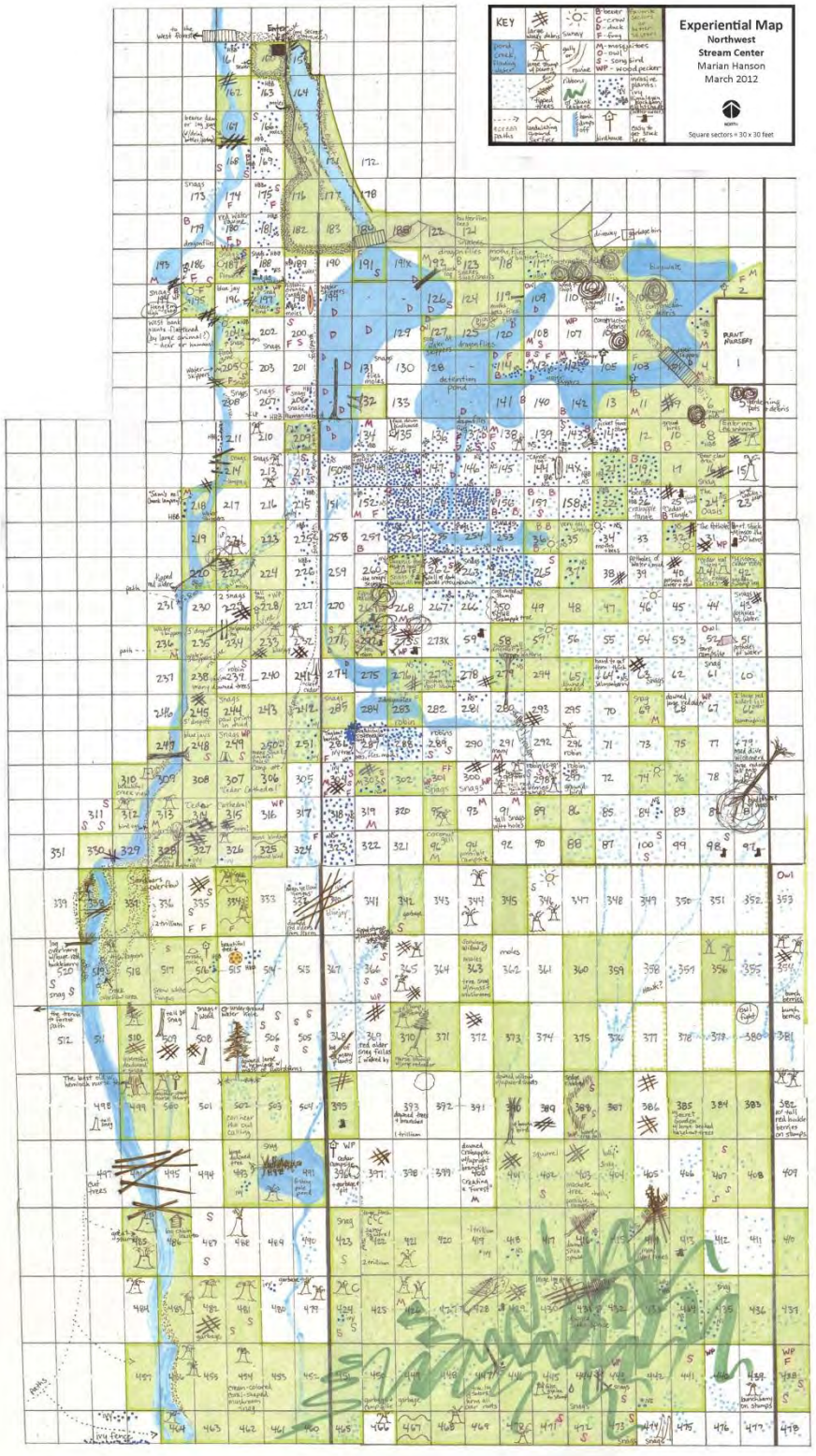


Figure 3.43: Experiential Map of site (Hanson 2012) 0 90 feet

3.7 Other Human Interest

Since the wetlands are to be experienced by human visitors as well, I noted other features of human interest. There are beautiful scenes for potential viewpoints which include plant landscapes, wildflowers, and seasonal bright colored fruit and leaves. Seasonal fluctuations in water flow patterns, plant growth patterns, wildlife activity, and time scales can be explored. Many large stumps left behind by the loggers of the 1800s present in various stages of decomposition with their logging notches still visible. They have become nurse logs for many plant species such as salal, red huckleberry, bunchberry dwarf dogwood, and western hemlock. Landscape mood swings can be experienced in the open sunny meadows, the serene isolation from the city, pleasant sounds of songbirds and water trickling; or in the sublime with dark moss-covered shadows, twisted dried tree roots and the holey old tree snags. The experiential map (figure 3.43) and the following photos (3.44-3.46) show a sampling of what's available to the human visitors at this site.

Photo 3.44 Framing a view (Hanson 2011)

Photo 3.45 Twisted old tree roots (Hanson 2011)

Photo 3.46 Beautiful seasonal color (Hanson 2011)

3.8 Inventory of Potential Concerns

Some potential concerns that may need to be addressed at the site include the presence of invasive plants, certain human activities, and infrastructural issues.

3.8.1 Invasive Plant Species

The first area of concern is the nonnative invasive plant species that cover a considerable amount of the site. Even though they do provide fruit for wildlife, the seeds can be spread to other areas by the same wildlife, where their vines and stalks take over the native vegetation. Photo 3.47 shows how English ivy (*Hedera helix*) is taking over a red alder tree in sector 286 and which may be one of the seed sources for the small isolated ivy plants that can be found scattered around the property (photo

3.48). I did pull the small ones I saw. A second potential ivy seed source is on the chain-link fence of the private residence in the southwest corner of the site just west of North Creek (photo 3.49). Within a 15-foot radius of the ivy-covered fence are several smaller ivy plants on the ground beginning to spread into the forest. Although not listed as an invasive plant on Snohomish County's website, the English ivy's four cultivars most invasive in the Pacific Northwest are listed as Class C noxious weeds in Washington State (SCDPW *Noxious Weeds*, King County *Noxious Weeds* n. pag.). It is an evergreen that grows well in the Pacific Northwest, out-competing low growing plants while providing habitat for pests such as the Norway rat. While different bird species eat the berries, they can be poisonous to some birds. It can cover tall trees increasing wind-throw by providing a wind "sail effect" from the treetop-heavy biomass it becomes. It can also decrease the health of the tree and increase its chance of becoming a hazard (King County *Noxious* "ivy" n. pag.).

Photo 3.47: Ivy climbs one tree (Hanson 2011)

Photo 3.48: Small ivy plants are scattered around the site (Hanson 2011)

Photo 3.49: Ivy-covered fence (Hanson 2011)

Bittersweet nightshade *(Solanum dulcamara)* is another aggressive non-native plant that is not listed as a noxious weed in Washington State, but has almost completely covered sectors 148, 153-5, 254-6, 264, 288, particularly in a large area just south of the detention pond. In the photo below is an example of one of the sectors in this condition (photo 3.50). From these areas, the bittersweet nightshade has continued to spread its vines into other nearby sectors. A few plants can be found scattered in the southeast portion of the site also. King County has labeled this a "weed of concern" and recommends that it be controlled, especially where it can interfere with fish stream habitat (King County *Noxious* "Bittersweet").

Photo 3.50: Bittersweet nightshade *(Solanum dulcamara)* covers shrubs and climbs trees (Hanson 2011)

Photo 3.51: Beautiful fruit spreads seeds when eaten by birds (Hanson 2011)

Himalayan blackberry *(Rubus armeniacus* a.k.a. *Rubus discolor)* and to a lesser extent the evergreen blackberry *(Rubus laciniatus)* are also non-native invasive plants found on the site. While the evergreen blackberry is only found in small amounts here, the Himalayan blackberry (photo 3.52) can be found in larger amounts in a number of sectors that are just east of North Creek in the northwest portion of the site (sectors 161, 163, 166, 168-9, 175, 181, 188-9, 197-8, 204, 206-7, and 209); just south of the duck pond in the north central portion (sectors 212, 215, 225-6, 149-150, and 152); and just south of the detention pond (sectors 14X, 19, 21-22, and 144) in the northeast portion of the site. There are also two isolated patches of Himalayan blackberries, one in sector 515 and one in sector 516, found in the west central area. Himalayan and evergreen blackberries are Class C noxious weeds on the Washington State Noxious Weed list (King County *Noxious* "Blackberries" n. pag.). They are very invasive as they can produce several seeds per berry, and form roots where the cane tips touch the ground. This can form thickets that out-compete native plants, prevent native tree seeds from germinating, and prevent access to water for larger wildlife (King County *Noxious* "blackberries" n. pag.).

Photo 3.52: Himalayan blackberry in foreground

Photo 3.53: English holly (2 photos: Hanson 2011)

English holly *(Ilex aquifolium)* is found lightly scattered around the site as small seedlings usually less than one foot tall (photo 3.53). English holly is a plant on the monitor list of the Washington State Noxious Weed Control Board (King County *Noxious* "holly" n. pag.). While commercially grown in the Pacific Northwest for flower arrangements and landscape ornamentals, birds widely disperse the seeds into forests where they can grow into dense evergreen shrubs and trees that shade out native shrubs and tree seedlings. Due to the problematic invasiveness of the above species, the King County noxious weeds website recommends that they be controlled in protected wilderness or areas where native vegetation is to be restored ("holly n. pag.).

3.8.2 Human Activities

Another area of concern is the human activity that occurs here. Evidence of human campsites can be seen in some of the drier areas of the site in sectors 52, 94, 306, 307, 314-315, 342, 396-7, 403, 450, 479-480 and 486. Some of the debris left behind include a tarp, sleeping bags, a plastic milk crate, deflated plastic mattresses, liquor bottles, other drink containers, milk jugs, sauce pans, cigarette butts, campfire sites, a machete stuck in a tree, two fishing poles next to a pond, and even a log shelter. In photos 3.54-3.58 are examples of some of the items found here.

Photo 3.54: Sleeping bags

Photo 3.55: Camping tarp

Photo 3.56: Carving trees

Photo 3.57: Trash

Photo 3.58: Camp art

Evidence of human campsites in sectors 396 and 52; tree carving and cigarette artwork in the "Cedar Cathedral" sectors 306-7 & 315; drink bottles of various kinds are found scattered around on the west side of the property (photos 3.54-3.58: Hanson 2011).

3.8.3 Infrastructure

The natural processes that occur on the site should also be considered in the design process. Because this is a wetland, most of the route needs to be on a firmer surface of either a boardwalk or a path on the higher and drier areas. Areas of more extreme water fluctuation, such as the North Creek overflow areas should be avoided by the boardwalk so it is out of the way of the flowing water.

Another situation that can occur from storms and water is falling trees. As seen earlier in the soils section, trees may fall in wind storms, from shallow soil above hardpan, or other reasons.

Even though this is a forested, mostly undeveloped site, underground utilities are located in the vicinity of the potential boardwalk route. In the northwest corner of the site near the trout stream, utility structures (photos 3.59-3.62) can be seen for sewer and electricity. Utilities need to be located by the professionals and marked before construction or digging occurs near these areas.

Photos 3.59-3.62: (L to R) Some of the site utilities that would need to be located and marked are near the gravel path in the northwest corner by the trout stream in sectors 161 and 183 (photos Hanson 2011).

As seen in the above photos, vegetation inventory mapping and experiential map, there much available at this wetland site to provide an interesting wetland educational experience.

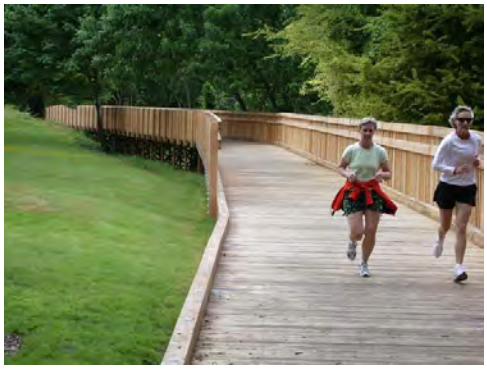
4.0 PROJECT CONSIDERATIONS

4.1 Project Parameters

In addition to the site inventory, project parameters and regulations need to be reviewed before the project design process can begin. The Adopt-a-Stream Foundation wants to build a boardwalk through the wetland forest south of their building for an outdoor educational experience in conjunction with their Northwest Stream Center curriculum. The user groups included in this project would be students of all ages, their teachers and other professionals who want to learn about wetland function, habitats, processes, stewardship and other aspects important to wetlands. The foundation wants to use this not only for environmental education purposes, but for fostering appreciation of wetland function and value, and to further their activities of restoring function to the streams and rivers of the region. They would also like to use this center as a revenue generator through the educational program, tours, and other activities (Murdoch pers. comm. 2011-12).

Due to budget constraints, this project is to be accomplished in a two-phase development plan. Phase I will consist of a half mile boardwalk loop that will begin in the north half of the forested wetland and extend as far and to as many sites of interest as possible. Phase II will potentially consist of another half mile boardwalk that connects to the Phase I boardwalk, which again will allow access to as many educational opportunities as possible.

The boardwalk will be designed and constructed by Pin Foundations, Inc. from Gig Harbor. They use the Diamond Pier precast concrete foundation, which is an environmentally-friendly product. They secure the piers using “pins” that attach their boardwalks without digging holes and pouring concrete so they don’t disturb the soil nearly as much as if they had to dig (Turner n. pag.). This type of boardwalk is engineered for wetlands and tidal areas, as well as other projects (Pin Foundations Inc. n. pag.). This elevated nature trail will be built with “100% recycled plastic lumber” which will last longer and require little maintenance (AASF “Elevated Walkway” no pag.). Pin Foundation’s boardwalk projects include the boardwalk in the Nisqually Delta, and piers for a boardwalk in Grays Harbor (Turner n. pag.). Examples of their boardwalk projects can be seen in the following photos from their website.



Photos 4.1, 4.2: Examples of Pin Foundation, Inc. projects (photos taken from www.pinfoundations.com)

4.2 Regulatory Implications

Permits for the wetland boardwalk may be needed before construction begins. At the Federal level, wetlands are under the jurisdiction of the U.S. Army Corps of Engineers. As mentioned in Section 404 of the Clean Water Act, a permit is required to do work in a wetland that may deposit fill, dredge or excavate materials (USACE "Do I Need…"n. pag., WSGORA "Aquatics Permitting" n. pag.). As the boardwalk construction techniques used by Pin Foundations, Inc. do not require much in the way of digging, this permit may or may not be needed (Turner n. pag.). However, if it is required, the wetlands should be delineated according to the *1987 Corps of Engineers Wetlands Delineation Manual* and the *Western Mountains, Valleys, and Coast Regional Supplement Version 2.0*, by a qualified wetland professional (USACE "Wetland Delineation" n. pag., WSDOE "Wetland Delineation" n. pag. WSDOE "Sponges"). A copy of this manual and the supplement can be found at the U.S. Army Corps of Engineer website http://www.nws.usace.army.mil using the search tab.

The State of Washington also has jurisdiction over Washington wetlands through the State Environmental Policy Act (SEPA) (WSGORA "Aquatics" n. pag.). SEPA requires a review to determine the environmental impacts the project will have on the wetland (WSGORA "Aquatics" n. pag.). A wetland permit would also need to be issued by the Washington State Department of Ecology who would determine if mitigation was required for the project through the Shoreline Management Act and the State Water Pollution Control Act (WSGORA "Project Q.," WSDOE "Sponges" n. pag.). The Washington Department of Fish and Wildlife has jurisdiction of Washington wetlands through the "Hydraulic Code" (Chapter 77.55 RCW), but since this boardwalk project will not be obstructing or diverting the flow of water on the site, this should not be needed (WDFW "Hydraulic Project" n. pag.).

The McCollum Pioneer Park, where the site is located, is owned by Snohomish County Parks and Recreation and is just outside the Mill Creek City limits, so the local jurisdiction is Snohomish County (City of Mill Creek "Trail Map"). Permits that may be required are the Critical Areas Ordinance Permit, the Floodplain Development Permit, and the Shoreline Management Program Permit which may be done with the SEPA review (WSGORA "Aquatics" n. pag.). Then according to Snohomish County Code (SCC 30.62A), additional plans and studies may be required such as a Site Development Plan, Critical Area Study, Mitigation Plan, Critical Area Site Plan, Designation of Wetlands and Fish and Wildlife Habitat Conservation Areas, list of Critical Species, and a Habitat Management Plan if critical species are actually present at the site according to the Snohomish County Code instructions (536-558). Since at least part of the trail should be wheelchair accessible, the Americans with Disability Act can dictate the conditions required for ADA access, as mud, roots and elevation changes can make this difficult (Kusler 10). Actual permits and reports needed for this project will need to be determined through the local, state and federal permitting offices.

5.0 DESIGN LITERATURE REVIEW

There are several things to consider when planning a design for an educational boardwalk route such as this. The budget and parameters of the project may require finding ways to cut costs or earn revenue. Basic visitor needs such as access, comfort and safety need to be satisfied. Consider the environmental impact and how environmental damage can be minimized or repaired if needed. Stewardship and environmental education provided through the site can improve environmental conditions beyond the boundary of the site. The designer should also consider how to optimize the visitor's experience through storytelling, variety, views, exposing beauty, and contrasting with the sublime, creating mystery, and involving the whole person.

5.1 Budget and Project Parameters

The reality of funding, site and project parameters and the needs of the client are important to a design project. They affect the design intent, size and quality of the project, as well as many other aspects. If the funds come in phases, and the story of the site needs to occur in a sequential way, would a complete story sequence be possible without the second phase (Brochu 118)? This may not be the best choice for a project with two or more phases. What decisions need to be made to stay within the budget? Is this design possible given the conditions found on the site? With a budget focus, the emphasis for the client is placed on cutting costs and earning revenue. The idea of cutting costs is not about being cheap, but having a budget and being careful with the funds available for the project (Brochu 18, Kusler 5). In the design, this can mean minimizing extras such as bridges, observation decks, towers, or seating (Kusler 5-6). Using the higher drier areas for unpaved trails as much as possible and using the boardwalk segments only in wet areas can also reduce the size of the budget. Positioning the boardwalk to accommodate the more typical flood levels and avoiding areas that are more flood-prone, particularly where water velocity can dislodge the boardwalk or erode the trail, can reduce the cost of damages (Kusler 7). Likewise, avoid areas where the trees are more unstable and prone to falling, or remove those within reach of the boardwalk. Locating signage on trees can prevent vandalism (Kusler 6, 10). While being based on the realities of the project, the funding and project limitations can dictate the design and/or route without providing adequately for the visitor experience, educational message, environmental impact or viable market potential (Brochu 18).

5.2 Basic Visitor Needs

Focusing on the needs of the visitor of a site must take into account accessibility, comfort, and safety. Before these characteristics can be determined, however, the target audience needs to be defined (Brochu 4, 110) (Kusler 3).

5.2.1 Accessibility

Accessibility includes aspects of the entry phase as well as the route itself. Available parking, entry location, ADA access, and signage need to be considered (Brochu 110). A kiosk or sign can mark the entry gate, designate where the trail begins, and indicate if there is a sequential route (Kusler 1, 10). Some aspects of the route itself should be considered for the sake of accessibility. The width should be at least 4 feet to enable passing or 6 to 8 feet if groups will be using it (Brochu 116-117, Kusler 5). A slope of 0 to 5 percent is best, and a level hard surface without mud or roots is important for wheelchairs and the disabled (Trapp et al. 89, Kusler 10).

5.2.2 Comfort

Providing for visitor comfort requires food, water, resting places, restrooms, adequate space, convenience and adequate directions. Boardwalks can keep visitors out of the mud and water, areas with seating provide rest and allow a comfortable place to view nature, and directional signs can let people know where they are and when they will be there (Trapp et al. 84, 93). Sections or points of interest can be labeled on map brochures. This allows the visitor to get to know its character, and appreciate it as something other than “wilderness,” “terrain vague,” or “the refuge of those without a proper place and outlaws” (Potteiger and Purinton 2, 82).

5.2.3 Safety

Boardwalks must be constructed to provide safe access. If a boardwalk crosses deep water, or is at a height of 2 or more feet above the ground, it needs a railing, especially if children use it (Kusler 5-7). If it is low with little risk of falling off (under a foot) then a rail isn’t needed. If it is to be used by people in wheelchairs, it should at least have a 2 by 4-inch rimmed edge (Kusler 6). A 4 by 8-foot section of boardwalk should be able to hold at least 2,000 pounds of weight in case a group gathers together in one area (Kusler 5). Hazards such as loose trees should be removed, boardwalks should be fastened securely, and warning signs can be placed if necessary to avoid potential hazards (Trapp et al. 84).

Providing for the needs of the visitor in the design process can allow greater access to a wider variety of people, and anticipate what can give visitors an easier and more comfortable experience. This creates a positive customer response, encourages return visits, and attracts a wider audience, all of which can increase revenue and further spread the environmental message (Brochu 15). Unfortunately this can raise the cost of the design with the extra features required to achieve the level of customer satisfaction desired (Brochu 17).

5.3 Environmental Impact

Developing a trail with an eye on the environmental impact of the project includes preventing or minimizing the amount of damage it causes, repairing or improving the area, and using the project to promote environmental education and stewardship.

5.3.1 Environmental Protection and Stewardship

Some people feel that what's best for a natural landscape is not to build a trail access within the area as trails invite use, not only by humans, but by invading predators such as dogs, cats, raccoons, and others (Trapp et al. 83). Removal of native plants or opening an area to sunlight can encourage the growth of invasive plant species whose seeds can be transported on the muddy soles of shoes, the fur of animals, or by fruit-eating birds (Trapp et al. 83). Through careful attention to the site, however, damage can be minimized and work can be done that can even improve the area through restoration, habitat repair and enhancement which can lead to healthier ecosystems. A trail can provide the access needed for these improvements (Louv 41, 353-4) (Birkby 217).

To reduce damaging effects of a trail in a wetland or other natural environment, it should not be located in areas easily damaged. It should go around large features such as large trees and stumps, avoid steep grades, muddy shorelines, and consider the topography of the site (Louv 266-7l). The higher and drier areas will experience less damage than the wet muddy areas, but they may not always provide good views (Kusler 4; Trapp et al. 82-3).

Buffers, barriers and deterrents are sometimes needed to protect sites. Vegetation planted at some points along a creek bank or steep slopes can slow erosion problems that occur from people and natural causes, or provide a visual screen to hide a view. Large decaying logs, large rocks, or plants can be used as barriers in areas that are used as campsites, to block access to areas that are being replanted after invasive plants are removed, or to discourage shortcuts across protected areas (Birkby 219, 222-3) (Trapp et al. 83) (Brochu 116-17).

5.3.2 Environmental Education

Access also allows for the environmental education necessary to appreciate the value of ecosystem functions, which promotes the activities and choices that can improve the environmental conditions (Louv 225). The processes of an ecosystem can be exposed to give the visitor an understanding of its functions and value. Finding a route that can allow the sequence of the landscape story to unfold is one way to explain the natural processes such as erosion, decay, water filtration, plant growth patterns and others that occur on a site (Potteiger and Purinton 3, 110, 112, 145-6). Along the way the plant communities and wildlife habitats of the wetland and surrounding area can be observed from a distance dictated by the trail, as well as described on signs posted at various stations, providing a dynamic story that touches the visitor. A trail provides the much needed exposure for students in outdoor learning stations, wetland research, bird and wildlife watching, guided tours, demonstrations for the public, events, and other activities such as those the Northwest Stream Center wants to provide (Kusler 1, Trapp et al. 80).

An approach that emphasizes the environmental impacts would work well for an environmental educational center. The design focus is on protecting the environment which is the same message that a center of this sort would promote. The route would

allow an easier time managing and protecting the environmental resources located there (Brochu 18). However, in the act of protecting fragile areas, providing buffers, and avoiding habitats, the visitor experience can be diminished and the environmental education diluted (Brochu 18). When this happens, it is harder to connect to the visitor. People come with their own opinions and attitudes about wetland values, and they hear the environmental lessons through their personal filters. A way must be found to provide experiences that can penetrate these filters, establish value and relevancy of natural ecosystems to the landscape as well as to the visitor, and to enable environmentally sustainable choices to be appreciated (Potteiger and Purinton 146, 152, 155).

5.4 Optimizing the Experience

Optimizing the visitor's experience comes from taking what the site has to offer and allowing the visitor to encounter it in interesting ways that enable him to be involved mentally, physically, emotionally, and spiritually. This provides a memorable experience that remains in his head and heart potentially allowing him to process and act on the messages he received from this experience. A route design can be enhanced through storytelling, providing variety, designing for views, exposing beauty and contrasting it with the sublime, using techniques to create mystery, and by involving the whole person.

5.4.1 Storytelling

Storytelling is a way to convey information about nature, wildlife habitats, processes, functions, value, history and other subjects pertaining to a site. This can be done through observation of wildlife activity, interpretation through signage or by guided tours. Revelation can come from being exposed to what is normally hidden from view, such as small scales, artifacts of history, wetland processes, or by exposure to what is normally hidden in the shadows or depths of the wilderness (Potteiger and Purinton 119, 135, 157, 164). Remnant objects encountered along the route can connect visitors to the history of a site (Trapp et al. 74). Small scale versions of nature, like a stump growing a "forest" of plants or an exhibit provide condensed versions of much larger objects or ecosystems for easier explanation (Potteiger and Purinton 165). Route location is important as processes or events can be sequentially shown through a particular route (Brochu 3, 111) (Potteiger and Purinton 110). This may appeal to the more mature visitor as they often favor the "sequential experiences" (Brochu 117). Various vegetation communities and wildlife habitats can be highlighted as they occur in no particular order. As a collection of puzzle pieces they can be gathered and assembled through the "scattered experiences" that the younger groups often enjoy (Brochu 117-18) (Potteiger and Purinton 174-5).

5.4.2 Variety

Variety is a key aspect of providing for an interesting site experience. Variety can be found in the diversity of vegetation communities, wetland types, and wildlife

encountered along the route. The contrasts of light and open meadows against the backdrop of dark evergreen forests, or the shady cool moisture of the wetland forest on a hot summer day provide variety that gets our attention along with the song birds, ducks, insects and other creatures waiting behind the next tree or shrub. A route should be designed to allow access to many different kinds of features, landforms, plants, flowers, colors, and other compelling characteristics (Trapp et al. 74, 76-7). The route should go by the tallest trees. It should feature the small scale habitats such as the nurse stumps that contain ecosystems of their own or different fungi and lichens that come in many shapes and colors. Habitats of different types such as forests, shrubs, emergent and aquatic vegetation, as well as ponding and flowing water should also come into view (Trapp et al. 76-7, Kusler 4-5). Seasonal changes can provide colorful flowers, fruit, fall leaf color, fluctuating water levels, and weather patterns to observe. Plants with different forms provide many textures, leaf shapes, density and smells to explore. Trails can curve around trees, ponds, and vegetation adding to the interest (Trapp et al. 74, Kusler 4).

5.4.3 Design for Views

Views should be designed with more than variety in mind. Characteristics such as size, shape, openness, light level, and subject matter should be considered (Potteiger and Purinton 115). Viewpoints should be planned in a way that provides panoramic views, beautiful or interesting subjects, good vantage points to watch wildlife or understand a process, frame a mood or highlight a quality, and whenever possible allow the sun to be behind the viewer and not in their eyes or camera lens (Trapp et al. 80, Tilden 85, Kusler 5). Techniques can be used here to help improve the viewpoints. Branches of trees or shrubs can be carefully pruned to frame a view. The route can be positioned to allow a quick glance or “flash-forward” of a pond or creek from a different angle or before arriving at a full viewpoint, and thick vegetation can act as a “blackout” between one scene and another of a different type (Potteiger and Purinton 114) (Trapp et al. 80). The lack of edge between vegetation of two separate properties allows a site to “fade” into the others making it feel larger or allow for habitat functions and ecosystem services to cross borders in a regional rather than isolated pattern (Potteiger and Purinton 114). Viewing blinds can be used in areas of higher wildlife activity, such as near the ponds, to allow observation without disturbing the wildlife, while observation towers can provide a panoramic view over tall shrubs, or a view into the tree canopy level to observe birds and other wildlife activities in the trees and snags of more open forests (Kusler 5, 9).

5.4.4 Exposing Beauty

Beauty is another characteristic that can add pleasure to the wetland experience. It is found in the views of water bodies, wildflower meadows, and panoramic views of the landscape. While beauty needs to be revealed, some aspects of a site need to be concealed to improve a view. Garbage, piles of work debris and invasive plants can be removed, while native plants can be added that provide berries, flowers, or other seasonal color and visual barriers if needed (Trapp et al. 80).

Vegetation and trail placement can be used to camouflage undesirable sights and sounds. Viewpoints should also face away from objectionable or artificial structures such as buildings and parking lots (Kusler 4; Trapp et al. 78, 80). Since beauty needs "the watchful devotion of a shepherd," areas can be maintained to improve views while considering the needs of the wildlife habitats (Tilden 109).

5.4.5 Contrast with the Sublime

While beauty brings pleasure to the wetland visitor, the sublime makes the route more interesting. The sublime gives a rugged beauty to the site which can sometimes border on the ugly or horrific. It can be intriguing, thought-provoking, or revealing of mystery, secrets or fear (Potteiger and Purinton 139, 143). It can make for a more thrilling adventure, while one is compelled to glance backwards from time to time for wild beasts. The twisted beauty of the sublime can be found in gnarled roots of a tree that fell and died sometime in the past, or in the stumps left behind by the loggers many years ago that provide a nursery for the forest plants growing on them, or the young western hemlocks that can be seen covering them with their tentacle-like roots. Some fungal growths attached to decaying wood might be ugly except for the neon colors or interesting forms they have. Forest clearings that look glowing and inviting when the sun is out can look much less so when the shadows behind them grow and engulf the light. Disturbance, weather, seasons and shadows can all play a role in the moodiness of a site. This is not necessarily bad if it can be used to reveal the secrets hidden in the forest. In many cases this can reveal processes and even historic events if the educational opportunity is put to use.

5.4.6 Reveal the Mystery

Mystery is another thought-provoking and engaging characteristic to experience. Mystery conceals secrets that may only be revealed to those who take the time to explore them. A route can help encourage the explorer by taunting him while hiding what's around the curve, or when a fragrance floating in the air is noticed but can't be located. The sounds of wildlife moving in the bushes nearby, a tiny sparkle of water peeking from behind vegetation, or a glow of light in the middle of a dense forest can propel curious people forward in hopes of glimpsing the source of the sound or light (Trapp et al. 74). It is this process of slowly revealing what a site has to offer that creates the suspense that attracts people and gets them involved in the adventure, and what needs to be captured in a route to make a site compelling (Potteiger and Purinton 135-6).

5.4.7 Involve the Whole Person

A trail needs to attract and keep the visitor engaged in the adventure. It should offer an invitation to enter and an encouragement to explore by providing beauty and intrigue while allowing visitors to pause when needed (Potteiger and Purinton 135-7, 143) (Trapp et al. 79-80). To be educational, it should have stories to tell and a design that facilitates telling those stories. But to be a great experience, it needs to touch "the whole man" (Tilden 46). By providing the opportunity for physical, sensory, mental,

emotional and spiritual connections, the experience can give the visitor an appreciation for the wetlands and provoke him to pursue the topic further while enjoying himself and contemplating more sustainable choices (Tilden 9, 33, 46, 105) (Brochu 2-3, 111).

A design that focuses on optimizing the experience can provide a more compelling design for the adventurer and for learning opportunities. However, it can be more invasive to the environment, more costly to the budget due to the extra structures required, and could increase the risk of boardwalk damage if placed in an unstable area such as a ravine or within reach of higher velocity flood water (Kusler 7). Consequently, there are several things to consider when planning a design for a boardwalk route through a wetland area such as the Northwest Stream Center. The next section discusses three precedent sites that provide good examples of designs for this type of situation.

6.0 PRECEDENTS

There are many parks in the Puget Sound area that contain wetlands and native habitats. I selected the Mercer Slough Nature Park in Bellevue, Rotary Community Park in Woodinville, and North Creek Park and Water Retention Facility in Bothell as three precedents to inform the boardwalk route design for the Northwest Stream Center. As multi-functional wetland parks that provide recreation, education and wildlife habitat within a functioning wetland ecosystem, each precedent represents a successful integration of humans and wildlife.

6.1 Mercer Slough Nature Park

Mercer Slough Nature Park is a 320-acre nature park on the east side of Lake Washington. Owned by the City of Bellevue, Washington, it is home to many wildlife species (Hinshaw 26, eCityGov Alliance n. pag.). The wetland area was once covered by Lake Washington. In the early 1900s, a series of canals were dug to enable ships to move into Lake Union and Lake Washington for repairs and storage during the winter. These canals lowered Lake Washington by approximately nine feet which exposed boggy areas, including the Mercer Slough, which periodically fill with water when the lake level fluctuates (Hinshaw 24, KCWLRD "Water Quality Monitoring n. pag.).

The park presents a nature experience within an urban setting that provides recreation as well as wildlife habitat and wetland functions. An asphalt trail surrounds the park for walking and biking. There are also a series of named trails. The Bellefield Trail, which includes boardwalks, goes through the upland forest and down to the scrub-shrub and meadow wetlands and past the field of blueberries which is from a historic pre-World War II farm (eCityGov Alliance n. pag., Hinshaw 26). The Heritage Trail winds through an old rhododendron nursery where pieces of the buildings left behind can be seen poking through the bushes in places, then up to the Winters House Visitor Center which contains exhibits, restrooms, rentals and other facilities available to visitors using the park. In addition to the foot paths, there is also a Canoe Trail that allows park and wildlife viewing from the water itself (eCityGov Alliance n. pag.).

In 2008, the Mercer Slough Environmental Education Center opened at 1625 118th Avenue SE, located on the upland forest hillside to the east of the wetlands (City of Bellevue n. pag.). The educational center, designed by Jones & Jones Architects and Landscape Architects, consists of environmentally responsible features such as green roofs, recycled materials, and rain gardens. It provides classes on wetland ecology to students and families (City of Bellevue n. pag., eCityGov Alliance n. pag.; Hinshaw 26, 28).

The Mercer Slough Nature Park provides historic and environmental education that connects humans and nature through the experiences found on the site. Their boardwalks and trails provide access to a landscape that tells the wetland story of human use, processes, wildlife habitat value, and ecosystem function. Utilizing the beauty of the landscape, variety of plant species, diversity of the wildlife, seasonal color of the vegetation, and historic remnants of past activities, visitors are touched in their

hearts and minds by the experiences available at this park and can appreciate what the wetland environment provides for wildlife and humans.

Photo 6.1: Unpaved gathering space (Hanson 2012)

Photo 6.2: Curved boardwalk (Hanson 2012)

The park offers several examples of design aspects that could be applicable to the Northwest Stream Center. They were able to cut costs by using an unpaved upland area for a gathering space (photo 6.1) and unpaved trails (photo 6.2) to extend their boardwalk route. The benches provide rest and wildlife viewing. The boardwalk curves invite exploration for the curious while the signage tells where the route is headed.

Photo 6.3: Gathering space, seating and signage at a junction in Mercer Slough Nature Park near rhododendrons (Hanson 2012)

Photo 6.4: Wildlife shares space with humans at the park (Hanson 2012)

This gathering space (photo 6.3) has room for several people to sit or stand and admire the seasonal color of the shrubs or do a little bird-watching, while the location provides a good place to rest or find family and friends. Providing wildlife habitats (photo 6.4), wetland ecosystem services, as well as human recreation, historical and environmental education combines to make this a multi-functional landscape for humans and wildlife.

Photo 6.5: Winter color from the blueberry fields (Hanson 2012)

Photo 6.6: The smooth water surface contrasts with the rough textures of the vegetation (Hanson 2012)

Photo 6.7: Contrasts of the busy freeway and the peaceful park pedestrian sidewalk (Hanson 2012)

Photo 6.8: An interesting historic remnant building (Hanson 2012)

A variety of contrasts are available here. The vegetation shows its seasonal color (photo 6.5), while rough textures of the dry winter plants contrast with the smooth surface of the water (photo 6.6). The fast vs. slow pace of the auto and pedestrian circulation is on display in this concrete sculpture which could encourage one to question their fast-paced lifestyle choices (photo 6.7). This section of the route is an example of how well interstitial spaces, or the spaces in between that are often considered leftovers or wastelands, can provide value to the landscape. The building (photo 6.8) is a great example of how the sublime can provide mystery, history, and interesting visuals for wetland environmental lessons. The moss, lichens and mold covering the wood are colorful while showing the process of decay. The trees leaning against the walls and roof give a sense of danger, and combined with the flood water show the wetland reclaiming territory that was taken from it years ago. At this particular spot in the landscape, humans do not appear to be welcome, and yet there is something compelling about the image.

The Mercer Slough Nature Park is a wonderful place to spend a sunny afternoon watching the wetland from the boardwalk, a canoe or while taking a jog. It is also a

place of environmental education and wetland function providing connections for humans and wildlife that use the park.

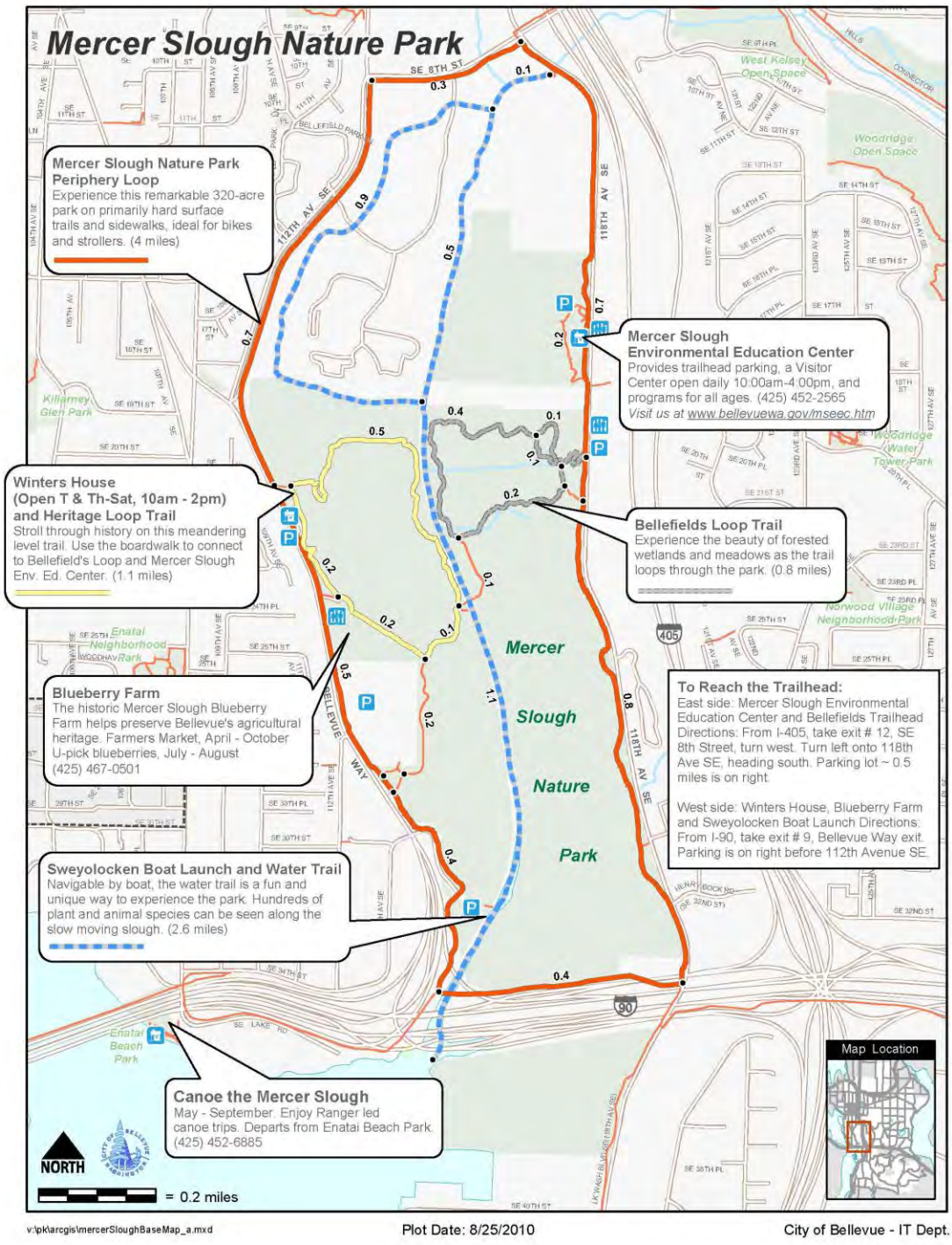


Figure 6.9: The Mercer Slough Nature Park map (City of Bellevue IT Dept. 2010) is from the following website: http://www.bellevuewa.gov/pdf/parks/mercer_slough_base_map.pdf

6.2 Rotary Community Park

Rotary Community Park is found in Woodinville, Washington, near the Woodinville High School, on Little Bear Creek. The 18-acre park was designed in 2001 by Lesley Wiscomb, R.L.A. of Wiscomb Landscape Architecture Services, Inc., and was divided into three phases of development (Spear n. pag.) Phase one was the creation of a one-acre skate park in the south end, phase two a playground and picnic area adjacent to the skate park, and phase three a one-mile gravel trail and boardwalk route with viewing platforms that goes through the wetland and forested area next to Little Bear Creek (Spear n. pag., Guyaz n. pag.). The combination of the three phases enables a variety of recreational activities for the park visitors to experience.

Little Bear Creek (photo 6.10) and its wetlands provide habitat for six salmonid species including sockeye, kokanee, coho and the endangered Chinook salmon, that migrate from the Puget Sound up the Sammamish River to spawn in the creeks connected to it, such as Little Bear and North Creek (Spear n. pag., Guyaz n. pag.). The boardwalks, trails, educational signage and viewing platforms of this park (photo 6.11) allow the visitors to observe the salmon and other wildlife in an outdoor learning center environment (photo 6.12), bringing humans and wildlife together in this multi-functioning, yet fragile landscape (Guyaz n. pag., Spear n. pag.)

The wetland at Rotary Community Park contains plant communities and habitats similar to the wetland at Northwest Stream Center. Native and non-native plants can both be seen in some of the park photos. Garbage and some invasive plants such as Himalayan blackberry, reed canary grass and scotch broom were removed from the site when the boardwalk was installed. Large woody debris was added and native vegetation was planted to improve riparian habitat (Spear n. pag.) Continued efforts to

Photo 6.10: View of Little Bear Creek
(Hanson 2012)

Photo 6.11: Viewing platform
(Hanson 2012)

Photo 6.12: Owl in a large western redcedar by the trail (Hanson 2008)

Photo 6.13: Invasive non-native plant species are removed and replanted with native species (Hanson 2012)

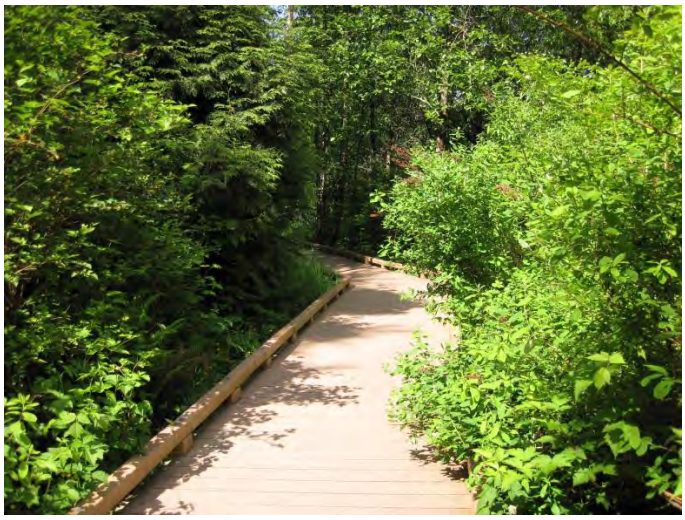


Photo 6.14: The boardwalk curves out of site into the forested wetland (Hanson 2012)

Photo 6.15: Route is a combination of boardwalk and gravel (Hanson 2012)

remove invasive species and replant with natives are still noticeable along some sections of the boardwalk (photo 6.13). Likewise non-native Himalayan blackberry, bittersweet nightshade and English ivy will need to be removed from the Northwest Stream Center wetland. Native plants such as skunk cabbage, vine maple and shield ferns can be viewed easily from the Rotary Community Park route which consists of a combination of gravel trails and boardwalks made of 100% recycled materials from plastic soda and milk containers (photos 6.14-6.15), as treated lumber would have added toxic chemicals to the wetland (Spear n. pag.). This same material is what the Northwest Stream Center plans to use for their boardwalk also.

Even though the boardwalk trail system is not as extensive as the Mercer Slough Nature Park, this site still provides valuable examples of habitat enhancement projects for improving salmon habitat along the creek, removal of invasive plant species, and providing environmental education opportunities in an outdoor setting with wildlife

nearby to enjoy. This park is a functioning wetland ecosystem combined with a recreational park for humans providing a multi-purpose landscape to be appreciated.

Figure 6.16: Master Plan of Rotary Community Park, 2002 Wiscomb Landscape Architecture Services, Inc. (Spear n. pag.)

6.3 North Creek Park

North Creek Park and Water Retention Facility is located in Snohomish County on 183rd Street SE in Mill Creek, Washington, just west of the Bothell-Everett Highway, and just east of North Creek. Originally owned by the Bailey family who were historic homesteaders, Snohomish County used it as a regional stormwater detention facility site. Sometime later, Bruce Dees and Associates, Landscape Architects, designed an interpretive trail with ¾ of a mile floating boardwalk running through the middle of the wetland (figure 6.17 and photo 6.18) for the Snohomish County Parks and Recreation (Bruce Dees & Associates n. pag., SCPR "North Creek" n. pag.).

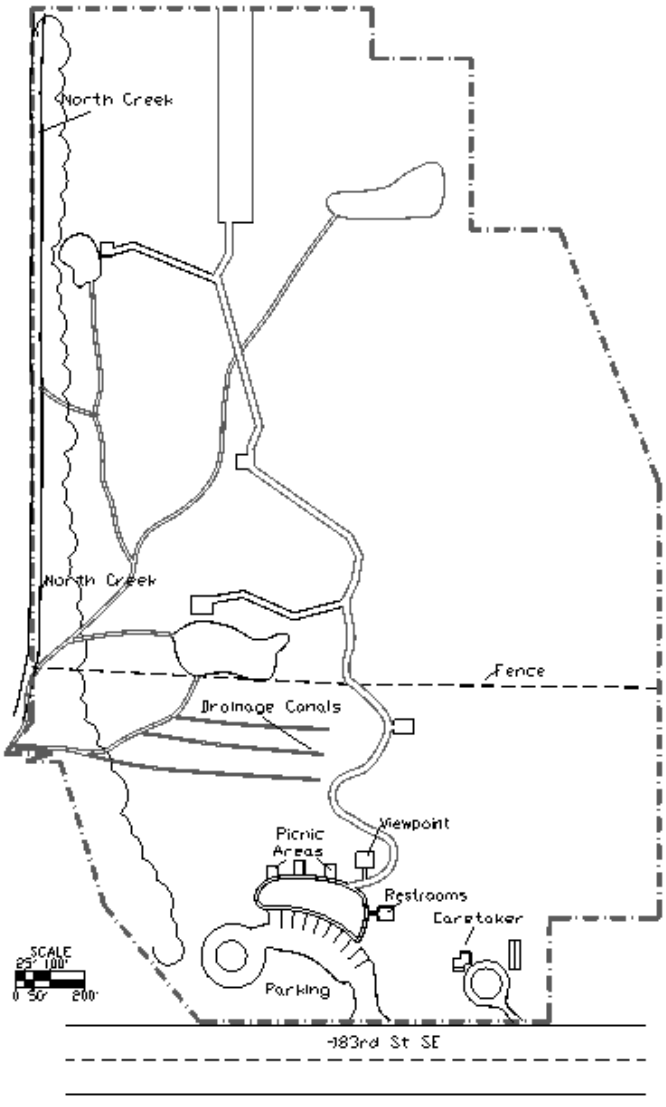


Figure 6.17: Diagram of North Creek Park (↑north)

Photo 6.18: aerial photo of North Creek Park looking ↑south
(Both images from SCPR n. pag.)

There is an upland park area to the south which consists of a playground for children (photo 6.19), covered picnic shelters, uncovered picnic tables, portable restrooms, a parking lot, and a trail down to the wetland boardwalks.

Photo 6.19: Upland playground (Hanson 2011)

Photo 6.20: Suburbia disappears in the background (Hanson 2011)

The wetland is located in the lowlands just north of the parking lot. Here wetland species of plants provide habitat for the wetland animal species while the site provides stormwater retention and a floodplain for North Creek, which is located just to the west of the wetland in the map above. The boardwalk provides access to the wetland ecosystem up-close and in panoramic views with the urban landscape fading into the background (photo 6.20). The boardwalk has two branches that extend into other areas of the wetland with gathering areas, seating, and educational signs explaining the view (photo 6.21). In the north end, the trail connects to 9th Avenue SE which then becomes Mill Creek Blvd. north of 164th St SW. This boardwalk trail will eventually become part of a regional system that will connect to the Sammamish River/Burke-Gillman Trail to the south, and the Interurban Trail in Everett to the north using boardwalks elevated on pin piles when necessary to cross other wetlands, as this doesn't inhibit wildlife movement or wetland function as much (SCDPW "Trail #RC1546 n. pag, SCDPW "North Creek Trail" n. pag.).

Photo 6.21: Gathering space with seating and signage (Hanson 2011)

Photo 6.22: The boardwalk and stormwater interact In April 2011 (Hanson 2011)

North Creek Park provides interactions with water, wildlife and natural forces, as the area is open and exposed to the elements. Wetland processes can be obvious here as water flows up to the boardwalk and sometimes over it (photo 6.22). This is a good example of what happens when a boardwalk is in the floodplain of flowing water. Recently, pieces were replaced with Styrofoam flotations (photo 6.23), as some of the sections were not floating well and were ducking under the water surface (SCPR "North Creek" n. pag.). Photos 6.24 and 6.26 were taken when it was hailing, but it seemed appropriate for the site and added to the wetland experience. It does a great job telling its story with the many opportunities to get wet here.

Photo 6.23: New boardwalk and flotation devices (Hanson 2012)

Photo 6.24: North Creek Park in a dark mood (Hanson 2011)

Photo 6.25: North Creek Park Wetland on a sunnier day (Hanson 2012)

Photo 6.26: Geese block the route (Hanson 2011)

North Creek Park, Woodinville's Rotary Community Park, and Mercer Slough Nature Park all contain wetland boardwalk trails that provide opportunities for wetland education as well as recreation while connecting nature and people, which can allow a better understanding of wetland function and value. It can lead to a greater appreciation of wetland ecosystems and potentially better choices for a more sustainable lifestyle that allows humans and nature to coexist. These three popular parks provide good examples of how these connections can occur. Table 5 is a summary of some characteristics of the three that can apply to the Northwest Stream Center.

PRECEDENTS	Mercer Slough Nature Park	Rotary Community Park	North Creek Park
Interstitial	water fluctuation	near freeway	stormwater retention
Space	canal construction leftover*	riparian flood zone	
Connections	humans to nature, history	nature, stewardship	nature
	environmental education	environmental education	environmental education
	Pacific Science Center*	Woodinville High School	regional trail system*
Multiple	education center, trails	recreation park	playground, picnic sites
Function	nature, blueberry farm	wetland function	water retention system*
Site	museum, history*	nature, high school educ.*	regional trail system*
Water Bodies	Lake Washington	Little Bear Creek	North Creek,
	Mercer Slough		water retention*
Vegetation	DF, SSW, EW	DF, WF, SSW, EW	DF, SSW, EW
Habitat Value	wetland, agriculture	wetland, riparian, forest	wetland, forest
Structures	bldg. remnant, farm, campus	play area, picnic, skate	playground, picnic
Boardwalk	gathering, seating, bridge	gathering, seating, rails	gathering, seating,
	rails, trails, signage, curves	bridge, trails, signage	signage, water velocity
Cut Costs	trail & boardwalks	trail & boardwalks	trail & boardwalks
Add Costs	add't boardwalk structures	add't boardwalk structures	center of floodplain
Accessibility	steep east entrance	easy, ADA access	steep south entrance
Comfort	seats, directions	seats, directions	partial facilities
	facilities open at times*	facilities	seats
Safety	rails for elevation & water	rails for water & elevation	kickboards, no rails
	kickboards	kickboards, warnings	significant water
Minimize	permeable surfaces	permeable surfaces	permeable surfaces
Environment	green bldg. design*	impermeable rec. area	asphalt parking lot
Damage	wetland functions	wetland functions	wetland functions
Stewardship	environment education*	environment education*	education signage
	facilities maintained	invasive plant removal*	facilities
	agricultural activity	replant native plants*	maintained
Education	wetlands, wildlife	wetland, environment	wetlands, wildlife
Opportunity	environment, history	salmon habitat*, wildlife	environment
Storytelling	artifacts, signs	wildlife, signs,	processes & water
	processes exposed	stewardship exposed	exposed, signs
Variety	human built & nature	human built & nature	human built &
	vegetation, seasons	vegetation	nature, vegetation
	circulation (trails & water)	seasonal interest	seasonal interest
Views	open, closed, light	closed, limited open	open, limited
	merges into background	more insular	limited closed
Experience	beauty, water, sublime	beauty, water, sublime	beauty, sublime
	mystery, activities	recreation activities	wet experience

Table 5: Precedent Characteristics that Apply to Northwest Stream Center (Hanson 2012)
*(City of Bellevue n. pag., eCityGov Alliance n. pag., Guyaz n. pag., Hinshaw 24,26,28, SCDPW "Trail #RC1546, SCDPW "North Creek" n. pag., SCPR "North Creek" n. pag., and Spear n. pag.)

7.0 CONCEPT

In the interstitial spaces of the landscape, or the spaces between the human built environments and those left undeveloped, is often where the unwanted leftovers of the human lifestyle and the dysfunctional edges of the natural environment can be found. Here is where garbage accumulates, invasive non-native plant species begin to infiltrate, damage is hidden under the border vegetation, and access for unauthorized and damaging activities can occur. This is where ecosystems become disconnected and environmental repair and restoration is often needed the most.

This space is where barriers are often erected between humans and nature which can contribute to the ecosystem disconnection. They can be through physical barriers such as a fence, through rules and regulations, or by individual perceptions. The barriers also contribute to the separation between human choices and their environmental consequences, the value placed on undeveloped land and the value of their ecosystem services, and the human adventurer and the outdoor areas to be explored. The previous three precedent sites are examples of interstitial spaces where barriers were removed between humans and nature, while maintaining ecosystem function and habitat value, and providing landscapes that allow multiple functions to occur. In the following I discuss the four principles I developed after visiting the three sites and researching wetlands, which form the underlying goals for my concept, "An Interstitial Space that Provides Connections." I believe this concept and its principles are appropriate to guide the direction of the wetland boardwalk design for the Northwest Stream Center.

7.1 Principle One: Connect Humans to Nature

"*…the human child in nature may well be the most important indicator species of future sustainability."* (Louv 353)

Experiencing nature leads to an appreciation of nature. It is hard to value something we don't know. By providing an enjoyable experience in a natural wetland setting, visitors will come to enjoy and appreciate it, which will enable a personal connection to develop. We need to find ways to provide these experiences. The often ignored spaces between human built environments and nature's ecosystems can provide the access and matrix for the connections to form between humans and nature.

7.2 Principle Two: Connect Humans to Environmental Education

"Through interpretation, understanding; through understanding, appreciation; through appreciation, protection." (National Park Service n. pag.)

Education provides the knowledge necessary for interpretation to occur. Interpretation is a way to take that knowledge and translate it into something that has the potential to connect. It is hard to do that with barriers in place. While the barriers

may be actual physical access issues, often they come from the personal filters we have that color our perceptions. We need to get around the filters for interpretation to provide understanding and appreciation. Access to the educational opportunities that this site can employ can remove the physical barriers. The experience has the potential to remove the filters. Once they are gone, the student and fellow explorer will be able to form the connections necessary to enable an appreciation of the wetland ecosystem and why they are important.

7.3 Principle Three: Enable Protection and Stewardship

"Leaving land alone doesn't work; the natives are overwhelmed by the invaders."
(Elaine Brooks, in Louv 41)

With strong connections developed through a relationship to nature, we will appreciate nature and value its functions. Through the gaps between the human and natural environments, we will gain access to maintain and improve its conditions. Non-native invasive plant species, chemicals, garbage and other damaging elements gained access before we did through smaller gaps. We can help bring the environmental conditions back to health with the knowledge we gain through education and understanding (Louv 225, 250; Ehrenfeld 730-31).

7.4 Principle Four: Design for Multi-functional Landscapes and Regional Networks

"We can use these precious resources, so long as we do not use them up. We should not dissipate our capital, but we should zealously dispense the interest." (Tilden 100)

Bringing humans and nature together can enable multi-functional sites with functioning ecosystems and wildlife habitat to combine with human interests and activities as they have done at Mercer Slough Nature Park, the Rotary Community Park, and North Creek Park. This can benefit both humans and wildlife (Ehrenfeld 728, 731). Then we can take these multi-functional sites and begin to connect them together like puzzle pieces, removing barriers to ecosystems so they function better regionally (Nassauer, "Landscape" 677-78).

7.5 Concept: An Interstitial Space that Provides Connections

By using the often neglected spaces between human developed landscapes and the undeveloped nature, or the "interstitial spaces," we can allow this connection between humans and nature to foster a more sustainable landscape that can provide for multiple uses, users, and functions all within the same site. The Northwest Stream Center at McCollum Pioneer Park can provide wetland function, habitat value, environmental education, recreation, revenue, and stewardship of the environment, while enabling interactions between humans and nature to occur that can encourage more sustainable choices in the future.

8.0 DESIGN SCENARIOS

A design for an educational boardwalk route through a wetland area must consider the budget, visitors' needs, environmental impacts of the project, and how the design can improve the overall experience for the visitor. In the following four alternatives, each emphasizes one of the above categories. A diagram of site characteristics is provided for each scenario to give spatial reference of those characteristics considered relevant for each particular focus. Then a second diagram shows the route alternative that could develop from such a focus. Aspects of each of these diagrams will then be used in the following section 9.0 as part of the proposed design for the boardwalk route.

8.1 Budget Focus

With a focus on the budget, the emphasis for the client is on keeping costs low and earning revenue. In the design, this can mean minimizing extras such as bridges, observation decks, towers, or seating. Cutting the costs involved with a boardwalk trail can mean using the higher drier areas for trails as much as possible and using the boardwalk segments only in wet areas, as the boardwalk is more expensive than unpaved trails (Kusler 7).

8.1.1 Site Consideration

In the following diagram (figure 8.1) are site characteristics to consider when designing the route with a budget focus. The wet and higher/drier areas were noted as trails can be used on the higher areas to extend the boardwalk reach. The flood zones of moving water were marked so they can be avoided to prevent water velocity damage, as well as other objects like falling trees that can cause expensive damage to the boardwalk. The crabapple trees were noted so the route can go around them as they can cause maintenance issues with their growing patterns of sending up numerous closely-spaced thin shoots which can grow through the spaces in the boardwalk. The location of unauthorized campsites, garbage piles and vandalism activities should be considered when placing signage and deterrents. The ticket booth and the gift shop were also located as they are important for revenue generation.

Another design concern for this project is that this will be a two phase process due to funding. The first phase will consist of a half-mile boardwalk loop. The second phase has a potential for another half-mile boardwalk loop when the funds are available. This will affect the first phase of the route design in a few ways. If the story of the wetland needs to occur in a sequential way, a complete story sequence may not be possible without the second phase (Brochu 118). The length of the first phase needs to be able to reach important areas. The second phase will need to attach to the first. The phase one design will need to plan to appropriately work with the second phase, and be able to adequately function well on its own until the second one is built. The budget focus will be a strong influence on this design alternative by limiting the choices (Brochu 18-19).

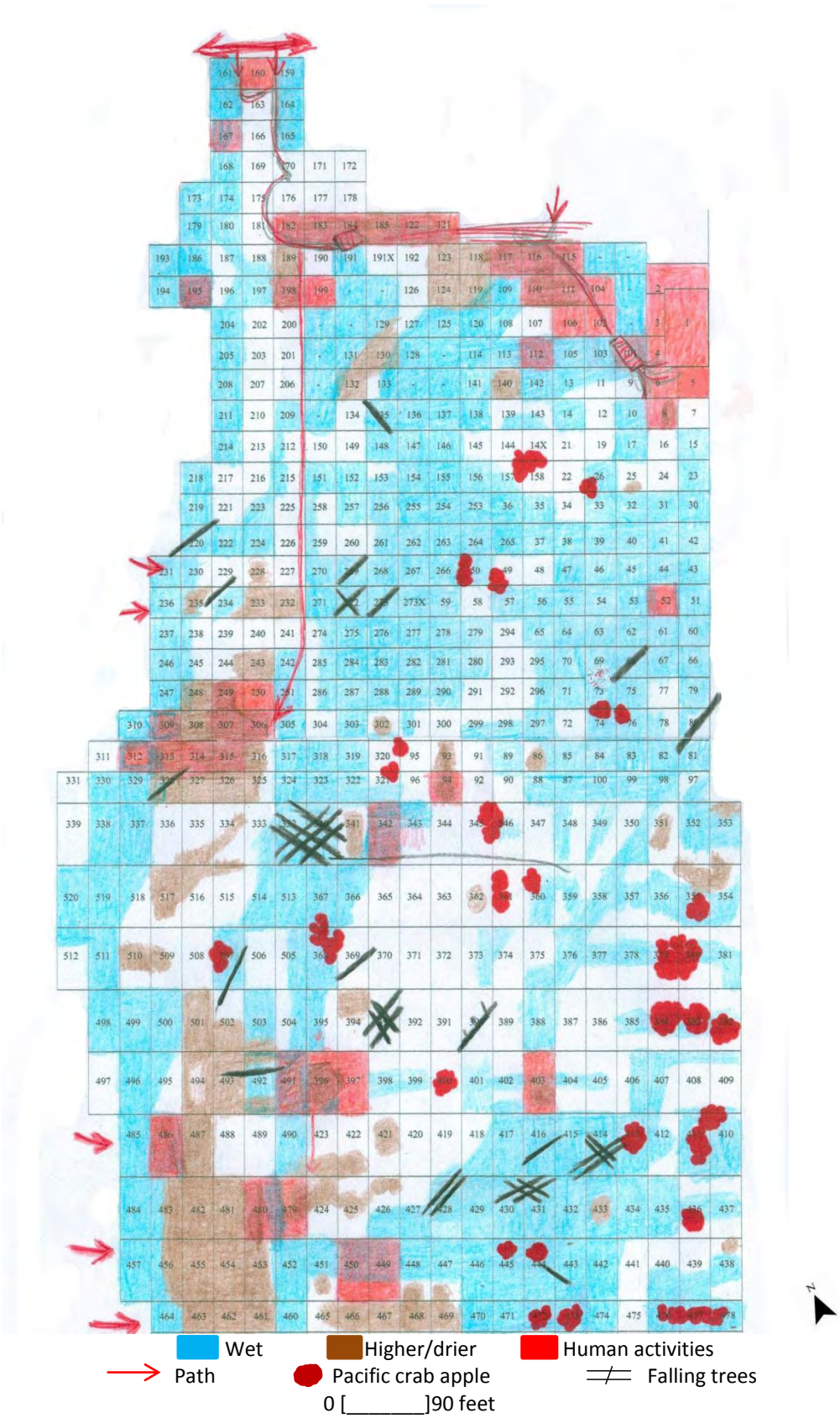


Figure 8.1: Site consideration for scenario #1 Budget Focus (Hanson 2012)

8.1.2 The Route

A route created with a budget emphasis can be found in the following diagram (figure 8.2). In this plan, the trail is routed through the higher/drier areas as much as possible to extend the route with a less expensive material. The drier locations will use less boardwalk material and an unpaved less expensive material such as gravel could be used to lower costs. Areas of Pacific crabapple and obvious falling trees will be avoided to lower maintenance and repairs. The creek floodplain will also be avoided as the strength of the water velocity could also damage the boardwalk. The boardwalk will not be located in trenches or ravines as that would require a pedestrian bridge with railings which would raise costs. Gathering spaces will be located where the higher/drier areas are so built platforms will not be needed. Signage should be attached to tall trees and native shrubs should be planted underneath to protect signs from vandals. For the sake of revenue generation, the route will begin at the ticket booth and end at the gift shop. This will give the loop a counter clockwise flow pattern.

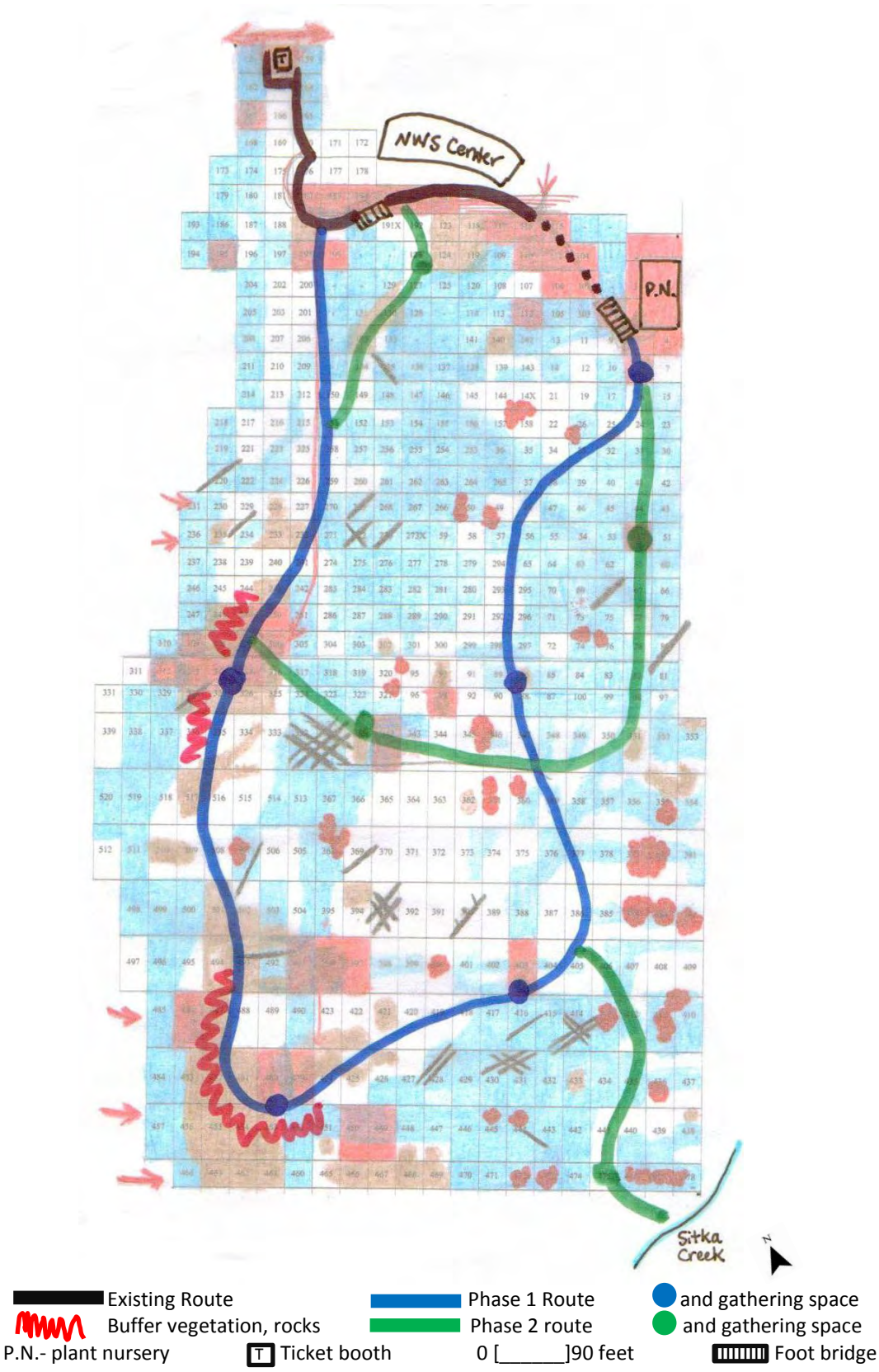


Figure 8.2: Diagram of route design based on scenario #1 Budget Focus (Hanson 2012)

"Interpretive sites not run by commercial ventures fail to recognize their visitors as customers" (Brochu 15)

8.2 Visitor Needs Focus

Focusing on the needs of the visitor of a site, a design must take into account accessibility, comfort, and safety. To do this requires some understanding of the characteristics of the potential audience. The Adopt-a-Stream Foundation would like to provide this boardwalk as part of their Northwest Stream Center outdoor educational program. The users in this case would be adult professionals and teachers in classes and seminars, students of different levels using this site as an outdoor learning center, organizational groups, community and regional visitors interested in learning about the wetland functions, or those just wanting to experience nature. The visitors may be part of guided tours, fieldtrips, scientific study groups, tourist groups, volunteer organizations, foundation members or potential donors to the center (Murdoch, pers. comm. 2011-12).

8.2.1 Site Consideration

Parking is available in several areas of McCollum Park. The entry location for visitors themselves will be at a ticket booth in the northwest corner of the site (photo 8.4). This will take visitors immediately past the trout stream exhibit before they enter the center's building or the wetland trail. A kiosk or sign needs to mark the entry gate and a sign needs to designate where the trail begins, especially if the trail has a sequential route (Kusler 1, 10). For the sake of accessibility, the trail width should be at least six feet with pullout areas, since groups will be using it, and to allow wheelchairs to pass, and the slope will not exceed five percent. For maintaining a firm level trail without obstacles, the boardwalk will be used exclusively for the route as a trail would not be adequate here (Trapp et al. 89) (Brochu 116) (Kusler 10).

Providing for visitor comfort requires food, water, resting places, restrooms, adequate space, convenience and adequate directions (Brochu 110-11) (Trapp et al. 84, 92). The center's building can provide food, water, seating, restrooms and additional information brochures and maps. Benches for resting areas along the trail can be located at areas with a good view of the landscape or wildlife activities. Different areas of the site can be given names and located on a map handout along with items of interest, for the convenience and comfort of the visitors (Potteiger and Purinton 2).

Safety is also important so the boardwalk will be designed and built by professionals experienced in this work and will have a two by four inch rimmed edge to prevent wheelchairs from going off into the mud (Kusler 6). Hazards such as loose trees should be removed, boardwalks should be fastened securely, and warning signs can be placed if there are any potential hazards (Trapp et al. 84).

The site diagram (figure 8.3) shows areas that pertain to visitor accessibility, comfort, and safety concerns. Areas to be avoided such as hazards, falling trees, deeper water, mosquitoes, beaver issues, and tenacious mud were noted. Human campsites

and access footpaths were also marked as these can cause visitors to feel uncomfortable and less safe. Deterrents should be placed to discourage this activity.

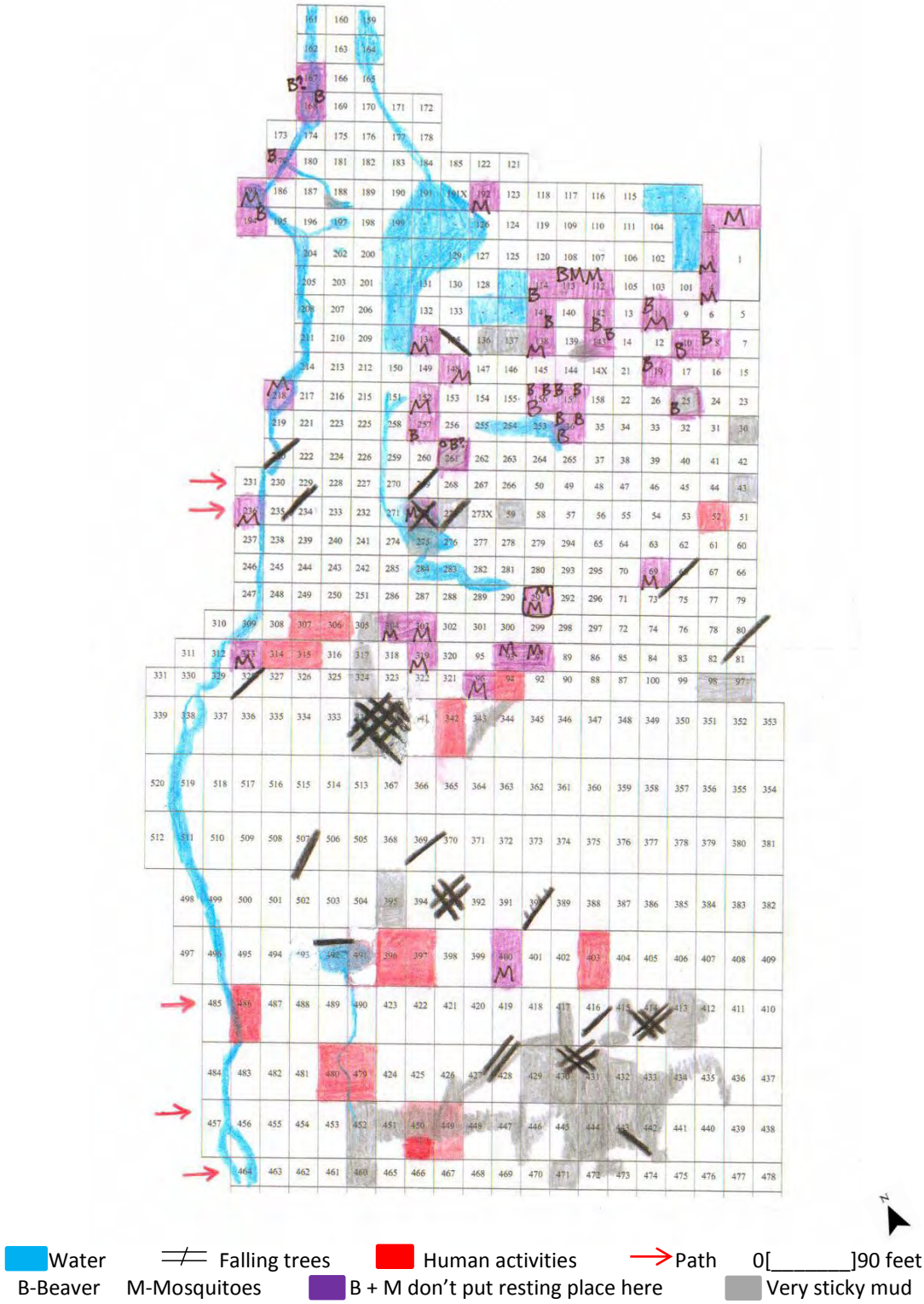


Figure 8.3: Site consideration for scenario #2 Visitor Needs Focus (Hanson 2012)

8.2.2 The Route

Photo 8.4: Site main entry (Hanson 2012)

Photo 8.5: AASF debris to move out of view for the forest trail entrance (Hanson 2011)

In the following diagram (figure 8.8), a route was added to address some of the needs of the visitor in relation to the site characteristics. ADA access requires the entry gate path (photo 8.4) to be less steep, so a longer entryway was added at the north end to lessen the grade. Adopt-a-Stream's work debris (photo 8.5) should be moved to an out of view storage bin, as the piles are currently scattered around one of the trail entrance/exit areas which looks confusing, messy and hinders access to the trail. Entry kiosks and directional sign locations were also located.

This route avoided as much as possible, some of the hazards such as actively falling tree areas (photo 8.6), sticky mud (photo 8.7), deeper water, and terrain with greater elevation changes. Seating and gathering spaces where visitors would be more apt to spend time were not located in areas where beaver and mosquito activity was highest, to prevent interactions. A shortcut trail was included for convenience, and areas needing deterrents were marked.

Photo 8.6: Falling tree hazard (Hanson 2012)

Photo 8.7: Thick mud hazard (Hanson 2011)

Figure 8.8: Diagram of route design based on scenario #2 Visitors Needs Focus (Hanson 2012)

"…but as the care of nature increasingly becomes an intellectual concept severed from the joyful experience of the outdoors, you have to wonder: Where will future environmentalists come from?" (Louv 147)

8.3 Environmental Impact Focus

Designing with an environmental impact focus includes preventing or minimizing the amount of damage a project causes, repairing or improving the area, and using the project to promote environmental education and stewardship. Access also allows for the environmental education necessary to appreciate the value of ecosystem functions, which leads to activities and choices that can improve the conditions of the environment (Louv 41, 159, 225, 353). This wetland boardwalk will provide access to the outdoor trail stations, wetland research, bird and wildlife watching, guided tours, demonstrations, events, and stewardship activities (Kusler 1) (Trapp et al. 80). Stewardship needs include removing invasive plant species as they did at Rotary Community Park (photo 8.9) and the removal of garbage and debris left behind at campsites in the drier western redcedar areas of the site (photo 8.10).

Photo 8.9: Access helped invasive plant removal at Rotary Community Park (Hanson 2008)

Photo 8.10: Access needed to remove debris from scattered campsites (Hanson 2011)

8.3.1 Site Consideration

In the following diagram (figure 8.11) features of interest have been noted pertaining to damage prevention, repair, and educational opportunities that the site contains. Areas that should be protected with buffers include the skunk cabbage wetlands in the south end and the banks along North Creek. Higher and drier areas are noted as they may provide better locations for the trails. Locations of human campsites are marked for garbage removal and deterrents to be placed. Invasive plants are noted for removal and are areas that should be replanted with native vegetation. Interesting nurse stumps, sectors where larger quantities of wildlife were encountered, and plant communities of limited amounts are also noted as places to explore from a little distance.

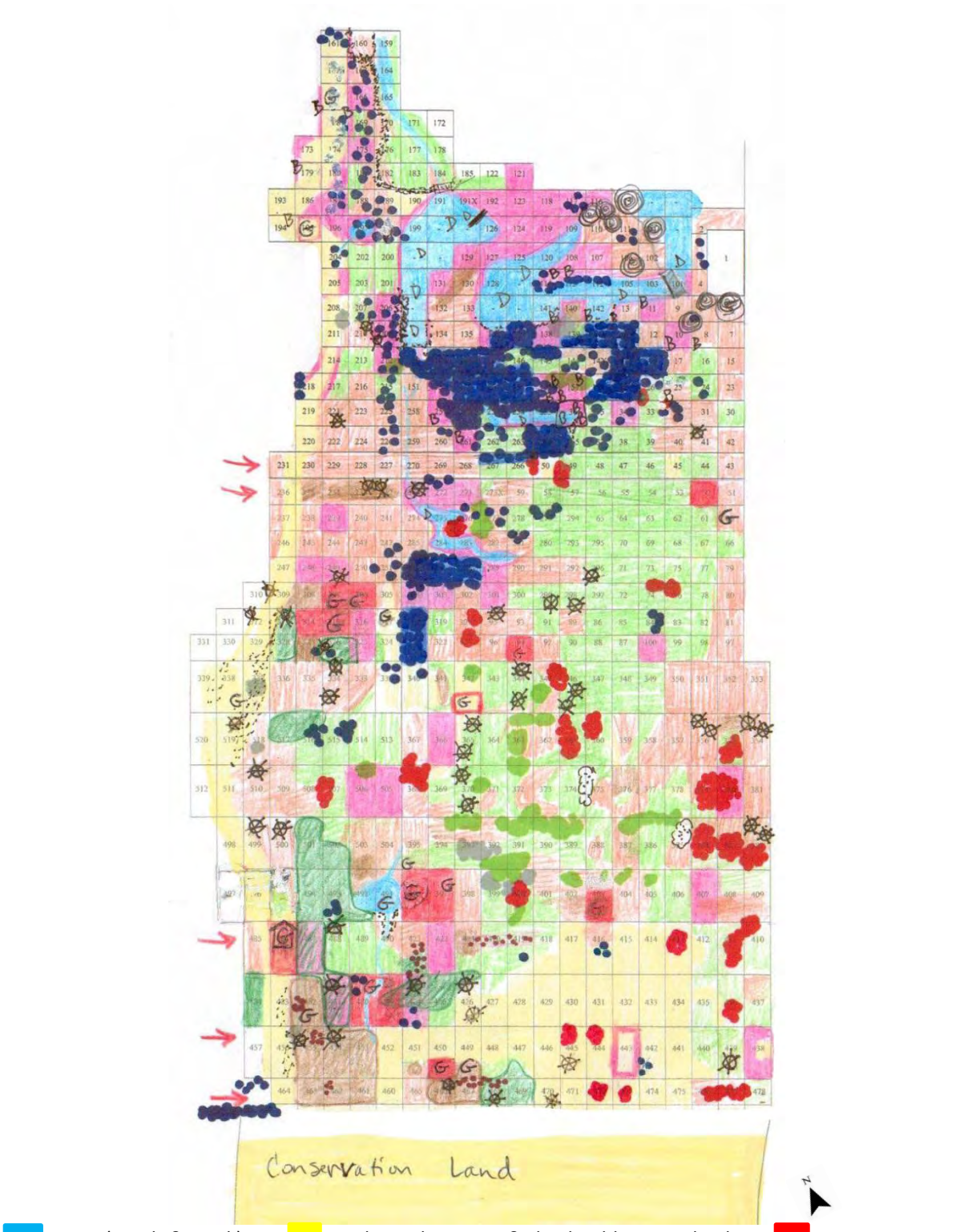


Figure 8.11: Diagram of site consideration for scenario #3 Environmental Impacts (Hanson 2012)

8.3.2 The Route

To reduce the damaging effects of the boardwalk trail in the wetland, this route will go through the higher and drier areas as much as possible, avoid the steeper grades of the ravines, and go around trees and large features (Kusler 4, Trapp et al. 92-83). Buffers should be placed in some areas near the boardwalk and the creek. Areas planted with vegetation along North Creek will help improve the bank erosion occurring from people climbing up after crossing the creek, and provide a visual screen to hide the view of the boardwalk. Other areas of the bank are being undermined by the forces of high water events (photo 8.12) and should be avoided as hazards. Large decaying logs, large rocks, or plants could be utilized as barriers in the higher and drier areas that are being used as campsites, to help deter the activity. They could block access to areas that are being replanted after invasive plant removal, or discourage shortcuts across protected areas (Birkby 219, 222-3) (Trapp et al. 83) (Brochu 116-17). Buffer space is also needed at the muddy duck pond edge in sector 209 where animals need access to the water and leave their tracks for visitors to view (photo 8.13).

Other interesting processes may need a closer look, such as the old nurse stump (photo 8.14) or the decaying wood with fungi, moss and slugs (photo 8.15).

Photo 8.12: North Creek has eroded its banks in some sections (Hanson 2011)

Photo 8.13: Deer and many other animals have left their tracks in this muddy pond area (Hanson 2011)

Photo 8.14: Old nurse stump (Hanson 2011)

Photo 8.15: Miniature community (Hanson 2011)

Photo 8.16: Site detention pond (Hanson 2011)

Photo 8.17: Skunk cabbage (Hanson 2011)

The processes of the wetland should be exposed to give the visitor an understanding of the wetland's functions and value. Water filtration is a function that can be observed at the site starting with stormwater from the asphalt flowing into the bioswale connected to the detention pond (photo 8.16), through the wetland out to the skunk cabbage areas in the south end (photo 8.17) and North Creek to the west. Following this sequence of wetland processes with the route is one way to explain the natural process of water filtration and cycling. The processes of erosion, decay, plant growth patterns and others can also be observed along the route telling this wetland's story (Potteiger and Purinton 3, 110, 112, 145). Figure 8.18 diagrams the route that follows the water flow through the wetland to showcase the wetland functions. Starting at the forested trail entrance in the northeast corner of the site, the bioswale which receives runoff from impermeable parking and building surfaces can be seen first. This bioswale runs into the detention pond, in which sediments can settle. The water then overflows into the scrub-shrub and forested wetland to continue the water filtration process until eventually it flows through several plant communities to the skunk cabbage emergent wetland. Then the trail cuts over to North Creek which can be observed sending water out into the community on the return aspect of the boardwalk trail. Along the way the plant communities and wildlife habitats of the wetland and surrounding area can be observed from a distance dictated by the trail, as well as described on signs posted at various stations, providing a dynamic story that connects the visitor with nature and its processes.

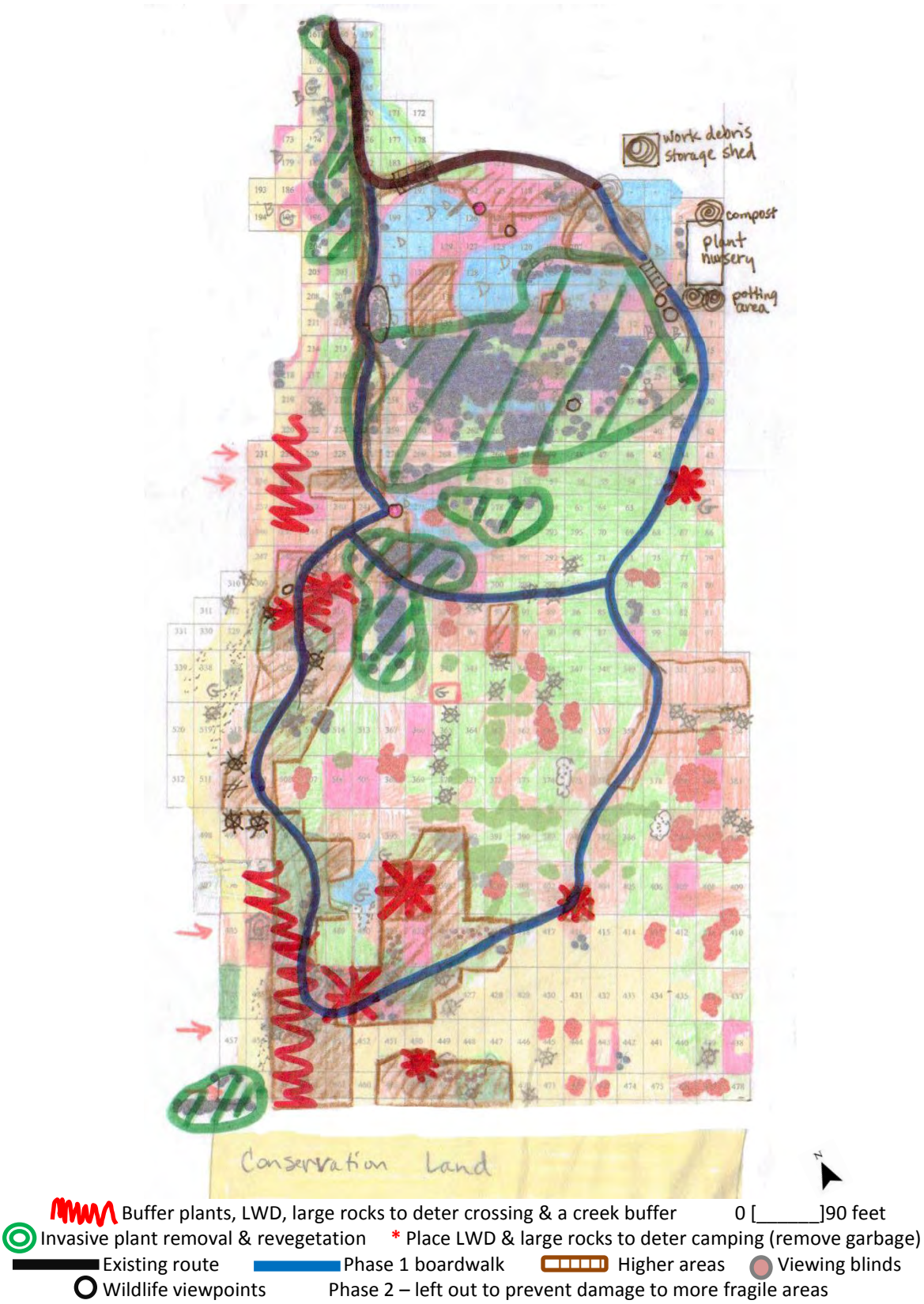


Figure 8.18 Diagram of route for scenario #3 Environmental Impact Focus (Hanson 2012)

"What becomes hidden or displayed tells the story of cultural values, myths, and ways of knowing." (Potteiger and Purinton 157)

8.4 Optimizing the Experience

This wetland forest has much to offer in stories to tell, variety to experience, viewpoints to find, beautiful images and the sublime, mysteries to be discovered and things to explore that can involve the physical, mental, and spiritual aspects of the visitor. The route needs to be designed to allow the visitor access to these experiences and the environmental learning activities that are available here. Water is scattered throughout the site in the form of ponds, trenches, creeks, puddles, thick mud, and standing water under vegetation (photos 8.19 and 8.23). Large woody debris forms snags for birds (photo 8.20), nurse logs and stumps for plants (photo 8.22), fish habitat on the creek (photo 8.23), and twisted shapes of nature's sublime artwork. Plants come in a variety of forms, many with flowers, colorful fruit (photo 8.21), and fall leaf color.

Photo 8.19: Duck pond

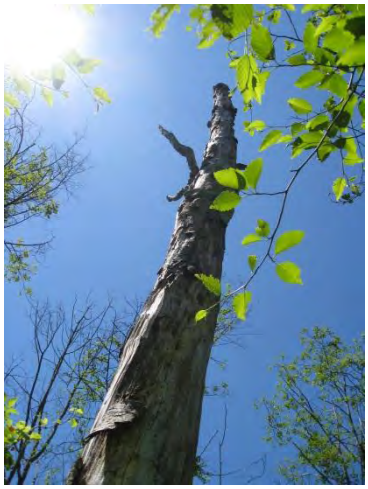


Photo 8.20: Tall tree snag

Photo 8.21: Red elderberries

Photo 8.22: Variety of vegetation

Photo 8.23: Fish habitat (photos by Hanson 2011)

In figure 8.24, is a diagram of sectors with the potential to provide the more interesting experiences for the boardwalk route through the site.

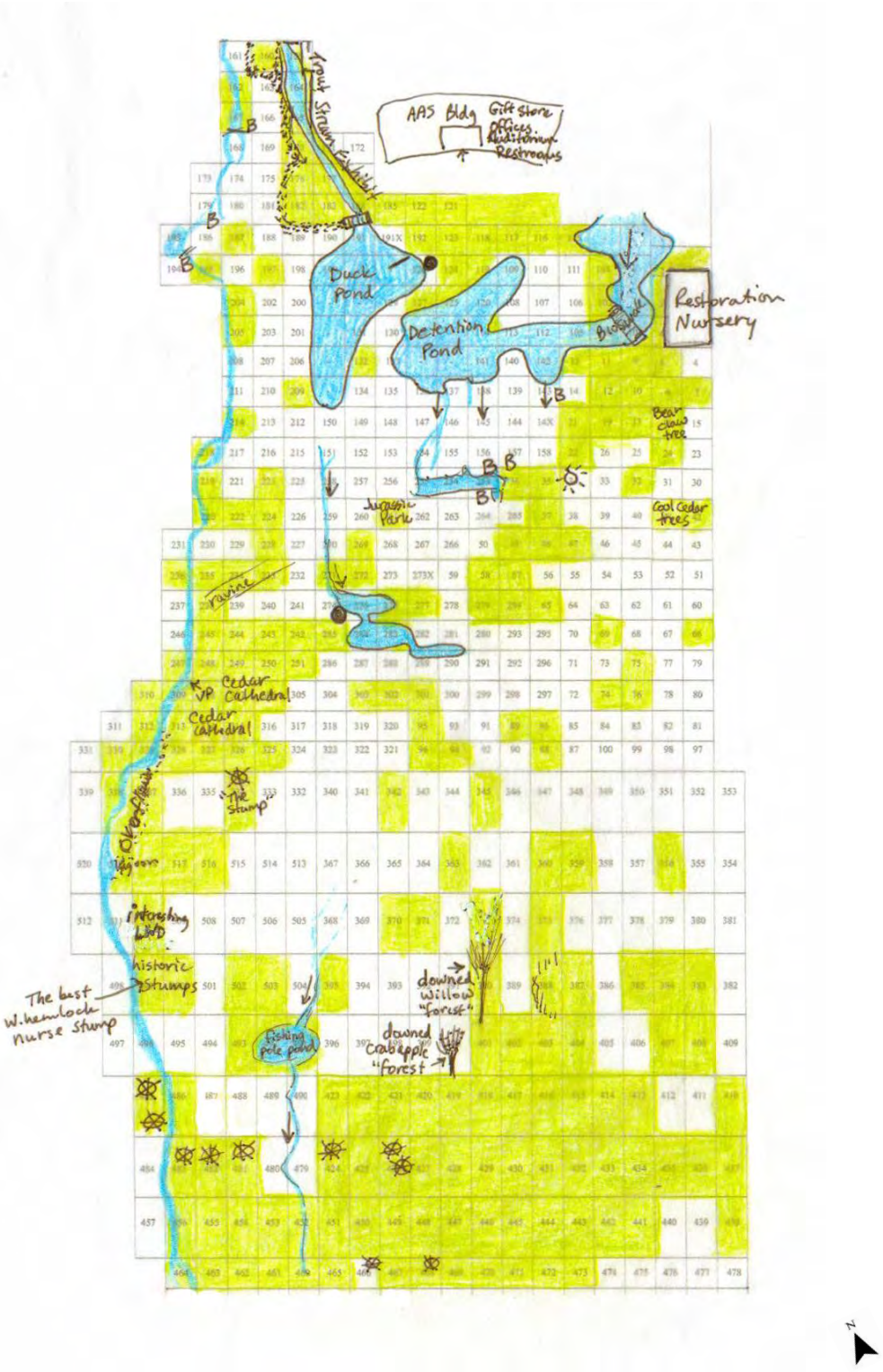


Figure 8.24: Diagram of site consideration for scenario #4 Optimizing the Experience (Hanson 2012)

8.4.1 Storytelling

Storytelling can convey the history, wetland functions, wildlife habitats, and educational information pertaining to this area (Potteiger and Purinton 129). Wildlife activity can be observed, signage will be located at stopping points (photo 8.25), and guided tours will be available here. Objects, such as the old orange canoe partially hidden in the shrubs near the duck pond (photo 8.26), or the notches in the stumps left behind by loggers about a hundred years ago (photo 8.27) can be exposed which can connect visitors to the history of the site (Trapp et al. 33). The trout stream exhibit (photo 8.28), which is a condensed version of a real stream, allows the stream design, habitats and functions to be displayed on a smaller scale for easier explanation. And the placement of the route will follow the sequence of the wetland filtration for better comprehension of the process similar to section 8.3. But unlike the cautious nature of the environmental focus, this experiential focus concentrates on bringing the visitor closer to the sites. Routing through the ravines, skunk cabbage wetlands, more highly populated wildlife areas, active processes of natural landscape changes, and other interesting features, the visitor will have an even better understanding of wetland characteristics, functions, and the species that inhabit them.

Photo 8.25: Signage at Mercer Slough tells stories of the area (Hanson 2012)


Photo 8.26: A remnant canoe begs the question, "What happened to the owner?" (Hanson 2011)


Photo 8.27: Loggers' notches (Hanson 2011)


Photo 8.28: Trout stream exhibit (Hanson 2011)

8.4.2 Variety

There is plenty of variety to experience at this site provided by vegetation, water, wildlife, colors, scales and scenes to encounter. This route goes by tall trees in the "cedar cathedral" area on the west side of the site, and the Douglas-fir trees in the southwest corner. Small scale features such as the nurse stumps or the variety of lichens, moss, and fungi on rotting woody debris found in many sectors should be close enough to the boardwalk to be seen. The variety of plant species, shapes, textures, smells, flowers, berries, and autumn leaf color enable the landscape to vary throughout the year for visitor interest. The route will pass through different wetland vegetation types such as forests, scrub-shrub and emergent wetlands, and several water bodies as these are great places to view wildlife such as beaver, water fowl, deer and others. Ponds, creeks, standing water and mud can allow a number of wetland lessons to be learned. Processes, habitats, flow patterns, and beauty can all be experienced. Frogs, water skippers, butterflies, dragonflies and other small wildlife offer small scale viewing at these locations as well.

Photo 8.29: Variety of vegetation and landscapes (Hanson 2011)

Photo 8.30: Small scales (Hanson 2011)

Photo 8.31: Seasonal color (Hanson 2011)

Photo 8.32: Barred owl (Hanson 2011)

Photo 8.33: Wetland variety (Hanson 2011)

8.4.3 Viewpoints

Photo 8.34: Duck pond looking north (Hanson 2011)

Photo 8.35: View framed by roots (Hanson 2011)

Stopping and gathering spaces positioned along the route can provide good places to examine the characteristics of the habitats and wetland processes found here. Viewing blinds (photos 8.36 and 8.38) positioned at ponds can allow unobtrusive wildlife observation. An observation tower (photo 8.37) will provide a panoramic view of the area over the top of salmonberry and spirea shrubs that are up to eight feet or more in places, and a line of site into the tree canopy level to observe the woodpeckers and other wildlife in the trees and snags, as this site does not have many opportunities for panoramic viewpoints. The lack of edge between the forest of this wetland site and the forests to the west, east, and south allows the site to "fade" into the others making this site feel much larger and more isolated from the developed areas that surrounds it, but the vegetation prevents long distance views. In the three images below (photos 8.36, 8.37 and 8.38) are examples of viewing towers and blinds taken from "A Guide to Wildlife Viewing and Photography Blinds" a PDF available at http://www.dgif.virginia.gov/.

Photo 8.36: Wildlife viewing blind (20)

Photo 8.37: Tower (22)

Photo 8.38: Viewing blind (12)

(3 Images: Virginia Department of Game and Inland Fisheries 12, 20, 22)

8.4.4 Beauty

At this site beauty can be found in the water views of the ponds, North Creek, wildflower meadows and the limited panoramic views of the scrub-shrub wetlands

(photo 8.39). Plants decorate the area with flowers such as pink salmonberry and nootka rose, yellow skunk cabbage and buttercups, red twinberry, white Pacific ninebark, and orange impatiens. Bright red fruit sparkle in the sun from red elderberry, Pacific crabapple, bittersweet nightshade, and red huckleberry. Fall colors from vine maple, Pacific crab apple, red-osier dogwood, and black cottonwood contrast with the evergreen plants (photo 8.40). While this beauty needs to be revealed, there are some aspects of the site that need to be concealed from the trail. At the forest entrance in the northeast corner of the site, the piles of work debris from the Adopt-a-Stream projects needs to be moved into a storage area behind vegetation to block the mess from view. The compost and other plant debris can be piled just north of the nursery where it can blend in and not be noticed. Once into the forest, vegetation and trail placement can be used to camouflage less than desirable views, and viewpoints should face away from objectionable or artificial structures such as the buildings near the ponds (Kusler 4, Trapp et al. 78). Garbage and invasive plants can be removed, while native plants can be added that provide berries, flowers, seasonal color, habitat value, and visual barriers if needed (Trapp et al. 78).

Photo 8.39: Beautiful scene (Hanson 2011)

Photo 8.40: Colorful foliage (Hanson 2012)

8.4.5 The Sublime

Photo 8.41: Roots of western hemlock show growth patterns on a nurse stump (Hanson 2011)

Photo 8.42: Hole under the stump may be a home to wildlife (Hanson 2011)

The sublime can be found in many sectors throughout this site in the exposed, weathered and twisted tree roots of logs, the nurse stumps with red huckleberry or salal growing out the top in wild abandon as the stump decays, or in the growth patterns of trees and roots that cover large woody debris like tentacles as they search for nourishment (photo 8.41). Odd holes in the ground or under stumps and logs can be shocking at first, and then intriguing as curiosity takes over (photo 8.42). These are some of the sublime features the route will enable visitors to discover and from which they can learn.

8.4.6 Mystery

A visitor may be tempted to see what's behind the forest in the glowing clearing (photo 8.43), but who left the machete stuck in the tree (photo 8.44) may remain a secret. The sounds of woodpeckers working, a distant large tree branch falling, or water trickling in a stream are some of the many experiences that can be encountered along this route designed to expose some of the mysteries hidden in this wetland forest. The boardwalk may curve and disappear behind vegetation propelling the curious explorer forward to see where it goes. Signs of unseen wildlife that hide in the woods can be revealed in the tracks, holes and plant damage left behind by their activities, as the route finds areas that the wildlife may frequent.

Photo 8.43: Glowing within the forest (Hanson 2011)

Photo 8.44: The machete tree (Hanson 2011)

The route can also reveal the secrets of humans who have visited the area over the years. In sector 486 is a small log cabin shelter or blind near the east bank of North Creek (photo 8.45). Who built it or why remains a mystery, but the surprise encounter can enhance the visitor experience. The qualities of this scenario focus of optimizing the visitor's experience through the route design can enhance the intriguing qualities of the site and increase the engagement of the visitor through the adventure, creating a more meaningful encounter with this wetland.

Photo 8.45: This log cabin or wildlife blind left behind at the site makes one wonder who, what, when, how or why? (Hanson 2011).

8.4.7 The Route

In the following diagram (figure 8.46) is a route proposed to give the visitor a greater opportunity to experience what the wetland site has to offer. The route is designed to go sequentially through the wetland functions while simultaneously allowing views of all the different wetland types and plant communities. It provides resting, gathering, and passing areas, as well as close views of smaller scale habitats such as nurse stumps. Other interesting aspects of the design include exposure to wildlife areas, habitat structures such as snags, water bodies of the wetland, interesting plants, a variety of viewpoints, seasonal color, and interesting finds such as nurse stumps, hidden topography, historic sites and views of the dynamic creek action. This route increases the sense of adventure through the variety of experiences available, but is it also more costly, environmentally damaging, and potentially riskier due to potential encounters with stormwater velocity, steeper topography, territorial disputes with wildlife, and route infringement on easily damaged areas of the site (Kusler 5, 7, 9).

Figure 8.46: Route design for scenario #4 Optimizing the Experience (Hanson 2012)

8.5 Summary of Design Scenarios

The four design scenarios I discussed were each formed through a lens with a single focus. The budget scenario created a route based on cost and revenue. The second scenario focused on the visitor's needs which consist of comfort, accessibility and safety. The environmental impact focus was concerned with minimizing the environmental damage, repairing and improving areas, and using the project to promote environmental awareness and stewardship. The fourth scenario emphasized what would provide the optimum experience for the visitor without considering the other impacts. Focusing in just one area, however, is not necessarily the best choice, as there are multiple areas to consider. In addition, trying to provide everything is also problematic as some choices contradict each other. In the following table 6, I have noted the advantages and disadvantages of the four scenarios, and how they may conflict. From this information, I will then pull out some priorities to use for the design in section 9.0 Design Proposal that I feel will provide a good plan for the educational boardwalk route that is to be built in the forested wetland at the Northwest Stream Center.

DESIGN SCENARIOS	Characteristics	Priority	Advantages	Disadvantages	Conflicts
Budget	reduce costs		realistic	minimizes the	visitor needs
Focus	raise revenue	X		experience	environ. impact
	mntn. budget	X			optimal experience
Visitor	access	X	more visitors	increase costs	budget focus
Needs Focus	comfort		good experience		environ. impact
	safety	X	return visits		
			raise revenue		
Environmental	min. damage	X	protects environ.	less experience	visitor needs
Impact Focus	stewardship	X	repairs environ.	less access	optimal experience
	education	X	environ. education	dilute educ.	
			concept goals		
			center's goals		
Optimize the	storytelling	X	more experience	more invasive	budget focus
Experience	variety	X	form connection	increase costs	ADA access
	viewpoints	X	memorable	risk damages	comfort (for some)
	beauty		ed. opportunity	limits ADA	env. stewardship
	sublime		adventurous	less childproof	safety
	mystery		provoke thought		
	involve visitor	X	engages visitor		

Table 6: Design Scenarios Summary
Information used to create this table came from the following sources: (Brochu 15, 17-18, 89, 110), (Kusler 4-5,7,9), (Trapp et al. 74,76-780,82-3), (Louv 1,3,41,225,269,353-4), (Potteiger & Purinton 11,119,135-6,139,143), (Tilden 33,46,85,88), (Birkby 217,219) & my on-site experience.

9.0 DESIGN PROPOSAL

Through the analysis provided by the four design scenarios in the previous section, I synthesized a design proposal that uses a more balanced approach than a single focus could achieve. In the following discussion of the final design proposal, the site characteristics and the criteria chosen for the design will be discussed.

9.1 Overall Design Description

Due to budget constraints the boardwalk route, as mentioned before, will be built in two phases. Phase one will consist of a half-mile boardwalk loop through the wetland forest that begins and ends at the current walkway on the south side of the Northwest Stream Center building within easy access of the auditorium, restrooms, offices and gift store. The second phase will include two viewing blinds and another half-mile of boardwalk connected to the first phase.

The entryway will be relocated to the northwest corner where a ticket booth currently sits unused. The booth window should face the north, as currently it faces south and has its back to the entering public. This would also raise the landing below the ticket window by approximately two feet which is needed to lessen the grade for ADA window access. To provide ADA access through the entrance, the path will be elongated to decrease the slope grade, and will require a boardwalk to accomplish the change. A north-facing sign can mark the entrance and a gathering space just north of the entrance next to the driveway would accommodate those waiting for others.

The boardwalk itself will be professionally designed, and will be built by Pin Foundations, Inc., who built many wetland boardwalks and piers in our region. This will provide a safe and reliable product with minimal damage to the wetland environment due to the way they attach the boardwalk with little digging required (Turner n. pag.). It will be low enough to the ground so railings will not be needed, but will provide kickboards for wheelchair safety.

The forest wetland route will begin in the northeast corner near the bridge that crosses the bioswale. Currently, Adopt-a-Stream work supplies and debris are stored in scattered piles here which will need to be moved to a storage area northeast of sector 115 in the corner of the parking lot for easy access, but out of view behind the vegetation, and out of the way of the forest entrance. A sign placed here at the entrance can indicate the beginning of the route into the forested wetland. It will cross the bridge, then pass by the detention pond and the Adopt-a-Stream plant nursery station, where it will proceed into the forested wetland heading generally south to follow the process of water filtration at the site. It will then head west to the area of historic tree stumps, then north through the “cedar cathedral” near North Creek. Areas where North Creek overflows during high water periods will be avoided as the velocity of the water could damage the boardwalk. The route will exit just west of the duck pond while skirting the muddy overflow on the southwest shoreline in sector 209, just

enough to allow a view of the animal tracks that frequently can be seen here while avoiding the steeper grade on the west side of the route.

Along the way, gathering spaces, seating, signage, passing areas and a shortcut trail will be located to provide rest, educational opportunities, directions, and space for accommodating groups and wheelchairs. The seating will not be located where the highest mosquito and beaver activities were noted, but avoidance will be hard to accomplish in a wetland setting. I recommend that the boardwalk be routed away from the deepest mud in case someone steps off, and that an arborist evaluate and remove unstable trees within reach of the boardwalk and gathering spaces (Trapp et al. 84).

During the preparation and construction phases, care should be taken to minimize damage to plants, habitats and other environmental structures. Garbage noted during the inventory stage should be removed. Rocks, large woody debris and native plants should then be added to these areas to discourage the camping. Invasive plants such as English ivy, Himalayan blackberry and bittersweet nightshade should be removed as much as possible, and replaced with native plants, possibly as mitigation.

To provide an interesting, educational and enjoyable experience for the visitor, the boardwalk will meander through a variety of vegetation communities, habitat structures, scales, colorful plants, water bodies and interesting views designed to reach out to the senses, intellect, and spiritual nature of the whole person. In the following table, diagrams, photos and other images, the design proposal will be presented.

9.2 Overall Site Plan

DESIGN PROPOSAL					
PHASE 1:	**Sector**	**View**	**Vegetation**	**Water**	**Features**
Front Entry	160	North Creek, bridge	DF, FW	creek	entry
		trout stream display		display	ADA access
Rest Spot 1	47	SSW	SSW	standing	seating
Viewpoint 1	499	DF, North Creek	DF-cedar	creek	seating
					viewpoint
Viewpoint 2	314	Cedar Cathedral	FW,DF-cedar	creek	seating
		North Creek	DF-Doug.fir		viewpoint
Viewing Blind 1	274	wildlife, pond	FW, EW	pond	seating
		skunk cabbage			view blind
PHASE 2:					
Viewing Blind 2	126-127	wildlife, duck pond	FW, EW	2 ponds	seating
		detention pond			view blind
Rest Spot 2	384	seasonal color	FW, SSW	standing	seating
Viewpoint 3	SE of 478	Sitka Creek	FW	creek	seating
					viewpoint
Rest Spot 3	487	DF, historic wood	DF-Doug.fir	creek	seating
Viewing Tower	293, 295	panorama	FW, SSW	none	tower
		wildlife, vegetation			seating

Table 7: Design Proposal Features (Hanson 2012)

Figure 9.1 Site Plan of Northwest Stream Center Wetland Boardwalk (Hanson 2012)
(Background photo: City of Mill Creek 2007)

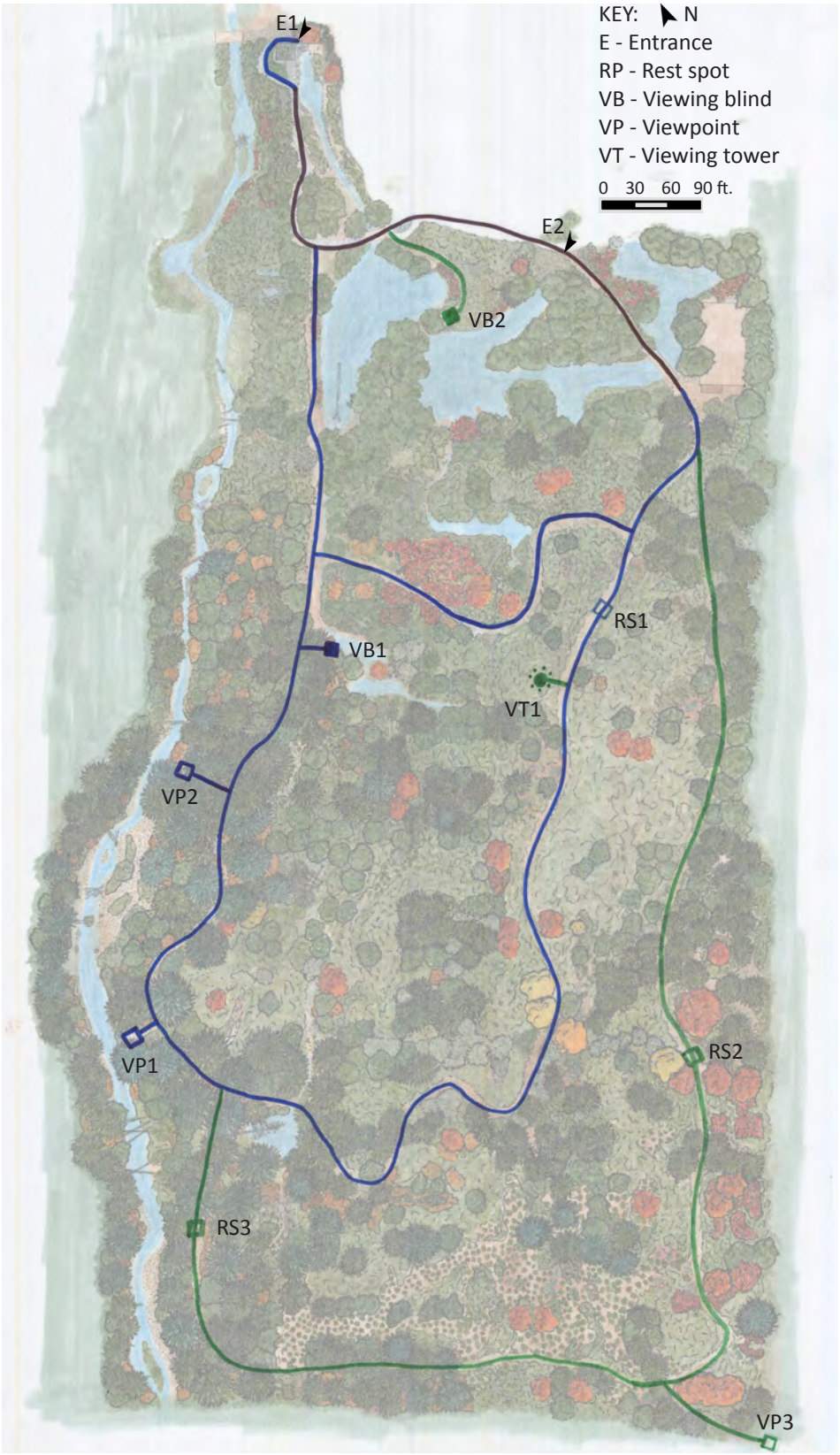


Figure 9.2: Boardwalk Route Diagram (Hanson 2012)

9.3 Entrance Designs

Main Entrance (E1)

- Turn the ticket booth to face north or put a window in north wall
- Add a garden area on north side of the trout stream exhibit to hide concrete wall
- Gathering space to assemble groups
- Provides small benches for waiting
- Small open area next to forest and North Creek with song birds
- Next to a driveway loop for easy pick up and drop off access for vans,

Figure 9.3: Mercer Slough Nature Park precedent as a gathering space at the entrance to allow waiting, meeting, and resting (Hanson 2012)

Photo 9.4: Current condition of the main entrance (E1) at the Northwest Stream Center (Hanson 2011)

The Entrances Feature:

- Visitor access
- ADA access
- Waiting area
- Gathering space
- Signage
- Directions

Forest Entrance (E2)

- Move debris to storage areas
- Signage denoting boardwalk entry
- Gathering space to assemble groups
- Near the center's restrooms, gift shop, offices and auditorium
- Provides small benches for waiting
- Small open area is surrounded by habitat for song birds, owls, and butterflies

Photo 9.5: Location and current condition of the entrance to the forest boardwalk (E2) (Hanson 2011)

9.3.1 Main Entrance (E1)

Figure 9.6: The main entry site's current condition (Hanson 2012)

Figure 9.7: Design Proposal for the Main Entrance (Hanson 2012)

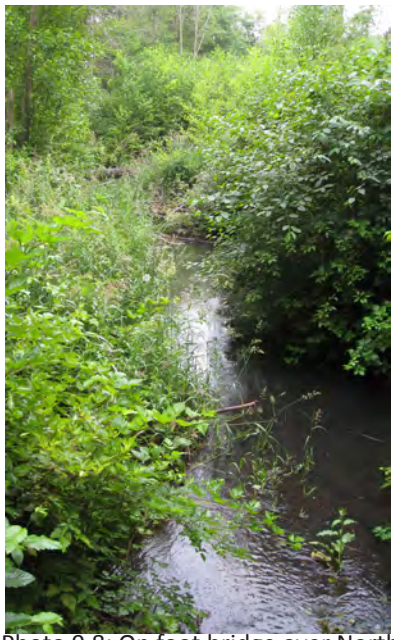


Photo 9.8: On foot bridge over North Creek west of entrance (Hanson 2011)

Features:
ADA access
Exhibit viewing windows
Wall area for sign
Booth for information

Photo 9.9: Trout stream exhibit next to main entrance (Hanson 2011)

Figure 9.10: Site Plan for Main Entrance (Hanson 2012)

9.4 Rest Spots

Photo 9.11: Rotary Community Park rest spot example for a dry site (Hanson 2012)

Precedents at Rotary Community Park and North Creek Park

Photo 9.12: North Creek Park rest spot example for a wetland area (Hanson 2012)

Rest Spot Characteristics:

- Seating to take a break or wait
- Gathering space to assemble groups
- Surrounded by wildlife habitat
- Educational signage

Site locations for the resting spots:

Photo 9.13: Site location for rest spot #1 (RS 1) at "Sunny Brier" (Hanson 2011)

Photo 9.14: Site location for rest spot #2 (RS2) at "Crab Apple Grove" (Hanson 2011)

Photo 9.15: Site location for rest spot #3 (RS3) in the "Forest of Tall Stumps" (Hanson 2011)

9.4.1 Rest Spot at “Crab Apple Grove” (RS2)

Figure 9.16: Design proposal for “Crab Apple Grove” to be surrounded by color while resting (Hanson 2012)

Features:

Photo 9.17: Seasonal color and fruit for wildlife (Pacific crab apple & red-osier dogwood) (Hanson 2011)

Figure 9.18: Site plan for rest spot (RS2) (Hanson 2012)

9.5 Viewpoints

Figure 9.19: Rotary Community Park viewpoint example (Hanson 2012)

Precedents at Rotary Community Park and Mercer Slough Nature Park

Figure 9.20: Mercer Slough Nature Park viewpoint example (Hanson 2012)

Viewpoint Characteristics:

- Seating to take a break or wait
- Gathering space to assemble groups
- Surrounded by wildlife habitat
- Educational signage
- Extends from boardwalk to a view

Site locations for the viewpoints:

Photo 9.21: Site location for viewpoint #1 (VP1) at the "Historic Wood Forest" (Hanson 2011)

Figure 9.22: Site location for viewpoint #2 (VP2) at the "Cedar Cathedral" (Hanson 2011)

Figure 9.23: Site location for viewpoint #3 (VP3) at "Sitka Creek Lookout" (Hanson 2011)

9.5.1 Viewpoint at “Cedar Cathedral” (VP2)

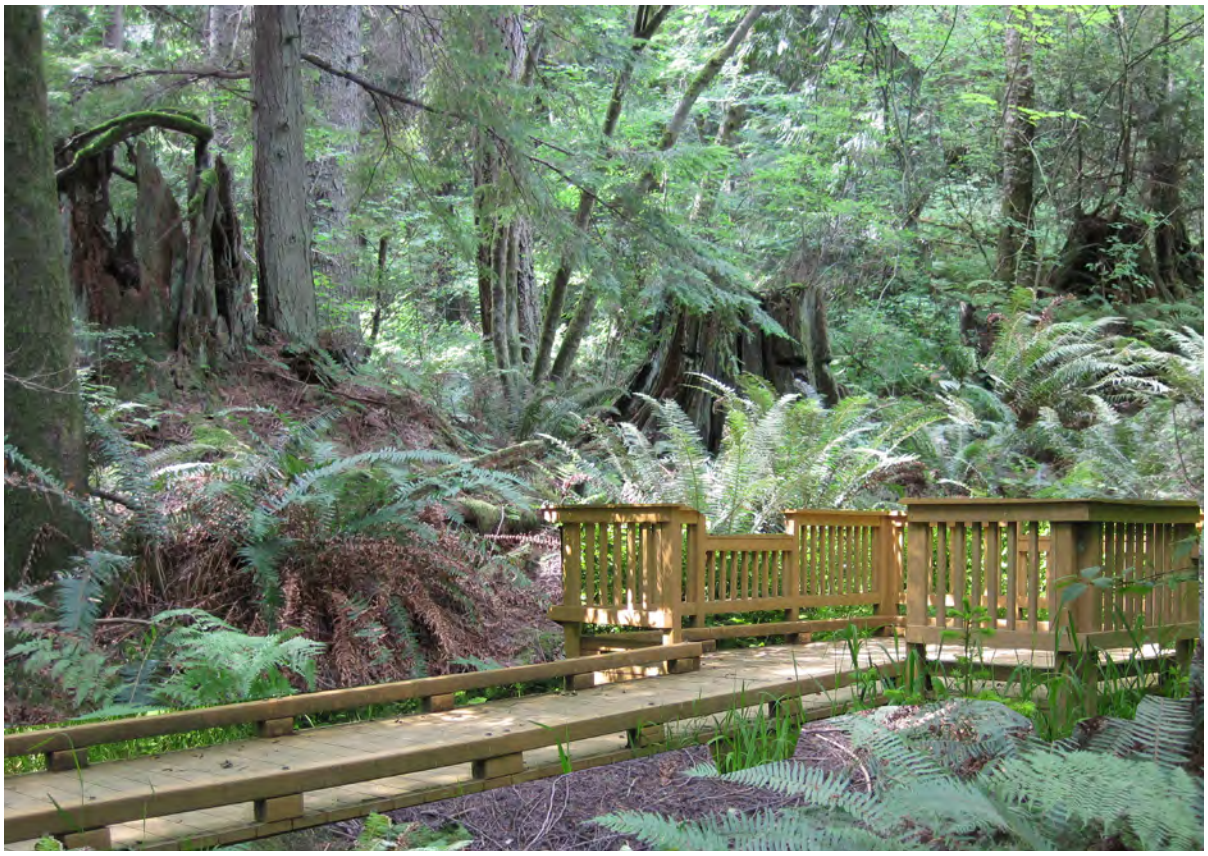


Figure 9.24: Design proposal for the “Cedar Cathedral” viewpoint (Hanson 2012)

Features:

- Dry forest
- Historic stumps
- North Creek viewpoint
- Woodpeckers
- Song birds

Photo 9.25: View of North Creek (Hanson 2011)

Photo 9.26: W. redcedar dry forest with Douglas-fir, salal & sword ferns (Hanson 2011)

Figure 9.27: Site plan for viewpoint (VP2) (Hanson 2012)

9.6 Viewing Blinds

Photo 9.28: Viewing blind example (VDGIF & CDW 12)

Photo 9.29: Viewing blind (VDGIF & CDW 14)

Photo 9.30: Viewing blind example (VDGIF & CDW 20)

Viewing Blind Characteristics:

- Barrier to prevent scaring wildlife
- Gathering space to assemble groups
- Surrounded by wildlife habitat
- Educational signage potential
- Seating potential

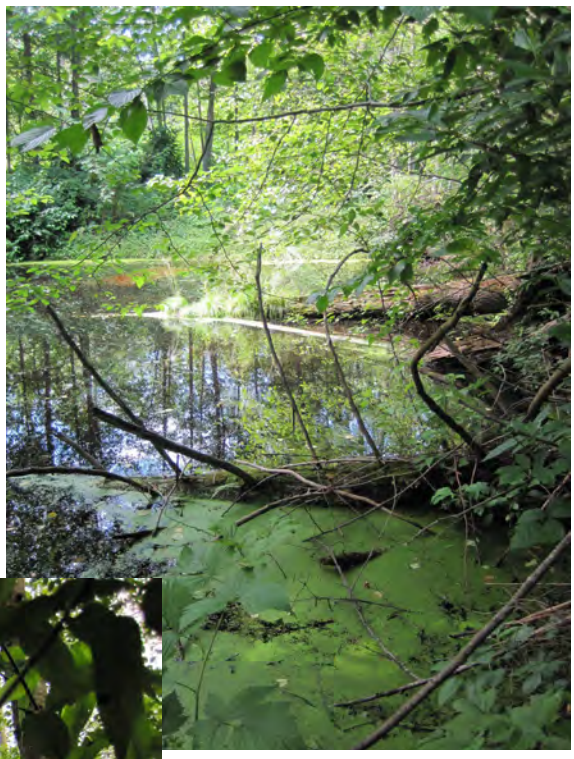


Figure 9.32: Site location for viewing blind #3 (VB3) at the ”Duck Pond” (Hanson 2011)

Site locations for the viewpoints:

Photo 9.31: Site location for viewing blind #1 (VB1) at the “Frog Pond” (Hanson 2011)

9.6.1 Viewing Blind at the “Frog Ponds” (VB1)

Figure 9.33: Design proposal for the “Frog Ponds” viewing blind using fish-shaped viewports (Hanson 2012)

Features:

Photo 9.34: Wildlife (Hanson 2011)

Photo 9.35: Emergent wetland skunk cabbage (Hanson 2011)

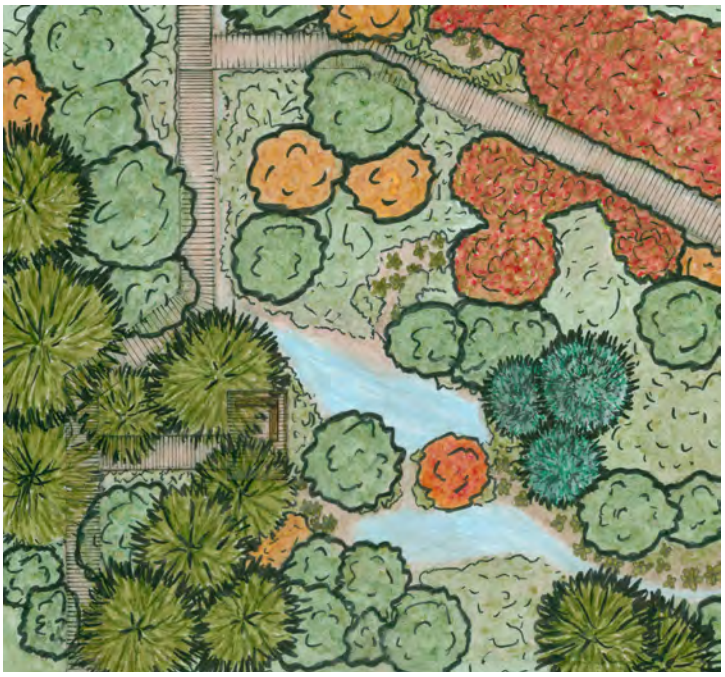


Figure 9.36: Site plan for viewing blind 1 (VB1) (Hanson 2012)

9.7 Viewing Tower

Photo 9.37: Viewing tower example taken from the PDF on wildlife blinds.
(Virginia Dept. of Game & Inland Fisheries and Colorado Div. of Wildlife 22)

Viewing Tower Characteristics:

- Panoramic viewpoint
- View into trees and tall snags
- Surrounded by wildlife habitat
- Educational signage potential
- Seating potential

Views from the Viewing Tower:

Photo 9.38: View from tower looking northwest at sector 57 (Hanson 2011)

Photo 9.39: View from tower looking west at sector 294 (Hanson 2011)

10.0 CONCLUSIONS AND REFLECTIONS

The Northwest Stream Center boardwalk project was a great experience, as I thoroughly enjoyed spending my summer in this nature environment. As a student in the University of Washington Landscape Architect program, I believe it provided valuable lessons on the stages of a professional project, and what needs to be done by the professional. In the following, I want to mention some of these lessons as well as a few others I learned while doing this project, and have divided them into four categories. The first group includes lessons related to the basics of a professional landscape architect project. The second is the lessons of wetland site inventory and some of its pitfalls. The third relates design theory and its connections to the experience of a site. And the fourth category promotes the appreciation of wetland ecosystems, their functions, and the importance of connections.

10.1 Education through a Professional Landscape Architect Project

The development of the professional project, as I mentioned above, has many lessons to teach about the profession and its practice. Two things I found to be important to a student doing this type of project for a thesis, however, involve time and communication. This was a large project for a student thesis, and while I enjoyed it, it was a learning process in many areas and learning requires time. I am very thankful that I started it in the summer when I had more time to spend on it. A project like this needs that extra time to get a thesis done within the school year.

Communication can make the job easier in other ways. I found it was important to clarify the parameters of the job. Open-ended directions such as “inventory everything,” unclear property boundaries, or expanding project boundaries into other areas, as well as adding to the list of duties beyond the scope of the project can make the job complicated and more time-consuming. Coming to an agreement about the project priorities and giving regular progress updates to the client will let him know that you are making progress, and indicate if there are problem areas. Do the same for your team members also.

10.2 Site Inventory

It is important to have a plan in place and a methodology set up for doing the site inventory, especially in a site where access and visibility can be a problem such as this one. Our methodology plan was to use a rope marking a north to south line along the east border of the property. From the plant nursery fencepost in the northeast corner of the site to the southeast marker by Sitka Creek was approximately 1,100 feet in length and we decided to measure our transect lines from this border. By using a compass, measuring tape, and a hand-held global positioning device, we felt we could do a good job of following a grid system of 30 x 30 sectors, and then plot it on a map using the GPS points. We wanted to be as accurate as possible, and use the GIS map to plot the route of the trail. We began our inventory with our measuring devices, *Rite in the Rain* field

notebooks, and a camera to photograph every sector. However, nature is messy, unpredictable and uncooperative at times, and can pass these qualities onto the equipment as well.

We found that a GPS unit which has a tolerance to within thirty feet is more of a waste of time to use than a help, and wasn't working well for the GIS mapping project. So we put it away and continued by using the compass and measuring tape. As we moved more into the thicker vegetation of salmonberry, Pacific crabapple, Himalayan blackberry (in limited areas), thick sticky mud, and standing water, it became harder to move in places and we were not able to cross all the way to the other side of the property, as we did not want to damage the vegetation, or ourselves, in the process. Consequently, we placed a second north to south rope from which we could measure the transects coming in from the central west, where it was higher and drier, and to help break up the expanse of the property.

In the meantime, I photographed every sector. To separate the images by sector on the camera, I took a photo of my boot between sectors, as a day's worth of photos could easily add up to 200 to 500 images. I found it best to leave some time to sort and label them every field day. I highly recommend each photo be labeled by sector, as they can easily get moved out of their folder when in use. My method was to label the folder first with the common information, download the day's photos from the camera, then as I was sorting them, add a photo label to each, such as 121-a, 121-b, 122-a, 122-b, etc. Later when I needed to locate a photo for a particular sector, it is easy.

Another strong recommendation would be to use a waterproof camera. A wetland has plenty of mud and water and it is easy to drop a camera or have it go into the mud and water when you fall in yourself (and you will). Take extra photos to weed out bad ones, and try to take the thicker forest photos on lighter days so they turn out better. Take photos of unknown plants to look up later, as it is too muddy to handle books in the wetland environment.

Simplify the notes. When your client says they want to know "everything," they probably don't mean that literally. I took too many notes. I didn't really need notes as detailed as I took, and they take up a lot of space in the report. Decide what is important ahead of time. I would recommend you do the plant inventory when the plants have leaves so they are much easier to identify. However, it is easier to see and move through the plants when most of the leaves are gone.

It is also easier to measure from your rope border line if a huge tree didn't just bury it when it fell. This incident is why our borderline took a turn on the east side. It was high enough to be impossible to see through and thick enough to be hard to climb through, so we worked from the other side for a while.

For a site this size and difficult, I suggest using a team of people to complete the inventory. Divide them up into two to three people per team, then have one measure, one take notes, and one take photos. Don't let them leave to do the computer work too early in the project or the site inventory gets behind, as it did in our case. Another time saver is to find a back route for the distant corners of a long site. Although this site is bound by forest on three sides, I was able to access the southwest corner by using the drier wooded trail on the park property to the west of the site. This saved me at least an

hour each way by not having to crawl through mud, water, and salmonberry to get out to the areas over a thousand feet south.

The last point I want to make about the inventory phase of this type is to be prepared. Wear tall waterproof boots and bring food, water, a jacket, a flashlight, and a cell phone. It is a long route back if you are cold, tired, hungry, wet, injured or lost, especially if it gets dark while you are trying.

10.3 Design Theory and Site Experience

Spending time at this site doing the inventory was not only enjoyable, but it gave me a much better understanding of the site characteristics such as water, soil, processes, vegetation communities, and wildlife. Getting that first-hand experience as a visitor can relate well to the design theory of site experiences as discussed in section 5.0 Design Literature Review. I found objects that were hidden such as the log cabin shelter and the machete. I observed animal behavior in the territorial owl dispute and the circulation patterns of the duck family. I was able to try out areas for potential wildlife viewing, while eating my lunch next to North Creek, sitting in the meadow next to the duck pond, or on a log in the dry forest. I think it is important to spend a little time at a site just observing or seeing the site through the eyes of the future visitors, as it is too easy to get wrapped up in the project and not contemplate what you are seeing or really trying to accomplish.

The seasons can add new dimensions to a site with water fluctuations, colors, flowers, fruit, weather or animal behavior, which can change the perception of the wetland if it gets dark and moody, or sunny, warm, and bright. Looking for wildlife in different ways helps to discover what lives there. By looking regularly for wildlife tracks left in the mud near the pond, or looking up into the tree canopy, I have seen signs of animals which told me what was there without actually seeing any of the animals themselves. I have also looked up and noticed owls who were casually watching my activity, probably well before I realized they were there.

Patterns found at the site can expose human activities, natural disturbances, and invasive plant circulation. Patterns of plant communities can show water level, plant companions, soil types and lessons in restoration techniques. By noticing these things and experiencing them at the site for myself, and coupling them with the design theory of experiencing a place, I am more able to design the route for the visitor to also enjoy while exploring.

10.4 Appreciation of Wetland Ecosystems and Connections

Now that some people have a better appreciation of the wetland ecosystems, we need to continue to repair the damage caused by the previous drain and dry advocates, and continue to bring understanding to other groups of people. I believe the time spent with these areas, coupled with the education that provides the understanding as discussed earlier in this report, will promote the appreciation of wetland ecosystems, their functions, and the importance of connections. To do that, we need access to good reference sites from which to learn, not more barriers to hide and ignore them. We need

to see them while we still have them, because we can't just throw the pieces together and expect sustainable functioning ecosystem to come from it. We need to understand the processes and the network connections. And we need to reconnect these ecosystems while there are still pieces to connect.

REFERENCES

Adopt-a-Stream Foundation [AASF]. "Elevated Nature Walkway," n.d. Web. 14 April 2012. <http:www.streamkeeper.org/aasf/NWSC.htm>

Adopt-a-Stream Foundation [AASF]. Website. <http://www.streamkeeper.org/>

Bach, Ashley. "North Creek Cleanup to Get Higher Profile." *Seattle Times* 1 Mar. 2005. Web. 11 May 2012. <http://community.seattletimes.nwsource.com/archive/?date=20050301&slug=northcreek01Ee>

Biebighauser, Thomas R. *Wetland Drainage, Restoration, and Repair.* Lexington: University Press of Lexington, 2007. Print.

Birkby, Robert C. *Lightly on the Land: The SCA Trail-Building and Maintenance Manual.* Seattle: The Mountaineers, 1996. Print.

Brochu, Lisa. *Interpretive Planning: The 5-M Model for Successful Planning Projects*. Fort Collins: InterpPress (The National Association for Interpretation), 2003. Print.

Bruce Dees and Associates. "North Creek Park," n.d. Web. 17 Apr. 2012. <http://www.bdassociates.com/Projects/wetlands/northcreek.html>

City of Bellevue. "Mercer Slough Ed Center Awarded Environmental 'Gold' Certification." 24 Aug. 2009. Web. 6 December 2011. <http://www.bellevuewa.gov/mseec-gold-environmental-certification.htm>

City of Bellevue IT Department. Mercer Slough Nature Park (map). 2010. Web. 6 December 2011. <http://www.bellevuewa.gov/pdf/parks/mercer_slough_base_map.pdf>

City of Everett Public Works Department. "North Creek Low Flow Augmentation." 2008. Web. 29 May 2012. <http://www.everettwa.org/default.aspx?ID=902>

City of Mill Creek. "City of Mill Creek Trail Map." 2008. Web. 5 February 2012. <http://www.cityofmillcreek.com>

City of Mill Creek. "2007 Aerial Photography-G". 2007. Web. 5 February 2012. <http://www.cityofmillcreek.com> (under City Hall and Maps)

Cooke, Sarah Spear, ed. *A Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon.* Seattle: Seattle Audubon Society, 1997. Print.

Department of Natural Resources [DNR]. "Recognizing Wetlands and Wetland Indicator Plants on Forest Lands in Washington," (n.d.): 1-154. Web. 5 April 2012. <http://www.dnr.wa.gov/Publications/lm_ess_recognizing_wetlands.pdf>

Dietrich, William. "Tom Murdoch: Now Directing Stream Makeover." *Seattle Times*. 1 May 2005, Pacific Northwest sec.: n. pag. Web. 11 May 2012. <http://seattletimes.nwsource.com/pacificnw/2005/0501/portraits.html>

eCityGov Alliance. "Mercer Slough Nature Park Trails." 2009. Web. 6 Dec. 2011 <http://www.myparksandrecreation.com/ParksTrails/Details.aspx?pid=471>

Ehrenfeld, Joan G. "The Expression of Multiple Functions in Urban Forested Wetlands." *Wetlands* 24.4 (2004): 719-733. *BioOne*. Web. 12 May 2012. <http://www.bioone.org/doi/full/10.1672/0277-5212%282004%29024%5B0719%3ATEOMFI%5D2.0.CO%3B2>

Enterprise Staff. "Construction Begins on Trout Habitat Exhibit." *Weekly Herald* [Edmonds, Lynnwood, Mountlake Terrace] 16 March 2007. Web. 11 May 2012. <http://www.heraldnet.com/article/20070316/ETP03/564459026>

Fevold, Karen, Christopher W. May, Hans Berge and Elissa Ostergaard. "Habitat Inventory and Assessment of Three Sammamish River Tributaries: North, Swamp and Little Bear Creeks," King County Department of Natural Resources and Parks, Water and Land Resources Division. 2001: 1-122. Web. 18 Apr. 2012. <http://your.kingcounty.gov/dnrp/library/2001/kcr756/NorthTribsReport.pdf>

Guyaz, Darren. "Salmon: Beyond the Skate Park." *Woodinville Patch.* 25 Jan. 2011. Web. 15 Apr. 2012. < http://woodinville.patch.com/articles/salmon-beyond-the-skate-park>

Hanson, Marian. Personal collection site photos of McCollum Pioneer Park, Snohomish County, WA. Taken by this author between June 2011 and May 2012.

Hanson, Marian. Personal collection site photos of Mercer Slough Nature Park, Bellevue, WA. Taken by this author on 2/5/12.

Hanson, Marian. Personal collection site photos of North Creek Park, Mill Creek, WA. Taken by this author on 4/8/12 and 4/6/11.

Hanson, Marian. Personal collection site photos of Rotary Community Park, Woodinville, WA. Taken by this author on 5/25/12, and in 2008.

Hinshaw, Mark. "Wet Park: Mercer Slough Demonstrates the Value of Preserving Wetlands in the City." *Landscape Architecture* 99:6 (2009 June): 24+. Print.

King County. "Bittersweet Nightshade: *Solanum dulcamara.*" *Noxious Weeds.* 2012. Web. 9 Apr. 2012. <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identificat...>

King County. "English Ivy: *Hedera helix.*" *Noxious Weeds.* 2012. Web. 9 Apr. 2012 <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identificat..>.

King County. "Himalayan Blackberry and Evergreen Blackberry: *Rubus armeniacus (*syn. *Rubus discolor)* and *Rubus laciniatus*." *Noxious Weeds.* 2012. Web. 9 Apr. 2012. <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identificat...>

King County. "English holly: *Ilex aquifolium*." *Noxious Weeds.* 2012. Web. 9 Apr. 2012. <http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identificat...>

King County Department of Natural Resources and Parks, Water and Land Resources Division (KCWLRD). "Hydrologic Information Center." 2009. Web. 29 May 2012. <http://green.kingcounty.gov/WLR/Waterres/hydrology/DataDownload.aspx?G_ID=689>

King County Department of Natural Resources and Parks, Water and Land Resources Division (KCWLRD). *Stream and Water Quality Monitoring*. 2009. Web. 21 Oct. 2011, 18 Apr. 2012. <http://green.kingcounty.gov/WLR/Waterres/StreamsData/WaterShedInfo.aspx?Locator=0450>

Kusler, Jon. "Common Questions: Constructing Wetland Boardwalks and Trails." *Association of State Wetland Managers, Inc.* 26 June 2006: 1-12. Web. 14 Apr. 2012. <http://www.aswm.org/pdf_lib/2_boardwalk_6_26_06.pdf>

Louv, Richard. *Last Child in the Woods: Saving Our Children from Nature-deficit Disorder.* Updated and expanded ed. Chapel Hill: Algonquin Books of Chapel Hill, 2008. Print.

Mitsch, William J., and James G. Gosselink. *Wetlands.* 4th ed. Hoboken: John Wiley & Sons, Inc., 2007. Print.

Moskowitz, David. *Wildlife of the Pacific Northwest: Tracking and Identifying Mammals, Birds, Reptiles, Amphibians, and Invertebrates.* Portland: Timber Press, Inc., 2010. Print.

Murdoch, Tom. Personal communications [pers. comm.] with Ecologist and Director of Northwest Stream Center. June 2011-Feb. 2012.

Nassauer, Joan Iverson. "Landscape Planning and Conservation Biology: Systems Thinking Revisited." *Conservation Biology* 20.3 (2006): 677-678. *EBSCOhost.* Web. 14 May 2012. <http://web.ebscohost.com.offcampus.lib.washington.edu/ehost/pdfviewer/pdfviewer?sid=67ae2d3d-026b-4482-9ba3-968df69ee5c7%40sessionmgr13&vid=2&hid=13>

Nassauer, Joan Iverson. "Monitoring the Success of Metropolitan Wetland Restorations: Cultural Sustainability and Ecological Function" in *Wetlands* 24.4 (2004): 756-765. *BioOne*. Web. 14 May 2012 <http://www.bioone.org/doi/full/10.1672/0277-5212%282004%29024%5B0756%3AMTSOMW%5D2.0.CO%3B2>

National Park Service. "Natural Resources Interpretation." *Archeology Program.* 2009 (last updated). Web. 26 April 2012. <http://www.nps.gov/archeology/ifora/tools_6.htm>

Pemberton-Butler, Lisa. "From a Parking Lot to Wetlands – Adopt-A-Stream to Celebrate Restoration of County Park Area." *Seattle Times* 20 June 1996. Web. 11 May 2012. <http://community.seattletimes.nwsource.com/archive/?date=19960620&slug=2335469>

Pin Foundations Inc. "Public Works." *Diamond Pier,* n.d. Web. 14 Apr. 2012. <http://www.pinfoundations.com/boardwalks.htm>

Pojar, Jim, Andy MacKinnon, Paul Alaback, Joe Antos, Trevor Goward, Ken Lertzman, Rosamund Pojar, Andrew Reed, Nancy Turner and Dale Vitt. *Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia & Alaska.* Revised ed. Vancouver, BC: Lone Pine Publishing, 1994. Print.

Potteiger, Matthew, and Jamie Purinton. *Landscape Narratives: Design Practices for Telling Stories.* New York: John Wiley & Sons, Inc., 1998. Print.

Rathbun, Andy. "Streams of Conscience: Adopt-a-Stream Has Helped Rehabilitate Habitats Since 1981." *Herald Net* [Everett] 22 Mar. 2008. Web. 11 May 2012. <http://www.heraldnet.com/article/20080322/LIVING08/383577402>

Santelmann, Mary V., and Kelli L. Larson. "Foreword." *Wetlands* 24.4 (2004): 717-718. *BioOne.* Web. 12 May 2012. <http://www.bioone.org/doi/full/10.1672/0277-5212%282004%29024%5B0717%3AF%5D2.0.CO%3B2>

Sheets, Bill. "Organizations Show Urban Stormwater's Environmental Harm." *Herald Net* [Everett] 29 August 2011. Web. 12 May 2012. <http://www.heraldnet.com/article/20110829/NEWS01/708299898>

Snohomish County. "Chapter 30.62A: Wetlands and Fish & Wildlife Habitat Conservation Areas." *Snohomish County Code.* Current through 15 Mar. 2012: 536-563. Web. 4 Apr. 2012. <http://www.co.snohomish.wa.us/County_Services/County_Code/County_Code_Collection.htm>

Snohomish County Dept. of Information Services [SCDIS]. GIS Division 2003. CD.

Snohomish County Dept. of Public Works [SCDPW]. "North Creek Regional Trail – (#RC1546)." 17 Nov. 2011. Web. 7 Apr. 2012. <http://www1.co.snohomish.wa.us/Departments/Public_Works/Services/Roads/Projects/ncreektrail.htm>

Snohomish County Dept. of Public Works [SCDPW]. "North Creek Trail." 2011. Web. 7 Apr. 2012. <http://www.co.snohomish.wa.us/documents/Departments/Public_Works/Roads/Projects/NCTBoards11142011.pdf>

Snohomish County Dept. of Public Works [SCDPW]. "Noxious Weeds in Snohomish County 2012: Classes and Status Weed List: Classes A-B Undesignated." 2012. Web. 9 April 2012.

<http://www1.co.snohomish.wa.us/Departments/Public_Works/Divisions/Road_Maint/Noxio...>

Snohomish County Department of Public Works Surface Management. "Lake Washington Watershed Information (map). 2005. Web. 4 June 2012. http://www.co.snohomish.wa.us/PWApp/SWM/watersheds/LWDwtrshd.html>

Snohomish County Parks and Recreations [SCPR]. "McCollum Park History," n.d. Web. 25 Jan. 2012. <http://www1.co.snohomish.wa.us/Departments/Parks/Park_Information/Park_Directory/Combination_Parks/McCollumParksHistory.htm>

Snohomish County Parks and Recreation [SCPR]. "McCollum Pioneer Park," n.d. Web. 6 Jan 2012 <http://www1.co.snohomish.wa.us/Departments/Parks/Park_Information/Park_Directory/Combination_Parks/McCollum_Park.htm>

Snohomish County Parks and Recreation [SCPR]. "North Creek Park and Water Retention Facility," n.d. Web. 17 April 2012. <http://www1.co.snohomish.wa.us/departments/parks/park_information/park_directory/regional_parks/north_creek.htm>

Society of Wetland Scientists (The). "Field Trips: SWS 25th Anniversary Annual Meeting." *Wetland Science and Practice* 21.1 (2004): 11-21. *BioOne.* Web. 4 June 2012. <http://www.bioone.org/doi/full/10.1672/0732-9393%282004%29021%5B0011%3AFT%5D2.0.CO%3B2>

Spear, Tom E. "Bridges and Structures for Trails: A Tale of a Trail: Boardwalks for Woodinville." *American Trails Magazine*. Spring 2007. Web. 15 April 2012. <http://www.americantrails.org/resources/structures/woodinville.html>

Stokes, David L., Marian F. Hanson, Deborah D. Oaks, Jaime E. Straub, and Aileen V. Ponio. "Local Land-Use Planning to Conserve Biodiversity: Planners' Perspectives on What Works." *Conservation Biology* 24.2 (2009): 450-460. *Wiley Online Library.* Web. 12 May 2012. <http://onlinelibrary.wiley.com.offcampus.lib.washington.edu/doi/10.1111/j.1523-1739.2009.01356.x/pdf>

Tilden, Freeman. *Interpreting Our Heritage.* 3rd ed. Chapel Hill: University of North Carolina Press, 1977. Print.

Trapp, Suzanne, Michael Gross, and Ron Zimmerman. *Signs, Trails, and Wayside Exhibits.* 2nd ed. Stevens Point: University of Wisconsin SP Foundation Press, Inc., 1994. Print.

Turner, Scott. "Gig Harbor Company Has a Solid Footing in Green Foundations." *Kitsap Sun*. 23 Mar. 2009. Web. 1 Apr. 2012. <http://www.kitsapsun.com/news/2009/mar/23/gig-harbor-company-footing-green/?print=1>

U.S. Army Corps of Engineers [USACE]. "Do I Need a Corps Permit?" 2012. Web. 26 Apr. 2012. <http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=Who_Needs_Permit>

U.S. Army Corps of Engineers [USACE]. "Wetland Delineation Information." 2011. Web. 26 Apr. 2012. Website contains wetland delineation manuals. <http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=REG&pagename=Wetland_Delineation>

U.S. Dept. of Agriculture Soil Conservation Service [USDASCS]. *Soil Survey of Snohomish County Area Washington*. In cooperation with Washington State Dept. Natural Resources and Washington State University Agriculture Research Center. 1983: 6, 20, 30-2, 60.

Vinluan, Frank. "New Habitat Area on North Creek is Moving Ahead." *Seattle Times.* 2 March 2000. Web. 11 May 2012. <http://community.seattletimes.nwsource.com/archive/?date=20000302&slug=4007688>

Virginia Department of Game and Inland Fisheries, and Colorado Division of Wildlife [VDGIF & CDW]. "A Guide to Wildlife Viewing and Photography Blinds: Creating Facilities to Connect People with Nature," (n.d.): 1-123 Web. 1 May 2012. <http://www.dgif.virginia.gov/wildlife watching/US-Viewing-Blinds-Publication-Low-Res.pdf>

Washington State Department of Ecology [WSDOE]. Ecology Publication No. 07-10-061: "Helping Urban Streams: North Creek Watershed – Fighting Flashy Flow." July 2007: n. pag. Web. 3 February 2012. http://www.ecy.wa.gov/pubs/0710061.pdf

Washington State Department of Ecology [WSDOE]. "Wetland Delineation," n.d. Web. 2 Apr. 2012. <http://www.ecy.wa.gov/programs/sea/wetlands/delineation.html>

Washington State Department of Ecology [WSDOE]. "Wetlands: Nature's Sponges, Nurseries, and Water Filters," n.d. Web. 26 April 2012. <http://www.ecy.wa.gov/programs/sea/wetlands/index.html>

Washington State Department of Fish and Wildlife [WSDFW]. "Hydraulic Project Approval (HPA)." 2012. Web. 26 Apr. 2012. <http://wdfw.wa.gov/licensing/hpa/>

Washington State Governor's Office of Regulatory Assistance [WSGORA]. "Aquatics Permitting." 2012. Web. 15 Apr. 2012. <http://www.ora.wa.gov/resources/water.asp>

Washington State Governor's Office of Regulatory Assistance [WSGORA]. "Project Questionnaire." 2012. Web. 15 Apr. 2012. <http://www.ora.wa.gov/resources/permitting.asp>

APPENDIX A:

Data Collection Field Notes of Marian Hanson for the Northwest Stream Center

Sector 1: 6/27/11 Marian: N 47° 52.630' W 122° 13.387' elev. 413' (SE corner of plant nursery), size 75' n-s x 42' w-e, light alder canopy – trees just outside fence line. 7/30/11 the owl in tree above nursery.
Sector 2: 6/27/11 Marian: N 47° 52.633' W 122° 13.387' elev. 415'
(pt. is ~25' north of plant nursery next to bioswale) N 47° 52.658' W 122° 13.393' elev. 433' (pt is 20' N of NW corner of nursery), W redcedar and red alder canopy, mid canopy 20' red-osier dogwood, salmonberry, and moss cover bank with 30% strawberries & 70% buttercups
Indian plum and bunch grasses, 2 3' holly, sword ferns along the water, herb-Robert along nursery fence line; 1" OM and woody branches with moss, birdhouse at N 47° 52.652' W 122° 13.392' elev. 426' (btw nursery and bioswale), lots of mosquitoes, heard 1 frog.
Sector 3: 6/27/11 Marian: N 47° 52.647' W 122° 13.395' elev. 413' (pt. is NE corner of sector); N 47° 52.643' W 122° 13.392' elev. 406' (pt. is SE corner of sector). Red alder canopy, salmonberry, sword ferns and horsetails 5' along water; 50% buttercups, 3' patch fringe flower, bunch grasses; 50% native blackberry coverage, 3' HBB sprinkled throughout; 1" OM w/ woody branches, + mosquitoes.
Sector 4: 6/27/11 Marian: N 47° 52.635' W 122° 13.396' elev. 405' (SE sector corner, SW corner nursery fence). Near bioswale – red alder, 40% salmonberry, GC 90% buttercups, 50% horsetails
N 47° 52.637' W 122° 13.405' elev. 405' (pt. is SW corner of sector next to pond. SW of bridge near pond) – Water's edge is salmonberry, twinberry, shield ferns. GC – 90% buttercups, 50% horsetails, 2 sword ferns, herb Robert. OM 1", woody branches, compost piles; + mosquitoes, 1 female duck.
Sector 5: 6/27/11 Marian: N 47° 52.630' W 122° 13.387' elev. 404' (pt. at SE corner of plant nursery, site just south); HP – 10' strip along north edge (elev. 406'). Red alder light canopy, 4 elderberry shrubs, shield ferns, salmonberry. GC – buttercups 70% cover, native blackberry; LP – most of the rest (elev 404')
1 10' holly tree with smaller 1-1.5' nearby, salmonberry 70%, shield ferns 70%, 8 deer fern, false lily of valley 80% cover; + OM soil, woody debris and moss.
Sector 6: 6/27/11 Marian: N 47° 52.626' W 122° 13.384' elev. 398' (pt. at SE corner). West edge is compost piles and discarded tree pile under w redcedar, center is a n-s path. Vine maple and false lily-of-valley on west side; ground feeding birds (occasionally), mosquitoes; ++OM cedar & woody debris.
Sector 7: 6/28/11 Marian: N 47° 52.630' W 122° 13.394' elev. 413' (pt is SE corner of sector)
N 47° 52.629' W 122° 13.394' elev. 402' (pt is SW corner of sector). Light red alder canopy around the edges, salmonberry 90%, shield ferns 70-80%, FLOV 90%, 1 huckleberry growing out of stump
OM – 2" then roots, 1-2" woody branches throughout, 3 big rotting logs.
Sector 8: 6/28/11 Marian: N 47° 52.631' W 122° 13.406' elev. 376'. W redcedar and w hemlock canopy, GC tree debris this half w/damp soil. Other half GC of FLOV, moss and very wet soil, 10% shield ferns, 5% salmonberry. 1 skunk cabbage, 1 vine maple, 1 elderberry, scattered native blackberries, 1 HBB, a few mosquitoes, beaver (?) damage on cedar trees (see photos).
Sector 9: 6/28/11 Marian: N 47° 52.630' W 122° 13.404' elev. 360' (SE corner of sector) large woody debris. Cedar debris under w redcedar trees, 2 vine maples, 1 large red alder and a few small ones beneath, 1 sword fern, 1 shield fern; rocky/sandy soil berm near pond; salmonberry, twinberry, shield ferns buttercups & a few horsetails 10' along pond.. LP – N 47° 52.634', W 122° 13.394' elev. 349' (midpoint so. border); HP - N 47° 52.629' W 122° 13.410' elev. 354' (cedar roots berm SW corner sector).
Sector 10: 6/28/11 Marian: N 47° 52.629' W 122° 13.410' HP elev. 354' (NW corner of sector). Light w redcedar canopy, 80% shield ferns, scattered salmonberry shrubs, FLOV on higher cedar roots (damp soil, more sun), scattered herb-Robert & NBB. Most of section is moist to wet and muck (foot sunk >1')
A few ground feeding birds, beaver (?) damage on cedar tree (see photo).
Sector 11: 6/28/11 Marian: N 47° 52.627' W 122° 13.416' elev. 364' (NW corner of sector). Tall red alder canopy, twinberry, salmonberry and shield fern by pond edge, GC is 85% buttercup, 15% FLOV, native blackberry, scattered herb-Robert. Beaver damage to 1 alder in pond, + mosquitoes, bird house NW corner next to pond. Soil wet in LP, moist in HP.

Sector 12: 6/28/11 Marian: N 47° 52.629' W 122° 13.418' elev. 373' (NW corner of sector). Tall red alder canopy, salmonberry covers 100%, scattered shield ferns; GC – 75% FLOV; light NBB & buttercups; 1 skunk cabbage & sword fern; OM – rich soil w/2" leaf debris, moss-covered woody debris, decaying stumps; (Possible small animal trails between stumps.)
Sector 13: 6/28/11 Marian: N 47° 52.634' W 122° 13.414' elev. 366' (SW corner of sector next to detention pond). Red alder canopy, GC buttercups 100% along shoreline and into water; twinberry & salmonberry cover the shoreline, scattered shield ferns throughout. OM – 1" with moss, moist soil.
Sector 14: 6/28/11 Marian: N 47° 52.630' W 122° 13.417' elev. 366' (NW corner of sector).LP – moist area near pond, SW corner 100% Himalayan blackberry coverage (5-6' tall). Red huckleberries growing out of 2 decaying stumps, scattered shield ferns, some sword ferns and horsetails, alder canopy with 1 western redcedar in SW corner, 1 clump of mushrooms, buttercups, FLOV next to wet muck; 1 decaying stump tipped over and its roots look like a picket fence.
Sector 15: 6/29/11 Marian (& Sam): GPS pt #56, 3 ft high point, 3+ ft. lower point. 3 tall red alder trees, 1 western hemlock; GC 100% FLOV on higher ground, skunk cabbage and shield ferns next to lower, very muddy area, 10' stump w/ a big huckleberry in center.
Sector 16: 6/29/11 Marian (& Sam): GPS pt #57, moist to wet, large downed trees crossing up to 4' high "Bear claw" marks 6' high on dead tree in NW corner (poss. stretch marks on tree); 100 % salmonberry with scattered shield ferns & skunk cabbage; 1 sword fern.
Sector 17: 6/29/11 Marian (& Sam): GPS pt #58; wet mucky mud, walked on downed trees; Cedars with many dead lower branches. Plants – filled with shield fern and salmonberry; false lily of valley, 2 large deer ferns and 2 sword ferns on west border.
(No sector 18)
Sector 19: 6/29/11 Marian (& Sam): GPS pt #59; wet and deep mud with RCG cover, LP. Thick HBB, some salmonberry, twinberry and spirea.
(No sector 20)
Sector 21: 6/29/11 Marian (& Sam): GPS pt #60; east half – HBB with RCG underneath (dying/shaded); west half – twinberry and spirea.
Sector 22: 6/29/11 Marian (& Sam): GPS pt #60B; salmonberry, shield ferns, HBB.
Sector 23: 7/1/11 Marian (Minsoo & Sam): GPS pt #62 – med. spaced cedar trees. NEEDS MORE PHOTOS Filled with shield ferns and salmonberry; very wet.
Sector 24: 7/1/11 Marian (Minsoo & Sam): GPS pt #63; "The Oasis" – downed tree with 4" deep water pool at the base. Lots of rotting big logs with moss and a little night shade. Area full of salmonberry and shield ferns.
Sector 25: 7/1/11 Marian (Minsoo & Sam): (was #18). GPS pt #64. South half – "The cedar tangle" – of dead tree branches and cedar trees. Thick woody decayed debris, floor covered with moss, downed trees. Beaver damage on base of some cedar trees. A few salmonberry shrubs, horsetails and shield ferns; some nightshade. North half – [Sector 25/18, 6/29/11, Marian (& Sam)]: Open area of canopy with cedar trees surrounding it, filled with salmonberry, shield ferns, & FLOV; large wood debris, large overturned tree stumps/roots, deep muck (got stuck) with sedge.
Sector 26: 7/1/11 Marian (Minsoo & Sam): (was #20) GPS pt #65 – "The briar tangle." South half – Open canopy, west border is crabapple tangle (drier), marshy standing water; shield ferns, salmonberry, some nightshade, RCG covers ground; ground level bee hive. North half – Wet and deep mud w/RCG understory; salmonberry, shield ferns, & HBB.
(No sectors #27-29)
Sector 30: 7/5/11 Marian (& Minsoo): Standing water, deep muck (sunk /stuck to top of boot), open canopy. Shield ferns 70%, salmonberry 70%, elderberry, skunk cabbage, FLOV, sword ferns.
Sector 31: 7/5/11 Marian (& Minsoo): "The potholes" – standing small pools of water in places.
W redcedar canopy, 50% salmonberry, 50% shield ferns, FLOV on logs. Lots of downed large logs and stumps, thick moss, red-headed woodpecker (see photo).
Sector 32: 7/5/11 Marian (& Minsoo): Large downed rotting trees, standing water in places, shield ferns 40%. Comes out into a shrub area with no tree canopy (sunny) of 80% salmonberry, some shield ferns, nightshade, small vine maple, some twinberry, with RCG.

Sector 33: 7/5/11 Marian (& Minsoo): Knee-high wood debris, standing water, open canopy, shield ferns and salmonberry; RCG covers ground.
Sector 34: 7/5/11 Marian (& Minsoo): Mostly RCG with 30% salmonberry, 30% shield ferns, 20% twinberry, scattered skunk cabbage and nightshade; a few moths and bees.
Sector 35: 7/5/11 Marian (& Minsoo): Thin red alder canopy; 2" standing water throughout, thick RCG 50% salmonberry, sprinkled with twinberry and nightshade (shrub layer taller than our head); (+ 1 unknown shrub – see photo).
Sector 36: 7/5/11 Marian (& Minsoo): 2" deep standing water, then a pond with duckweed; sprinkled with red alder trees and a few dead ones, salmonberry and spirea. Tall thick RCG & 1 unknown shrub (see photo). Beaver damage, animal path through brush (see photos).
Sector 37: 7/5/11 Marian (& Minsoo) (heading back to east border): 2" standing water and firm mud; shrub leaves are pale, lots of spirea. Groundcover is RCG, FLOV and scattered buttercups; twinberry and salmonberry throughout, a few elderberry and 1 vine maple; some nightshade, 1 patch of 7' tall irises, a few sedges with shield ferns.
Sector 38: 7/5/11 Marian (& Minsoo): Woody debris, moss, standing water and mud; patches of RCG salmonberry 70%, some twinberry small shield ferns, FLOV, sedges and *Juncas effuses.*
Sector 39: 7/5/11 Marian (& Minsoo): Standing water in potholes and mud; lt. canopy red alder, salmonberry 80-90%, scattered shield ferns; FLOV covers ground, scattered 5' patches of sedges, 1 licorice fern.
Sector 40: 7/5/11 Marian (& Minsoo): Irregular potholes with muddy standing water and large woody debris with moss. Cedars in mid-section, alders in east section, salmonberry 50%, 2 lady ferns, a few horsetails, false lily of valley on 80%.
Sector 41: 7/5/11 Marian (& Minsoo): "Cedar Root Tent", near tent tarp; swampy muddy pools, woody debris with moss on HP. Interesting cedar trees with stumps & rotting wood; shield ferns 40%, several skunk cabbage, scattered salmonberry.
Sector 42: 7/5/11 Marian (& Minsoo): "Historic cedar tree roots" – follows trail of downed trees and over stumps above water. Cedar canopy, muddy swamp bog with standing water, next to site border.
Sector 43: 7/6/11 Marian (& Sam): Lots of decaying tree logs, potholes of water, lots of moss on decaying wood. Light cedar canopy, 30% shield fern, scattered skunk cabbage, FLOV on logs; tree snags, lt. salmonberry.
Sector 44: 7/6/11 Marian (& Sam): East area - mucky mud, 90% salmonberry, buttercups 85%, scattered skunk cabbage and horsetails, 5 X 10' patch of sedge in flower (see photo). West area - going into a marshy area with little tree canopy, but surrounded by red alder, 4-6' woody branch debris, scattered sword ferns, standing water, false lily of valley and moss on woody debris and shield ferns.
Sector 45: 7/6/11 Marian (& Sam): Light red alder canopy, 50% salmonberry, woody debris with moss GC mostly open mucky mud & shield ferns; patches of thick FLOV on HPs.
Sector 46: 7/6/11 Marian (& Sam): Sunny, wet, woody decayed debris, 50% salmonberry and shield ferns.
Sector 47: 7/6/11 Marian (& Sam): Mud, understory plants with open mud in places and scattered woody debris of logs; 80% tall salmonberry, and shield ferns, false lily of valley on woody debris; scattered RCG, horsetails, and skunk cabbage.
Sector 48: 7/6/11 Marian (& Sam): Salmonberry and buttercups, then into twinberry, spirea and scattered red alder. Then back into salmonberry and false lily of valley; red huckleberries on stumps.
Sector 49: 7/6/11 Marian (& Sam): Light canopy of red alder, Pacific crabapple, 95% tall 7' salmonberry 50% FLOV in higher areas, and buttercups in muddy lower areas.
Sector 50: 7/6/11 Marian (& Sam): Light salmonberry; GC mix of buttercups, FLOV, RCG, small shield ferns and scattered skunk cabbage, then into vine maple and big Pacific crabapple tree on west edge
Cool stump that is rotted out, downed mossy tree, lots of mossy/woody debris, firm mud.
Sector 51: 7/14/11 Marian (and Minsoo): Cedar trees, potholes of water, logs covered with moss, moss and cedar debris throughout. Open understory lt. salmonberry, shield ferns, skunk cabbages and FLOV.
Sector 52: 7/14/11 Marian (and Minsoo): Edge of cedar clearing with tarp campsite then halfway point going into a more open canopy with salmonberry and an understory of FLOV. Swampy, deep mud, scattered with horsetails, shield ferns; resting owl.
Sector 53: 7/14/11 Marian (and Minsoo): Open canopy with red alder nearby, 90% salmonberry, understory of 60% common weed, sprinkled with shield ferns, lady ferns, FLOV, and horsetails.

Sector 54: 7/14/11 Marian (and Minsoo): Open mud with some standing water (1-2"), 1 stump with huckleberry shrub. Understory of patches of false lily of valley, weeds and reed canary grass under 90% salmonberry and an open canopy of red alder sprinkled with shield ferns.
Sector 55: 7/14/11 Marian (and Minsoo): Open alder canopy, 90% salmonberry; GC 60% FLOV, scattered skunk cabbage and shield ferns; large woody debris with moss and lichen; mucky mud, open in areas.
Sector 56: 7/14/11 Marian (and Minsoo): Open canopy with red alder, 95% salmonberry
RCG, shield ferns, skunk cabbage, scattered huckleberries; some standing water and mud.
Sector 57: 7/14/11 Marian (and Minsoo): Sunny open canopy, mucky mud, 70% salmonberry, twinberry mixed in; understory of reed canary grass and shield ferns.
Sector 58: 7/14/11 Marian (and Minsoo): Many small (10-12') red alders, some twinberry & 60% salmonberry; thick GC of RCG, shield ferns and scattered skunk cabbage with some small debris; between THE crab apple tree to N & "root wall" to S.
Sector 59: 7/14/11 Marian (and Minsoo): Low point with standing water and mud (easy to get stuck here). Med red alder canopy, vine maple mid canopy, light red elderberry, 40% salmonberry, light twinberry, skunk cabbage, light RCG and scattered sword ferns.
Sector 60: 7/19/11 Marian (and Minsoo): Soft mud, lots of small woody debris, light cedar canopy
50% salmonberry, 30% shield ferns, a few nettles, mossy roots with FLOV.
Sector 61: 7/19/11 Marian (and Minsoo): Standing water and mud, peripheral red alder canopy, dead snag. Wet mud patches alternate with mossy roots/wood debris covered with false lily of valley
Salmonberry 95%; shield ferns, skunk cabbage and horsetails scattered throughout.
Sector 62: 7/19/11 Marian (and Minsoo): Solid salmonberry in most, woody debris mossy with false lily of valley and 1 sword fern, then mud and 1" of standing water, 1 weed species throughout (see photo).
Sector 63: 7/19/11 Marian (and Minsoo): Light red alder canopy & young red alder, 85% salmonberry; mud, woody debris, snags.
Sector 64: 7/19/11 Marian (and Minsoo): Light red alder canopy, Salmonberry 95%, hard to get through, occasional nightshade. Lots of small to med woody debris, mud with a little standing water.
GC of scattered herb-Robert, sword ferns and 1 weed species (see photo).
Sector 65: 7/19/11 Marian (and Minsoo), 9/12/11 Marian: Salmonberry 95%, some twinberry, w/a mixt of shield ferns, sword ferns, 7' tall bracken fern, FLOV with moist, firm soil with standing water in places; some downed trees.
Sector 66: 7/20/11 Marian (and Sam): 2-4" standing water with wet mucky mud (can get stuck easily) Open canopy (now), 2 large red alders still alive but fell over; 30% salmonberry, shield ferns, RCG; FLOV & shield ferns on west edge; 1 hummingbird.
Sector 67: 7/20/11 Marian (and Sam): Open canopy surrounded by cedar and red alder; salmonberry 30%, shield ferns, 1 10' patch reed canary grass, 1 7' patch sedge, GC 50% FLOV, scattered skunk cabbage, mossy with woody debris with some woodpecker activity, 1 huckleberry on a stump; pothole puddles of 1-2" standing water.
Sector 68: 7/20/11 Marian (and Sam): 90% salmonberry, downed large red alder, 1 weed type (see photo), 3-4" puddles of water/potholes, FLOV on higher areas.
Sector 69: 7/20/11 Marian (and Sam): Similar to 68 with 90% salmonberry and an open canopy; dead red alder snags, downed tree and branches, FLOV & moss on soil, 1 weed specie (see photo), 1" standing water & mud, mosquitoes.
Sector 70: 7/20/11 Marian (and Sam): Short 5' vine maple, then into 100% salmonberry up to 10' tall
GC of FLOV or open mud and lots of woody debris.
Sector 71: 7/20/11 Marian (and Sam): 95% salmonberry; scattered bracken ferns, small shield ferns, buttercups, open mud, mossy areas with FLOV.
Sector 72: 7/20/11 Marian (and Sam): Open canopy with nearby red alder, 70% salmonberry, RCG, & 1 weed species; scattered sword ferns, shield ferns and FLOV.
Sector 73: 7/20/11 Marian (and Sam): 95% salmonberry, open wet mud with FLOV & moss on high points & wood debris; 1 red alder, open under low Pacific crabapple tree branches (tree tunnels & mud).
Sector 74: 7/20/11 Marian (and Sam) & 9/10/11 Marian (and Mark): Tall light red alder canopy; wet mud soft and thick in places, 60% salmonberry, 70% reed canary grass, scattered shield ferns and skunk cabbage, FLOV in patches, open mud, wood debris with moss, open canopy, song birds, sunny.

Sector 75: 7/20/11 Marian (and Sam): Open red alder canopy, w redcedar near east edge
60% salmonberry & RCG; scattered shield ferns, skunk cabbage, GC of FLOV.
Sector 76: 7/20/11 Marian (and Sam): (1 Pacific crabapple), 95% RCG GC, 30% salmonberry, RCG, herb-Robert, with mucky mud and 2" standing water.
Sector 77: 7/20/11 Marian (and Sam): 95% RCG GC, 30% salmonberry, RCG, herb-Robert, with mucky mud and 2" standing water, scattered large skunk cabbage; red huckleberries on woody debris.
Sector 78: 7/20/11 Marian (and Sam): 50% Salmonberry, shield ferns, and thick RCG, standing water in places; red huckleberry on woody debris, then into red alder.
Sector 79: 7/20/11 Marian (and Sam): Red alder cover, 70% salmonberry, scattered bracken ferns and sedge; FLOV and moss 95%, with some mud and wood debris.
Sector 80: 7/20/11 Marian (and Sam) & 9/10/11 Marian (and Mark): Downed large red alder tree that fell on border & has a dryer lint bird nest (?) in the rotting part of the tree just east of border rope
RCG, then red alder, salmonberry w/FLOV; (camera not working).
Sector 81: 7/22/11 Marian (and Minsoo): Med red alder canopy, downed trees, 95% salmonberry 8' tall moss and FLOV 100% ground cover; tiny stream.
Sector 82: 7/22/11 Marian (and Minsoo): Med red alder canopy similar to 82 with occasional nettles and horsetails, then goes into a sunny open canopy with open mud and more nettles, 80% salmonberry and shield ferns, bunch grass (or small sedge) and weeds (see photo); then into RCG, 80% salmonberry, 2" standing water and mud.
Sector 83: 7/22/11 Marian (and Minsoo): Salmonberry 90% and lots of wet mud; weeds (see photo), nettles, scattered shield ferns, FLOV and woody debris.
Sector 84: 7/22/11 Marian (and Minsoo): Reed canary grass, 50% salmonberry, mixed weeds, small shield ferns, isolated sword ferns, nettles and some nightshade, deep mud, 1-2" standing water.
Sector 85: 7/22/11 Marian (and Minsoo): 95% tall salmonberries, standing water and wet mud; woody debris with FLOV, 1 red elderberry, scattered sword ferns.
Sector 86: 7/22/11 Marian (and Minsoo): Light red alder canopy, 95% salmonberry; similar to 85 but becoming slightly higher elevation so drier with FLOV.
Sector 87: 7/22/11 Marian (and Minsoo): 95% tall salmonberries, standing water and wet mud; woody debris with FLOV, 1 red elderberry, scattered sword ferns. Similar to 85 except more mud and less ground cover (and across a mud creek).
Sector 88: 7/22/11 Marian (and Minsoo) Same as sector 87 – 95% tall salmonberries, standing water and wet mud. Woody debris with FLOV, 1 red elderberry, scattered sword ferns. Similar to 85 except more mud and less ground cover.
Sector 89: 7/22/11 Marian (and Minsoo): Medium red alder & western redcedar canopy, 80% salmonberry, but not as thick here; muddy open ground, FLOV on woody debris, scattered shield ferns and weeds, skunk cabbage, 10' patch of sedge.
Sector 90: 7/22/11 Marian (and Minsoo): 95% salmonberry and thicker here, slightly higher and less mud More FLOV, moss and woody debris.
Sector 91: 7/22/11 Marian (and Minsoo): Edge of w redcedar and red alder canopy, tall snag with holes, dead branch debris; 90% salmonberry, scattered red huckleberry, scattered horsetails, 90% FLOV on HPs; mud (creek), mosquitoes.
Sector 92: 7/22/11 Marian (and Minsoo), 9/10/11 Marian (& husband Mark): Tall red alder canopy, salmonberry 100%, with a little red huckleberry. Similar to 91 with salmonberry, FLOV in places and thicker leaf litter.
Sector 93: 7/22/11 Marian (and Minsoo), 9/10/11 Marian (& husband Mark): Western red cedar canopy, open underneath, mosquitoes. Groundcover of 50% cedar tree debris and 50% FLOV at periphery.
Sector 94: 7/22/11 Marian (and Minsoo): Open under western hemlock canopy, 90% FLOV, 1 large stump. Possible campsite (?) (found an old inflatable mattress).
Sector 95: 7/22/11 Marian (and Minsoo): Large western red cedar canopy, then back into salmonberry and red alder; red huckleberries on stump, Pacific crabapple tree at west border.
Sector 96: 7/22/11 Marian (and Minsoo), 9/10/11 Marian (& husband Mark) W red cedar, then red alder and large western hemlock canopy, Pacific crabapple with a coconut shaped gall (see photo); mosquitoes 70% salmonberry , 5% twinberry, tree debris and some FLOV.

Sector 97: 9/10/11 Marian (& husband Mark): 3' wide trench with a little standing water and thick mud (easy to get stuck) that ends just south of sector at cedars. W redcedar canopy (just south of red alder canopy), 70% salmonberry (taller than 8'). GC 70% FLOV, stinging nettles scattered within, OM – downed wood and leaf litter.
Sector 98: 9/10/11 Marian (& husband Mark): Edge of w red cedars into open canopy, 95% salmonberry (5-7' tall), thick mud with RCG, stinging nettles, horsetails and 1 weed type (see photo), easy to get stuck here; FLOV on woody higher areas; can hear a robin in SW.
Sector 99: 9/10/11 Marian (& husband Mark): Similar to 98 with open canopy, sunny, 10' tall salmonberry 95%; mud in places; GC of RCG with scattered small shield & sword ferns; FLOV on woody debris.
Sector 100: 9/10/11 Marian (& husband Mark): Open and sunny, 60% large salmonberry taller than 10'; Less GC – scattered shield ferns & RCG; woody debris w/FLOV, licorice ferns & moss, patch of small Pacific ninebark, more mud; nearby songbirds.
Sector 101: 7/29/11 Marian (was # F): East bridge, bioswale, detention pond; water skippers in bioswale (see photo). Chipmunk-like squirrel on bridge (no photo). Tall red alder canopy, woody debris in water, muddy leaf litter pond bottom. Shield ferns, salmonberry at shoreline, dogwood stakes; GC 70% buttercups and 30% horsetails.
Sector 102: 7/29/11 Marian (was #G): AAS construction/work debris piles; sector goes halfway into bioswale. Red alder canopy, young 5" diameter w redcedar, shield ferns, sword ferns and buttercups along bioswale.
Sector 103: 7/24/11 Marian (was #H): NW of bridge, north shore of detention pond, path goes through center. Tall red alder canopy, w redcedar next to pond. Salmonberry, scattered NBB, willow (or red-osier) stakes, snowberry N edge of path; shield ferns, horsetails, 60% buttercups, 2" OM, woody debris along bank. AAS construction/work debris along path, 1 frog.
Sector 104: 7/24/11 Marian (was #I): Path in SW corner and west border of sector, detention pond north & east border. Eastside is a peninsula that extends into bioswale, nearby song birds. Tall thin red alder canopy, red-osier dogwood 15-20' tall and shorter 2-4' salmonberry, 3 sword ferns, 1 Indian plum, center filled with stinging nettles, lt. RCG and patches of herb Robert, Bunch grasses and buttercups along bioswale. Mostly woody debris and OM with lots of AAS construction/work debris along path.
Sector 105: 7/24/11 Marian (was #J): North shore of detention pond, Tall red alder canopy, thin mid canopy of red elderberry, 40% salmonberry, NBB, willow (or red-osier) stakes; scattered horsetails & shield ferns, buttercups; lots of OM, small to med woody branch debris, and 1 stump. Bird house on a red alder leaning over pond, 2 ducks in the pond. 4" wide, 2' deep post hole or animal hole.
Sector 106: 7/25/11 Marian (was #R): Construct ion deb3is piled here, tall red alder canopy, mid canopy light red elderberry; then salmonberry 70%, woody debris with moss and OM throughout. Scattered NBB, 1 thimbleberry, herb-Robert.
Sector 107: 7/25/11 Marian (was #L): (Similar to 106) can hear a woodpecker, tall red alder canopy, mid canopy light red elderberry, 70% salmonberry, 1 Indian plum; woody debris with moss and OM throughout, scattered NBB, herb-Robert.
Sector 108: 7/25/11 Marian (was #M): Ground begins to drop down into water line, tall red alder canopy, a little red elderberry, 70% salmonberry, scattered shield ferns near shoreline; 1 holly, light GC of herb-Robert, NBB, RCG and buttercups. Heavier OM, some woody debris; songbirds and mosquitoes.
Sector 109: 7/25/11 Marian, 7/29/11 Marian (was #N): Mid to tall red elderberry; salmonberry, holly, scattered Indian plum, GC mostly buttercups, 1 sword fern, scattered HBB and RCG. Water canal cuts across here, large woody debris near water, lots of leaf litter. 7/29/11 Owl in NW side of 109 (see photos). NW bank of water, mostly red alder canopy with 2 w redcedar on W edge. Salmonberry and light red elderberry, then edge of buttercup meadow; 1 decaying log, soil moist but very firm.
Sector 110: 7/25/11 Marian (was #O): Water channel ends here, beginning of the compost pile; tall red alder canopy; scattered salmonberry and thimbleberry. Mostly buttercups sprinkled with RCG and herb-Robert. Lots of leaf litter and small woody debris.
Sector 111: 7/25/11 Marian (was #P): Mostly a big woody debris compost pile and AAS construction/work debris pile. Near the east path's north entrance. Tall red alder canopy, leaf litter and woody debris with light GC of NBB & herb Robert; scattered thimbleberries, red elderberry, salmonberry and HBB. Mix of NBB,

buttercups, herb Robert and weeds next to path west side. Buttercups, weeds, 1 salmonberry and log wood along path's east side.
Sector 112: 7/25/11 & 8/17/11 Marian (was #Q): Lots of leaf litter, woody debris (1-7" diameter) piles near detention pond north shoreline. Tall red alder canopy, mid canopy red elderberry, salmonberry shrub layer; A little NBB GC, scattered dicentra, 1 young tree (see photo). 10 x 10' patch of *Vinca minor* near shore (sector SW corner ~ 55' from stump), 3' patch of piggyback plants, mosquitoes
8/17/11 – South 1/3 water, 2/3 covered with nightshade and some woody debris to edge of the peninsula in north. Light red alder canopy from shoreline, NE corner 5' RCG patch.
Sector 113: 7/25/11 & 8/17/11 Marian (was #R): Tall red alder canopy, mid canopy red elderberry, salmonberry with scattered Indian plum and thimbleberry, HBB, 1 holly, 2 tree shrubs (see photo), nearby songbirds, mosquitoes. Plants extend out into debris in pond water. 8/17/11 – (looking from #140) tall red alder canopy along edge, much of it mostly water channel filled in with logs and mud and covered with nightshade plus 1 salmonberry and 1 red elderberry; soil along edge of water is very firm with little OM. Ducks in detention pond (narrow channel part) feeding along edge, 1 beaver stump, mosquitoes, water skippers, 1 frog.
Sector 114: 7/25/11 & 8/17/11 Marian (was #S): Tip of the peninsula, old and newer beaver damage to alders next to shoreline. Tall red alder canopy, shrub layer of Indian plum, salmonberry, 1 spirea, holly GC – light with NBB and scattered bunch grasses, evergreen BB. Heavier buttercups along shoreline, scattered sword ferns north side shore. Nightshade vine extends into water at tip of peninsula. 8/17/11 – (looking from #141) GC butter cups at detention pond shoreline, then nightshade along edge; lt. red alder canopy from shoreline, sunny in middle, Very light duck weed along muddy edge, duck family, and 1 frog.
Sector 115: 7/29/11 Marian (was #T): (NW corner on brick path) East side of sector touches bioswale 20-25' dogwood fills most of sector with smaller shoots underneath. Tall red alder canopy, construction/work debris, woody/leaf litter OM. NW corner and sector has Pacific ninebark, GC of buttercups & construction debris w/2 x 2' patch of tall grass, 2 snags, 1 w redcedar.
Sector 116: 7/29/11 Marian (was #U): Pile of wood chips, woody compost pile next to path; salmonberry clump; GC of buttercups, mixed with grass and yellow-flowered legume.
Sector 117: 7/30/11 Marian (was #V): Construction/work piles; ocean spray on N end with roses (see photos). 1 Pacific crabapple tree, 2 willow species (see photos), snowberry, HBB; GC buttercups, mixed grasses, yellow legume, dandelions, morning glory.
Sector 118: 7/30/11 Marian (was #W): Ocean spray, snowberry on N edge; GC 95% buttercups and yellow legumes, NBB and mixed grasses; scattered salmonberry, willows, 1 rose species, open canopy, firm ground, scattered *Juncus effusus*, 2 sword ferns; bees, wasps, moths, and flies.
Sector 119: 7/30/11 Marian (was #X)
100% open meadow of buttercups, with scattered NBB and yellow legume; salmonberry near log/
Sector 120: 7/30/11 Marian (was #Y): NW half is land, SW half is water. GC 100% buttercups, scattered HBB, 2 elderberries 10' from shore, Red-osier dogwoods scattered along pond bank, 1 small rose, 2 trees (dogwood or cascara (?) with drupes but no thorns) (see photos). Old beaver damaged stump, 1 log in water, ducks and ducklings in pond, 1 bird hopping around, a robin eating the elderberries; small pesky flies that look like miniature houseflies.
Sector 121: 8/2/11 Marian (was #Z): North half is brick sidewalk, open canopy, shrubs a mix of snowberry, thimbleberry, ocean spray, salmonberry; NBB (+1 shrub similar to snowberry but thicker – see photo). Mixed GC of *Juncus effusus,* NBB, seedy weeds, mixed grasses, RCG. Butterfly (black with white), dragonflies, bees in the trays of sedum. 8/23/11 Saw 2 garter snakes under sedum trays to into the grass.
Sector 122: 8/2/11 Marian (was #AA): Open canopy, mix of shrubs similar to 121 but more nootka rose 1 small black cottonwood, and half is brick sidewalk.
Sector 123: 8/2/11 & 8/26/11 Marian (was #BB): North half is shrubs – 2 willow (see photo), nootka rose, 1 other rose, Pacific ninebark, 1 shrub that looks like a wrinkled dogwood leaf (see photo) then edge of red alder canopy and 1 25' w redcedar (9" diameter) with beaver damage and wire mess around base.
South half is mostly GC – 90% buttercups with *Juncus effusus*, NBB and yellow legume. Saw 1 garter snake in the buttercups. 8/26/11 – 10 x 10' thick patch of NBB 3'high, 1 snail in Pacific ninebark, slugs, 1 small Cascara tree with a black berry.

Sector 124: 8/2/11 & 8/4/11 Marian (was #CC): East half is a buttercup meadow, GC thin out towards shrubs; then into west half red alder tree canopy and 1 25' w redcedar. Shrub layer of red-osier dogwood, HBB, red elderberry, willow; open under w/little GC. Moist but firm soil, then out to SE corner of pond, twinberry next to pond, signs of animal activity light trampling underneath (ducks?)
Duck family nearby in duck pond with duckweed.
Sector 125: 8/4/11 Marian (was #DD): 2/3 is buttercup meadow and 1/3 is shoreline and detention pond GC 95% buttercups, light NBB mixed in; slightly thinner under shrubs. W periphery is salmonberry, red elderberry; shoreline mostly buttercups, w/sword ferns & RCG; stumps & light woody branch debris red huckleberry and moss on decaying log at water's edge. Dragonflies over water, yellow bird in the elderberries (see photo).
Sector 126: 8/4/11 Marian (was #EE): SE shoreline of duck pond and into duck pond, shoreline alders lean over pond. Tall red alder canopy, decayed log goes into water from S shore. Light shrub layer of twinberry, salmonberry, red elderberry; 1 sword fern, GC of buttercups, NBB, RCG; moist (not wet), med soft to firm soil. Heavy leaf litter & branches); duck weed on top of pond, water skippers & ducks here. Golden yellow bird likes to eat the red elderberries, nearby noisy songbird.
Sector 127: 8/4/11 Marian (was #FF): Isthmus between the duck pond & detention pond including NW shoreline of det.pond. 11' wide land with a LP path that ducks use to get between 2 ponds. Tall red alder canopy with a few dead snags. Light shrub layer of red elderberry, salmonberry, HBB, Indian plum; mostly buttercups with light mix of NBB, RCG, other grasses and horsetails. Soil wet with rocks (added for firmness at LP?) Woody branches and lots of leaf litter and moss, many nearby songbirds. The owl was in the tree here the other day; water skippers, ducks, mosquitoes.
Sector 128: 8/4/11 Marian (was #GG): (Similar to 127) NW shoreline of detention pond, tall red alder canopy. Mid canopy of red elderberry, lots of woody branch debris with moss. Shrub layer of twinberry, salmonberry, HBB mix; 1 rose (see photo); GC of NBB, a few horsetails and buttercups along the shoreline.
Sector 129: 8/4/11 Marian: 5-10' of shoreline then duck pond with duckweed. Moist but firm soil, tall red alder canopy, mid canopy large red elderberry; shrub layer of scattered salmonberry, HBB, twinberry and thimbleberry, 1 small holly. GC – NBB, a few shield ferns at pond edge then mix of herb-Robert, horsetails, buttercups. 2 small trees with beaver damage (see photos), woody branches and leaf litter OM.
Sector 130: 8/4/11 Marian: Tall red alder canopy, mid canopy red elderberry and vine maple. Salmonberry, 1 huckleberry, a few HBB and Indian plum. GC – SE sector detention pond edge, mostly NBB and decaying wood with moss. Some RCG and horsetails mixed in. Center mostly NBB (drier and higher here) with a few buttercups, bunch grasses, 1 evergreen BB; robins eating red elderberries.
Sector 131: 8/16/11 Marian (was #JJ): SE shoreline of duck pond and extends into pond. Red alder canopy, mid canopy of vine maple and red elderberry. Salmonberry and NBB throughout, GC – buttercups and scattered horsetails at shoreline. 2-3" diameter dead tree snags, OM leaf litter and small branches, old beaver tree stubs. Duck family in pond, duck weed on pond, a few small flies, and probable mole hills. Next to biggest log in the pond.
Sector 132: 8/16/11 Marian (was #KK): The west half is next to biggest log in the pond, 1 big and 3 smaller logs in water. Pond covered in duckweed, duck family here. East half tall red alder canopy, mid canopy red elderberry and 1 red-osier dogwood, NBB and buttercups over 95%, 2 small (2' tall) holly trees. Firm soil, damp, with some leaf litter and 1-3" branch OM.
Sector 133: 8/16/11 Marian (was #LL): Tall red alder canopy, mid canopy red elderberry and tall twinberry; shrub layer of salmonberry; scattered shield ferns, buttercups and NBB cover. Lower NE area near pond is mostly bare damp soil with woody small branches and shrubs (duck area? – see photos), 1 rose just S of pond, 5' patch of stinging nettles in SW corner and 1 Indian plum.
Sector 134: 8/16/11 Marian (was #MM): Duck pond south end through mud into shoreline, duck weed in pond. Very wet mucky mud, duck weed here (was probably full of water at times). Buttercups, poss. RCG, nightshade and moss filling in on higher log and mud areas. East lake side – tall red alder canopy, mid layer of red elderberry; shrub – salmonberry, red-osier dogwood. Buttercups 60% of GC, with a few shield ferns, horsetails and RCG mixed in. LP connects to lower SW area, mosquitoes, ducks in pond. Moist soil but dried on HP, some leaf litter and branches for OM. End of pond area – tall red alders, nightshade in shrubs and tall trees, nettles, salmonberry, HBB and nightshade mix. GC – buttercups with a few RCG; muddy but firm; OM leaves and branches.

Sector 135: 8/16/11 Marian (was #NN): HP – drier, harder soil, rocky and clay in some areas. LP – soft, moist to wet, downed tree with bird house attached underneath here. Tall red alder canopy, mid canopy red elderberry, 1 red huckleberry on a stump; salmonberry, no shrubs in LP; GC 70% buttercups with some NBB mixed in; 1 small rose next to bunch grass in SE corner (with a little powdery mildew).
Sector 136: 8/16/11 Marian (was #OO): South shore of detention pond, NW is red alder canopy, then opens up in SE corner. Mid canopy of red elderberry, salmonberry, Pacific ninebark, nightshade mixed with shrubs and trees; GC – buttercups 70% and a little bunch grass. Firm higher bank in NW and then lower SW wet mud & a little standing water. SE open with nightshade & buttercups with standing water.
Sector 137: 8/16/11 Marian (was #PP): South end of detention pond and an overflow trench with duckweed (directly S of bldg.). Open meadow of buttercups mixed with nettles and nightshade with wet very soft mud and 2" standing water; 15' shrubby red-osier dogwood near shoreline. Standing water LP next to pond with 1 shield fern and scattered nettles. 2 black 4" drain tubes running from pond into SE corner of sector. Then into red alder with nightshade growing in it; 1 golden yellow songbird, nearby songbirds, frog, dragonflies (blue), swarm of mosquitoes, robin, small flies. The ducks went north on the trench back to the detention pond.
Sector 138: 8/17/11 Marian: Detention pond and S shoreline dips S into 138 here, west side very wet next to trench. S pond shoreline very wet to moist soil with little GC under Pacific ninebark. Stump in SE corner with red huckleberry and FLOV on drier, higher SE near stump. NE - tall red alder canopy, mid canopy red elderberry and shorter 10' red alder, with twinflower and nettles, bare damp but firm soil here, 1" OM small branches then mud with sandy clay soil & 1-2" round rocks; duck family, frogs, mosquitoes, songbirds. More open in 1/3 S under red alders with GC of buttercups and scattered stinging nettles, sword ferns, shield ferns, and bunch grass, then is salmonberry south.
Sector 139: 8/17/11 Marian: Tall red alder canopy, mid canopy red elderberry. Salmonberry, Pacific ninebark, 2 holly trees, GC buttercups with scattered bunch grass. SE corner of sector opens to a wet meadow of mixed buttercups, nightshade and nettles.
Sector 140: 8/17/11 Marian: Tall red alder canopy, mid-shrub layer open in center. Perimeter of red elderberry, salmonberry, Pacific ninebark, Indian plum and twinberry. GC – buttercups with a few bunch grasses mixed in. Soil hard and dry in higher areas, firm and damp in lower areas. Ducks feeding along edge of detention pond.
Sector 141: 8/17/11 Marian: NW 1/3 of sector is detention pond. Shoreline, then tall red alder canopy and open in center. GC – buttercups mixed with bunch grass, pulled 1 HBB. Ringed perimeter of shrubs with twinberry, Pacific ninebark, salmonberry. 1 large overturned decaying stump, beaver sticks on shoreline (see photo). Ground is hard with some rocks and only slightly damp, 1" leaf litter on top.
Sector 142: 8/17/11 Marian: East half is detention pond; west half is very firm soil with tall red alder canopy; a few shrubs – salmonberry, red elderberry, twinberry; but is mostly GC – buttercups with scattered bunch grass, 1 sword fern, 2 shield ferns. Old beaver damage next to water.
Sector 143: 8/17/11 Marian: Detention pond dips south into this sector, standing water in LP with plastic drainpipe. NW – tall red alder canopy. SE – tall w redcedar, tall red alder canopy, HBB mixed w/stinging nettles & nightshade. NE – detention pond edge. SW – more open 2" standing water & mud covered w/buttercups, nightshade & stinging nettles; N to E side shrubs – salmonberry, red elderberry, larger shield ferns. Nearby songbirds, beaver damage (?) on cedars, ends at the picket fence stump.
Sector 144: 8/18/11 Marian: North edge is w redcedar and red alder, higher with FLOV, shield ferns and salmonberry. Then open canopy into thick salmonberry, HBB with little GC except a little RCG. Slightly lower, moister & softer soil; then thick 7'tall spirea w/ HBB and nightshade. The "canoe log," crabapple tree area to SE and twinberry with thick woody debris under.
Sector 145: 8/18/11 Marian: North-NE – stinging nettles mixed with nightshade and 1 small seedy (round balls) weed. Then 8-10' tall and thick twinberry shrubs, salmonberry, with a few scattered red alder. Thicker wet mud and standing water towards central area and north, with 40% buttercups, a few shield ferns and skunk cabbage, FLOV on higher areas, moss on woody debris.
Sector 146: 8/18/11 Marian: 6' tall hollow stump in NE corner with huckleberry on top. Light red alder canopy, thick salmonberry and twinberry, with some nightshade mixed in; buttercups thin into open, soft, very wet mud with 1" standing water and nettles.

Sector 147: 8/18/11 Marian: Light red alder canopy and open in places, salmonberry mixed with nightshade. Nightshade covers trees, ground and shrubs in NW and west side. Very wet soil w/standing water, trench/canal area with duckweed (canal used by ducks). GC mostly woody debris with moss, a few stinging nettles and shield ferns; then it opens in the NW to nightshade with a few buttercups and nettles. Canal/detention pond trench drains into this area, duckweed.
Sector 148: 8/18/11 Marian: North end is open canopy with nightshade, a few nettles and buttercups mixed in. 1 willow tipped over; very wet and muddy with 1-3" standing water and duckweed. Thin salmonberry and a few shield ferns to the south but nightshade covers everything. South end sunny and open canopy, mosquitoes swarm in several places.
Sector 149: 8/18/11 Marian: Tall red alder canopy, 8' tall thick tangle of HBB and some salmonberry, buttercups with a little RCG and a few bunch grasses. Then thins out to open soil with no GC plants and some woody debris from HBB. Soil fairly dry to slightly damp and very firm, some mole activity ("Sam's owl" tree area). 7/27/11: 5:45 p.m. a noisy robin bothering the sleeping owl just SE of the pond.
Sector 150: 8/18/11 Marian: Tall red alder canopy, 80% salmonberry with some HBB mixed in. GC mostly buttercups near path edge then little GC under thick shrubs. Some nightshade mixed in especially in sunnier NW. 1" leaf litter but soil looks dark with humus, south end drops 3' to a depression W border.
Sector 151: 8/30/11 Marian: Tall red alder canopy, thick salmonberry. Light GC of NBB, scattered shield ferns, and sword ferns. 3-4' wide trench with standing water (slowly flowing south) on west side of sector, 5-6' wide trench with 1-2" standing water and soft mud coming from central east heading SW and connecting with the west trench in SW corner of sector; mosquitoes.
Sector 152: 8/30/11 Marian: Red alder opens up to shrubs of tall twinberry and salmonberry mix with some HBB. Still wet standing water trench with soft mud and buttercups mixed with shield ferns and a little nightshade and a few skunk cabbages; mosquitoes.
Sector 153: 8/30/11 Marian: Shrub layer becomes thick 10-12' tall spirea, then tall twin berry and an open meadow of buttercups with lots of nightshade covering shrubs (south ½). Buttercup area in standing water trench and thick mud; mosquitoes, can hear nearby birds and frogs.
Sector 154: 8/30/11 Marian: Open canopy, night shade covers all plants including nearby salmonberry and a few scattered red alders. Duckweed trench crosses 10' west of sector w edge, then is marshy 1-2" standing water beyond trench; moths & nearby birds; can hear animal movement (ducks?)
Sector 155: 8/30/11 Marian: Animal movement (ducks?), open canopy. 1-2" standing water under buttercups & nightshade; scattered skunk cabbage and stinging nettles; nightshade covers everything here. Then after 20' east it goes into shrubs of salmonberry, twinberry with thick nightshade, tangle of shrubs and woody debris underneath. Sector ends at Pacific willow and large skunk cabbage.
Sector 156: 8/30/11 Marian: Mostly Pacific willows with some red alder. Twin berry and salmonberry lightly mixed in with nightshade lighter here. Ground is wet and very muddy throughout with lots of woody debris. Light GC mix of buttercups, RCG and shield ferns. Lots of beaver activity and plants trampled throughout this section.
Sector 157: 8/30/11 Marian: Pacific willow; ground marshy and wet throughout; can hear nearby birds and animals. Lots of downed wood with licorice ferns; buttercups and RCG. Many willow branches cut by beavers and leaning against the crabapples in next sector.
Sector 158: 8/30/11 Marian: Red alder, Pacific willow and twinberry; then salmonberry in south half with nightshade.
Sector 159: 8/23/11 Marian (was #172): East of the ticket booth path, north end of trout stream exhibit.
Sector 160: 7/14/11 & 8/23/11 Marian (was A→173→160): Triangular area between 2 paths (NW corner of site by ticket office & trout stream exhibit), 9' wide path. Along perimeter - 3 taller cedar, 3 red alder, 5 small Douglas-fir, 95% salal, bracken fern, annual weeds (mustards, herb-Robert, grasses, vetch along path) and 1 linium. Mid-section – smaller alder mixed in, bracken fern, 30% salmonberry, 1 stump
NW area – salmonberries, buttercups, HBB, annual weeds, saw 1 mouse.
Sector 161: 7/14/11 Marian (was B→174→161): (East bank of North Creek next to south edge of bridge) West side of section (east bank) – smaller woody debris, some mud, mostly salmonberry and a 15 x 15' clump of red alder trees, 1 Douglas fir, 1 sword fern, 2 shield ferns. Mid bank – 80% RCG scattered with salmonberry. North end is buttercups and grass groundcovers along north path, 60% HBB, 1 patch of RCG along path, mostly salmonberry under the alders. East side – HBB, herb -Robert (and a yellow annual), sewer

pipe next to path; mole holes. Center – scattered twinberry, large woody logs, groundcover is mostly RCG, scattered shield ferns and salmonberry. SE area – red alder, elderberry, salmonberry, dogwood, salal along path edge. Moist but firm soil with small to med woody debris, willow clump. Creek – woody debris/logs across creek at SW corner of this section.

Sector 162: 7/14/11 Marian (was C→175→163: 30' from big cedar tree in corner to cement wall of trout stream display. Approx. 10% salal along the edge near path; native blackberries and herb-Robert along path edge, mole hills next to cement wall. Cedar trees, bracken ferns and vine maple mixed in with salal; patch of salmonberry under shrubby willow tree in SE corner of sector. Mid to North Creek bank 85% salal with scattered sword ferns, NBB, vine maple, red alder, and HBB, with a few shield ferns next to bank.

Sector 163: 8/23/11 Marian (D→176→163).

Sector 164: 8/23/11 Marian (was #177): Trout stream exhibit and gravel path (9-12' wide).

Sector 165: 8/23/11 Marian (was #178): Trout stream exhibit and gravel path.

Sector 166: 8/23/11 Marian (was #179): East border of sector is gravel path, medium w redcedar canopy along west side of path. Mid canopy is vine maple and smaller (20') red alder. Shrub layer salmonberry, vine maple, bracken fern, NBB in a thick mix (east side). 1' tall log retainer wall then drops heading west ~2.' Under cedar tree is a tangle of HBB and salmonberry, thin GC of sword ferns, FLOV and NBB, 1 salal. Mole hills w/ a banana slug, songbirds nearby.

Sector 167: 8/23/11 Marian (was #180) East and west bank with North Creek in center. Large woody debris in creek with pooled water above and faster below. Possible beaver dam? Or lots of debris caught in big woody pile? Drink bottles mixed in with woody debris; on central debris is seedy weeds, red-osier dogwood, impatiens, morning glory and 1 willow mixed. East bank – 20' red alder (2-3" diameter 60%. Shrub layer thick mix of salmonberry 80% with HBB, a few red-osier dogwoods, 4' tall impatiens, NBB; GC – RCG and buttercups. West bank – mostly RCG & impatiens with a few (fireweed?) mixed in. Many songbirds here and nearby, water skippers, mosquitoes, & black-winged dragonfly.

Sector 168: 8/29/11 Marian: North Creek east bank, across 2'wide east fork, then across 10' wide central island then across 5'wide west fork of creek to west bank area. East bank – mix of skunk cabbage, RCG, impatiens, buttercups, a few HBB and red-osier dogwood mixed with 10' tall red alders. Center island is a mix of buttercups, grasses, RCG, willows, seedy weeds, and sedges. Beaver damaged 2" diameter tree stubs (branching out at base) and wood lying around that is also sending out shoots and roots (willow?) West bank is a mix of RCG, impatiens and large downed tree branches, recently trampled skunk cabbage and grass; can hear songbirds in area; 3" slugs (black European).

Sector 169: 8/29/11 Marian: Starts at HP of w redcedar, large stumps & 1 shiny shrub (rhododendron? see photo). Vine maple under tall cedars and salmonberry. Light GC of FLOV, herb-Robert and NBB with lots of cedar debris. Then slopes westward downhill towards creek, with lots of cedar tree debris GC 4" diameter w redcedar growing out of large burned out stump. Thick HBB, salmonberry and a few 2-3" w redcedar trees, 1 vine maple on woody debris. Opens to east edge of North Creek, recent beaver damage; large logs. East bank is wet with buttercups, skunk cabbage, RCG and impatiens.

Sector 170: 8/29/11 Marian: East side of sector is part of trout stream display, gravel path runs south through center. West side is tall w redcedar and shorter 10-15' red alder, 5' tall vine maple w/salmonberry, HBB, NBB, buttercups, mixed grasses. Then drops 2-3' into ravine bordered by cedar tree stumps and logs.

Sector 171: 8/29/11 Marian: Trout stream display central and east side to fence line.

Sector 172: 8/29/11 Marian: NW edge of AAS building and trout stream display east edge.

Sector 173: 8/29/11 Marian: North Creek at least 10' wide and over my boots in places here. RCG covers west bank and into water. East bank is red-osier dogwood and young red alder grove which hang over creek. Water moving but pooled and slow, area on west side is probably a wet marsh. Dead snags and shrubs edging RCG on west side of sector. Hear a small animal splash into water nearby but never saw what it was (beaver?)

Sector 174: 8/29/11 Marian: 2-3" diameter red alder canopy (20-25') goes west downhill to North Creek (red water ravine is just south). Ducks and songbirds nearby. Thick tangle of salmonberry with RCG near water; red-osier dogwood, young red alders and HBB also mixed in. GC patches of piggyback plants, herb-Robert, NBB, RCG, 1 1' tall w redcedar, and 1 skunk cabbage, North Creek is west side of sector. Open canopy by North Creek, soil moist and soft with leaf litter and some woody debris. Saw 1 frog near red water, could hear another.

Sector 175: 8/29/11 Marian: (Just west of gravel path) Begins under med (5-8" diameter) red alder canopy. Mid canopy 1 young (3" diameter) w redcedar, and many 10-20' red alders with a few dead tree snags mixed in. Little GC except 1" leaf litter and dead shrub woody material. Elevation slopes downhill 3-4' drop westward away from path and becomes moist and soft with larger woody debris and more GC under 1-3" diameter red alder grove with NBB, piggyback plants with some RCG. E/W ravine-like area with thin shrub layer of salmonberry and red-osier dogwood.
Sector 176: 8/29/11 Marian: Trout stream display and curved part of gravel path. 9/16/11 Saw a garter snake on the gravel path next to trout stream (see photo).
Sector 177: 8/28/11 Marian: *This sector is narrower ~ 15' E/W, south central trout stream display.
Sector 178: 8/28/11 Marian: East side of trout stream display and edge of AAS building.
Sector 179: 8/28/11 Marian: Young red alder trees open to tall meadow of RCG, alders & woody debris show recent beaver activity; meadow is a mix of RCG, impatiens, sedges and a few seedy weeds. Scattered shield ferns, salmonberry, red-osier dogwood. West bank of North Creek mostly RCG with young red alders in background with a few willows and buttercups; saw a dragonfly.
Sector 180: 8/28/11 Marian: Trench area with open mud and 2-3" standing water in places. The ducks in the duckweed trench, then they walked off west towards the creek. A few shield ferns, RCG, piggyback plants and large skunk cabbage in open muddy areas. HP knoll of more piggyback plants & young salmonberry w/scattered shield ferns and impatiens; thicket of young red alders ½ - 2" diameter, with a few herb-Robert plants. Some woody debris 2-3" branches and some 5-10' tree snags, 1 downed tree "The Red Water Ravine" - A pipe just north of trench dumps water into a 2-3' wide trench which runs west into North Creek with rusty red gooey sludge (algae? Or fungus?) Buttercups, impatiens and RCG on NW side of creek sector NW corner with a few sedges. Frogs and ducks are here now.
Sector 181: 8/28/11 Marian: Edge of gravel path and through salmonberry and mostly HBB down 3' to lower area.
Sector 182: 8/28/11 Marian: Gravel path is along west and south border of this sector. Red alder canopy, mid canopy red elderberry, vine maple, young red alders and 1 cedar. Shrub layer – thick salmonberry along west side of path and tall fireweed east side. GC – buttercups with a few seedy weeds, grasses, NBB and a few FLOV along path. Small branches and leaf litter OM, hear a frog and robin nearby.
Sector 183: 8/28/11 Marian: *This sector is narrower ~ 15' E/W, contains SW end of trout display.
Sector 184: 8/28/11 Marian: Red alder canopy, foot bridge in center of sector where trout stream display runs under. Stream 3-4' wide north side, 6-10' wide just south of bridge entering the duck pond.
Sector 185: 8/28/11 Marian: South patio by back office door, SW corner of building garden of mixed shrubs, next to foot bridge and buttercup meadow area SE adjacent to bridge.
Sector 186: 8/28/11 Marian (was #192): Shrubs open to sunny meadow of tall RCG, impatiens, salmonberry and fireweed. Can hear frogs in water. Water and a 2' diameter drain pipe under logs, irises, stumps and tree snags, short 2'3' diameter red alder mid canopy and red-osier dogwood.
Sector 187: 8/28/11 Marian (was #191): Log and pond tree roots that trench goes around, 1 willow. Red elderberry, salmonberry, sword ferns, NBB, moss, buttercups and nightshade growing on overturned tree roots and 1 white lichen or mushroom (see photo). Large woody log debris west behind tree roots. Then tall salmonberry and red elderberry continue with 10-12' tall thick twinberry and 20' red alder & mostly woody debris mound just S of water trench that curves around it.
Sector 188: 8/28/11 Marian: From 189 it continues sloping lower to west under red alders, salmonberry and HBB. Big mossy log under the HBB, then canopy begins to open up to a wet muddy area with 1-2" standing water in a westward trench; still thick with HBB and salmonberry but GC plants start here with FLOV; moss and red huckleberry on log then thin cover of shield ferns, skunk cabbage, RCG and short salmonberry; more logs in wet area. Then trough becomes 1' deep with water and thick soft mud (like quicksand), with duckweed next to a root base of a tipped tree log. Buttercups and NBB cover south bank and RCG and shield ferns cover north bank of trough with 2" diameter 15-20' tall red alder and some salmonberry, some nightshade and red elderberry; 2 dead tree snags next to trough on 1 ½' higher ground & some HBB.
Sector 189: 8/28/11 Marian: Just S of foot bridge path and W of duck pond. Tall red alder canopy, mid canopy of shorter red alder more open on east side near path. Shrub layer of salmonberry & HBB tangle, buttercups 95%, 2 dead small evergreen trees. 1 small vine maple, 1 rose, 1 sword fern, 1 elderberry, a few

morning glories, NBB, grass. Soil very hard and dry (compacted clay fill?); seedy weeds next to path, 1 sawbeak sedge. Starts next to path on higher dike area then going west it drops gradually 3-4' under HBB and salmonberry tangle, little GC except 1" OM under salmonberry, a few mole hills.

Sector 190: 8/26/11 Marian: Mostly dry, hard soil with rocks, hill covered with buttercups w/a small 1 ½' path down to the duck pond; pond covers SE corner of this sector. A few snowberry, roses, 1 small shore pine *(Pinus contorta),* and 1 other (see photos). Fairly open canopy, GC 60% buttercups, 10% bare, 20% short mixed grasses & 10% *Juncus effusus* with scattered yellow legume flowers, morning glories & HBB.

Sector 191: 8/26/11 Marian: Trout stream exhibit canal/pond edge just S of footbridge and SW corner of bridge. Tall red alder canopy, red elderberry mid canopy. Salmonberry and 1 large shrub (see photo), songbirds and 1 frog (see photo).

Sector 192: 8/26/11 Marian: Tall red alder canopy, mid canopy red elderberry and 1 vine maple. Shrubs – salmonberry and red-osier dogwood, GC of buttercups 95%, duckweed at pond's edge. Soil is firm and damp to dry; wet along water's edge. Duck log extends from here with grass and huckleberries growing on it and the ducks resting on it; a few mosquito swarms.

Sector 193: 8/25/11 Marian: North Creek in a pool, then possibly a beaver dam, then water narrows below dam and then pools again, water also overflows in grassy meadow in places. RCG open meadow east of creek with other herbaceous plants mixed in – impatiens, 1 mint family species (marsh skullcap – see photo). Dead trees and stump, thick west bank shrubs of salmonberry mostly with shield ferns, red huckleberry and RCG, GC – buttercups and grasses; mosquitoes swarm over water.

Sector 194: 8/25/11 Marian: West bank of North Creek and into meadow of grasses, impatiens, horsetail; then merges with a backdrop of salmonberry and light red alder. Dead tree snags, light vine maple mid canopy hangs over creek.

Sector 195: 8/25/11 Marian: North Creek east edge to west bank; part of creek runs through islands of RCG. Loose log dam/debris over creek here with willow stakes. GC on log debris is buttercups, mixed grasses, annual weeds, moss and *Juncus effuses.* Mixed grasses and buttercups line creek edge with some salmonberry, fireweed and impatiens, shield ferns, 2 willow species, spirea, and Pacific ninebark. 1 shoe hanging from vine maple over creek, dead tree snags. West bank appears a large animal was moving or lying there along creek (grass flattened). Saw a woodpecker fly by and can hear songbirds and 1 frog.

Sector 196: 8/25/11 Marian: (Just beyond pond and log weir) it is 1-2' higher but a trench goes west to/from (?) pond. Open canopy, mostly GC in trench with piggy back plants, impatiens, small shield ferns, lots of woody debris and dead stump. 1 tall herbaceous plant species with lance-shaped leaves and purple flowers (see photos). Thick shrub layer surrounds with spirea, salmonberry and 1 red elderberry mixed with tall RCG (196 ends at creek edge), nearby blue jay.

Sector 197: 8/25/11 Marian: Heading westward 9' into sector the ground slopes and is lower and becomes moist, and there is a small pond with duckweed, woody debris logs (water smells). 10' stump with holes, dead tree snag, scattered red alders and 1 small w redcedar tree. Fairly open canopy, mid canopy of red elderberry and young red alders (thin canopy), salmonberry with HBB mixed in, 1 spirea, 1 rose, scattered shield ferns, mixed tall grasses, impatiens, buttercups, and 1 weed species GC with shiny leaves covers some mud; frog in pond, nearby songbirds, 1 wood pecker.

Sector 198: 8/25/11 Marian: The orange canoe in NE corner of this sector. Red alder canopy, thick salmonberry mixed with HBB. Little GC away from path edge, mostly bare soil with scattered NBB, FLOV, shield ferns or horsetails, moss on some woody debris. East 2/3 is very hard, dry (clay?) soil mixed with small rocks. 1" leaf litter and small-med woody branches, some mole activity. Then slope begins to drop 1-2' westward towards the creek.

Sector 199: 8/25/11 Marian: More open meadow area west side of duck pond. NW open meadow is GC is 100% buttercups with scattered shrubs of roses, HBB. West 1/3 is vegetation and west shoreline of duck pond, 1 yellow iris (removed). Shrubs area – Edge of tall to med red alder canopy with thick 50% salmonberry and 20% red-osier dogwood, with scattered HBB, NBB, and morning glory. GC under shrubs is OM of mostly scattered woody logs and branches. Soil is hard and drier in higher area, soil right next to pond is moist. East 2/3 is duck pond with duckweed, and underwater work ramp (?). Water skippers, dragonflies, duck family, frogs, 1 garter snake.

Sector 200: 7/26/11 Marian (and Minsoo), 8/30/11 Marian: Edge of path, is a lower than pond edge with red-osier dogwood, buttercups and scattered sword ferns; light red alder canopy, 1 red elderberry shrub,

95-100% salmonberry, scattered dicentra, sword ferns, shield ferns, skunk cabbage and buttercups. 1 licorice fern and moss on a stump, soil is moist but firm. Tall red alder canopy edge, tall salmonberry (6-7') solid. Path is a little lower then slight HP just west then it drops 3' heading west into a moist LP; can hear nearby frog (have seen frogs near pond at times) and a few songbirds. Little GC except NBB and scattered shield ferns, sword ferns and skunk cabbage.

Sector 201: 7/26/11 Marian (and Minsoo), 8/30/11 Marian: Tall red alder canopy edge, tall salmonberry (6-7') solid. Similar to #200 but with few groundcover plants, small woody debris.

Sector 202: 7/26/11 Marian (and Minsoo), 8/30/11 Marian: East half salmonberry similar to 200 with dead tree snags rather than red alders, then the west half is mostly reed canary grass. Begins just before 7' stump and is lumpier here; mossy large woody debris, stumps & 1 tall stump with licorice & shield ferns, and a few nearby dicentra. Low muddy area with light GC plants of skunk cabbages, NBB, shield ferns and covered with 95% salmonberry.

Sector 203: 7/26/11 Marian (and Minsoo), 8/30/11 Marian: Similar to 202 – low muddy area with few GC plants except a few skunk cabbages, NBB, shield ferns and covered with 95% salmonberry, RCG borders west edge. Large hollow stump with red huckleberry and a small evergreen tree.

Sector 204: 7/26/11 Marian (and Minsoo), 8/30/11 Marian: Sunnier and open with mostly reed canary grass with scattered skunk cabbage, HBB, native blackberry, nightshade and a weed (see photo). Large "cool fungus" on dead tree (see photo); some drink containers caught in wood. Logs and large wood across North Creek with some garbage, flood area for creek (?)

Sector 205: 7/26/11 Marian (and Minsoo), 8/30/11 Marian: Similar to #204, flood area for creek (?), creek is 5-8' wide with river rock island in center. Hear nearby frogs and a few songbirds; swarms of mosquitoes by water & water skippers. Is mostly RCG with impatiens, fireweed and yellow legume mixed in. Scattered salmonberry with some HBB, a few dead tree snags.

Sector 206: 7/26/11 Marian (and Minsoo): Red alder trees in patches with dead tree snags, salmon-berries and HBB; 1 hummingbird. Edge of path, is a lower area from the pond edge with red-osier, dogwood, buttercups and scattered sword ferns. 7/27/11 garter snake, activity in pond, & possibly frogs.

Sector 207: 7/26/11 Marian (and Minsoo) Thick, tall salmonberry, red elderberry, HBB with woody debris branches and OM GC with scattered shield ferns, then to open canopy with RCG 85%, scattered sword ferns and skunk cabbage, 1 patch of irises, with dead tree snags. Meadow edge is red alder with occasional salmonberry, this is a low area.

Sector 208: 7/26/11 Marian (and Minsoo): This sector goes from low area to higher bank and then to North Creek. Large Pacific ninebark shrub next to round rock creek shoreline. RCG covers ground with a few piggyback plants, scattered HBB & clump of sedge or iris.

Sector 209: 7/26/11 Marian (and Minsoo), 9/8/11 Marian: Begins near footpath, then "The gully" – wet mud with 1" standing water in places. Red alder canopy, 1 vine maple, but mostly salmonberry with some HBB mixed in, scattered buttercups, RCG and horsetails with logs and 2 dead tree snags. 9/8/11 – 2 adult ducks on the duckweed pond, but I spooked them; deer tracks on muddy path west side of duck pond along N/S line and then they went SE south of pond. See photos from various days for different animal tracks seen in the mud here near pond.

Sector 210: 7/26/11 Marian (and Minsoo): Red alder canopy and then west fairly open canopy with red alder and Pacific ninebark. Then impatiens mixed with RCG, salmonberry, sedge and buttercups
salal on stump, ends just before creek.

Sector 211: 7/26/11 Marian (and Minsoo): North Creek and its 2 banks; HBB especially on west bank, RCG and buttercups.

Sector 212: 7/26/11 Marian (and Minsoo): Begins at muddy pathway under red alder & tall Pacific willow canopy, thick salmonberry, HBB, scattered horsetails & buttercups E edge of path. Then a low muddy 1-2" standing water gully with RCG, horsetails and buttercup. Many songbirds near pond & trees.

Sector 213: 7/26/11 Marian (and Minsoo): Past 2 stumps with red huckleberry; then a tangle of salmonberry, impatiens, vine maple & shield ferns; less muddy ground here & covered with piggyback plants; snags.

Sector 214: 7/26/11 Marian (and Minsoo): North Creek, east and west banks, tall dead tree snag. East bank covered with salmonberry, shield ferns, piggyback plants. West bank – vine maple, HBB, salmonberry, buttercups, RCG and piggyback plants. Saw a small fish or lamprey (?) here.

Sector 215: 7/27/11 Marian (and Sam)" Along the path – buttercups, light RCG, scattered sword ferns & shield ferns. Thick salmonberry and scattered HBB, then ground drops lower into a LP gully.
Sector 216: 7/27/11 Marian (and Sam): Fairly open canopy of red alder, light mid canopy vine maple. Mostly salmonberry w/spirea, scattered piggyback plants & shield ferns. Woody debris, open firm mud.
Sector 217: 7/27/11 Marian (and Sam): Very light canopy of red alder, mid canopy 1 red elderberry, light vine maple. Mostly salmonberry, 1 sword fern; GC of piggyback plant, goes to North Creek edge.
Sector 218: 7/27/11 Marian (and Sam): North Creek and west bank; water pools here and goes around a central island/bar. West bank fairly open canopy with mid to tall vine maple, RCG, HBB, shield ferns Island – buttercups and RCG. Water skippers, mosquitoes, and possibly a brook lamprey ("Sam's eel").
Sector 219: 7/27/11 Marian (and Sam): Just S of #218 & heading east. North Creek and 2 banks with a woody debris dam. East bank – light red alder canopy, thick salmonberry, shield ferns, piggyback plants, skunk cabbage and marsh skullcap(?). West bank – vine maple, shield ferns, light salmonberry, light impatiens, GC piggyback plants.
Sector 220: 7/27/11 Marian (and Sam): Just S of #219, includes North Creek and 2 banks. West bank – red alder, w redcedar canopy, mid canopy of tall vine maple. 1 red alder tipped across the creek, buttercups, salmonberry, shield ferns. Creek is a slow moving pool here, 1 tall Sitka spruce (?), LP area just SE of tree East bank – shield ferns, salmonberry, piggyback plants.
Sector 221: 7/27/11 Marian (and Sam): Light red alder canopy, tall salmonberry, scattered skunk cabbage and shield ferns. GC of buttercups, piggyback plants, open mud in gully trough. Large decayed stump with licorice ferns and red huckleberry.
Sector 222: 7/27/11 Marian (and Sam), 9-17-11 Marian: Light tall red alder canopy, vine maple mid canopy, 70% salmonberry. Wet trough LP canal area with very large skunk cabbages in patches, piggy back plants, shield ferns and horsetails in LP; moist with firm mud (see sketches). Sword ferns and FLOV on HPs; moss and red huckleberries on logs, mole hills in mud.
Sector 223: 7/27/11 Marian (and Sam): LP gully with mud and 1" standing water, skunk cabbage, light RCG. Then slightly higher with thick salmonberry and scattered shield ferns, buttercups and piggyback plants (continues higher after this); med red alder and vine maple canopy.
Sector 224: 7/27/11 Marian (and Sam): Similar to 223, LP gully with mud and 1" standing water, skunk cabbage, light RCG. Then slightly higher with thick salmonberry and scattered shield ferns, buttercups and piggyback plants (continues higher after this); med red alder and vine maple canopy.
Sector 225: 7/27/11 Marian (and Sam): Red alder canopy, 15' w redcedar, thick salmonberry; along path is HBB, buttercups, RCG, NBB, shield ferns, sword ferns, bunch grass and mustard plants.
Sector 226: 7/27/11 Marian (and Sam): Similar to 225 with red alder canopy, with 2 small w redcedar, thick salmonberry. Then along path is HBB, buttercups, RCG, NBB, shield ferns, sword ferns, bunch grass and mustard plants.
Sector 227: 7/27/11 Marian: Tall red alder canopy; 2/3 north is mostly buttercups with a little RCG, and herb-Robert. 1/3 south is mix of red elderberry, salmonberry, snowberry, shield ferns, sword ferns and NBB; soil is moist but firm (higher path area this sector), very little OM or debris.
Sector 228: 7/27/11 Marian: Tall w redcedar, tall red alder, tall vine maple; tire buried at base of 1 cedar. Bird house in tree, 1 stump; drier with cedar debris and leaf litter under cedars. Scattered sword ferns, small cedars, small vine maple and NBB. Then a more open canopy with salmonberry, buttercups, shield ferns and NBB. Scattered woody debris; 8/31/11 woodpecker 90' high in tall red alder tree snag.

Sector 229: 7/27/11 Marian: Med. red alder canopy, med-tall vine maple, tall salmonberry, 1 small Douglas-fir in shade, red huckleberry on rotting woody debris. Moist firm soil with leaf litter and woody debris, 2 big dead tree snags, NBB, scattered shield ferns, buttercups and piggyback plants.
Sector 230: 7/27/11 Marian: (needs more photos – blurry) LP & goes to North Creek (buried black cottonwood), red alder and vine maple canopy; mix of salmonberry, shield ferns, sword ferns, piggyback plants and NBB. Elevation drops here towards creek, mosquitoes. Rocky (round rocks) creek shoreline with vine maple and salmonberry hanging over it Tall vine maple growing out of snag, mossy rocks and logs. Near shore piggyback plants, scattered shield ferns, sword ferns and horsetails.

Sector 231: 7/27/11 Marian: (needs photos) North Creek and west bank; shoreline & creek bed 1-4" round rocks/gravel mix. Westside is w redcedar, red alder, vine maple canopy; GC of skunk cabbage, piggyback plant; scattered sword and shield ferns
Sector 232: 8/2/11 Marian (and Minsoo): Red alder/w redcedar canopy, large and small vine maple. Light salmonberry; shield ferns, sword ferns, buttercups, NBB and FLOV. Downed trees and logs 4-12" diameter, large tree stumps with salal & red huckleberry.
Sector 233: 8/2/11 Marian (and Minsoo): Red alder, w redcedar canopy with vine maple. 10' HP area has vine maple, salmonberry, shield ferns and sword ferns mix. GC – FLOV, patches of piggyback plants, scattered skunk cabbage and sword ferns, scattered RCG; lots of woody debris; into ravine LP west with deep wet mud.
Sector 234: 8/2/11 Marian (and Minsoo): Begins in a ravine and then up steep incline 10' to under a suspended log in trees. Tall red alder canopy, tall vine maple and red elderberry mid canopy; salmonberry, sword ferns, piggyback plants.
Sector 235: 8/2/11 Marian (and Minsoo): 5' high east bank and then drops into North Creek, sector ends halfway into creek. Red alder canopy, vine maple mid canopy; salmonberry, sword ferns and 1 shrub (feels like a viburnum, fuzzy and thicker leaf); water skippers in creek and mosquitoes.
Sector 236: 8/2/11 Marian (and Minsoo): Mid North Creek into west bank, similar to 235, with path to creek on west bank. Red alder canopy, vine maple mid canopy; salmonberry, sword ferns; water skippers in creek and mosquitoes.
Sector 237: 8/2/11 Marian (and Minsoo): (Just So. of 236) heading east from west side of creek and across North Creek. River rock open area next to a big w redcedar tree (river overflow area?), red alder, vine maple, huckleberry, NBB, shield ferns, piggyback plants; big log on embankment.
Sector 238: 8/2/11 Marian (and Minsoo): Mostly vine maple on east bank of North Creek, large stump with huckleberry and a log. Light red alder canopy, light salmonberry, piggyback plant GC, HBB, herb-Robert; moist but firm soil, many downed trees here, ravine area.
Sector 239: 8/2/11 Marian (and Minsoo): Red alder and w redcedar canopy, downed trees and branches with moss; shield ferns, sword ferns and FLOV scattered in open soil or leaf litter GC. Moist but firm soil, continues up the ravine, nearby robin and songbirds.
Sector 240: 8/2/11 Marian (and Minsoo): Red alder, w redcedar thicker canopy; shrub layer mostly vine maple w/light salmonberry. Large sword ferns, FLOV on higher areas, lots of OM on soft ground. Scattered shield ferns, 1 deer fern; sector ends at path w/buttercups & piggyback plants.
Sector 241: 8/2/11 Marian (and Minsoo): Red alder and w redcedar canopy, large sword ferns, many deer ferns, skunk cabbage, shield ferns, FLOV with a little NBB, salmonberry, & scattered red elderberry. Ends at the w redcedar with a deep cleft in SE corner.
Sector 242: 8/2/11 Marian (and Minsoo): Red alder canopy, vine maple, scattered salmonberry, short tree snags. Large open soft mud at LP, pulled out 2 ivy plants. GC in patches, buttercups, FLOV, and NBB. Then thick with 3-4' tall shield ferns and scattered skunk cabbage; 2 young trees (see photo, then buttercups along path.
Sector 243: 8/2/11 Marian (and Minsoo): Red alder canopy, tall vine maple and little seedlings, scattered salmonberry, large 4' sword ferns cover half of area, FLOV scattered. Lots of leaf litter and small branch OM, moss on ground in areas.
Sector 244: 8/4/11 Marian (and Minsoo): Soil soft but firm, lots of OM leaf litter, small branches and some downed trees w/moss. Red alder tree canopy, tall vine maple and south edged with tall w redcedar. Shorter vine maple, salmonberry, large sword ferns throughout and shield fern. GC – lightly covered w/FLOV, herb-Robert, open areas & then into piggyback plant
Sector 245: 8/4/11 Marian (and Minsoo): Light tall red alder canopy, tall vine maple mid canopy throughout. Shrub layer mix of shorter vine maple, tall shield ferns and thick salmonberry
GC mostly piggyback plants with scattered buttercups and impatiens. Large logs with moss, lots of leaf litter, moist but firm soil. On west edge of sector ground drops off 5+' to creek edge at site of large log with overturned roots at SW corner, west border in center of North Creek.
Sector 246: 8/4/11 Marian (and Minsoo): West half of North Creek and just west of creek. Tall red alder nearby with shorter w redcedar and 25' vine maple. Light GC under VM of scattered small shield and sword ferns, piggyback plants. No GC under cedar only cedar debris, log with huckleberry and moss.

Sector 247: 8/4/11 Marian (and Minsoo): South of 246, west bank and west half of North Creek. Rocky and sandy shoreline w/o plants and mud under trees, then edged with salmonberry and shield ferns. Large log across creek here and a deeper pool in creek, mosquitoes.
Sector 248: 8/4/11 Marian (and Minsoo): East half of North Creek and east bank; muddy and then climb up 3' to higher and drier. Tall w redcedar canopy, 1 red alder and 1 w hemlock, nearby tall VM to north. Fairly open shrub layer with scattered salmonberry, small vine maple and w redcedar, large sword ferns.
Large diameter rotting stump, GC – FLOV, NBB, lots of OM, moss on ground, 1 rhododendron (large evergreen leaves) (see photo).
Sector 249: 8/4/11 Marian (and Minsoo): North edge of "The Cathedral" of very tall w redcedar canopy with scattered tall red alder. Large vine maple and open mid canopy with a few smaller vine maple and salmonberry thinning out into an open shrub layer, scattered sword ferns. Rotting log with shield ferns, sword ferns, FLOV, huckleberry and moss. FLOV under vine maple, no GC plants under cedars. Lots of thick OM cedar debris, leaf litter, and decaying wood on ground; soil moist but firm, soft from OM, possible mole hills, a few songbirds nearby.
Sector 250: 8/4/11 Marian (and Minsoo): 2" diameter animal holes in ground (moles?) and a 3+" diameter hole. Large w redcedar trees in south end of sector with mostly cedar tree debris for GC, a little moss on fairly dry ground. Just north is an open area of large sword ferns, shield ferns and FLOV GC. Mossy woody debris with light NBB, then a lower open muddy area w/a little OM. Then 2' higher east edge with cedar and red alder canopy; leaf litter and thicker OM with salmonberry, large sword ferns & shield ferns, a little FLOV & 1 sedge patch. Ivy on mud edge (I pulled out).
Sector 251: 8/4/11 Marian (and Minsoo): Continuation of 250 HP with salmonberry, large sword ferns, shield ferns, FLOV. Then it drops into a muddy trench area with soft deep open mud (boots get stuck) and 1' standing water with mostly very large skunk cabbage & a little ivy in places; carrot-family plant, light salmonberry in N slightly drier area. 9/8/11 Can hear blue jays, a woodpecker & songbirds in woods just east of North Creek.
(No sector 252)
Sector 253: 8/30/11 Marian (was #159): Lots of water here as duck weed trench comes into SW corner from NW and a 2' wide and 3' deep trench flows south along east side and into the south trench. Open canopy with a few struggling red alders and tree snags. Tangle of salmonberry, RCG and nightshade with a few large skunk cabbages.
Sector 254: 8/30/11 Marian (was #160). Juvenile ducks in the trench here. Salmonberry, nightshade and RCG trough, duck week in water. Fresh willow leaves and branches floating down (fresh beaver activity?) Nightshade covers north half & can hear songbirds.
Sector 255: 8/30/11 Marian (was #161): Nightshade covers everything, wet meadow with standing water. Trench with duckweed flows into other canal under nightshade; bird house in tree. Light red alder canopy and tree snags, some salmonberry underneath nightshade. Can hear frogs and songbirds.
Sector 256: 8/30/11 Marian (was #162): North end nightshade covers everything, then it is mostly light scraggly red alder canopy with tree snags and salmonberry.
Sector 257: 8/30/11 Marian (was #163): Higher mound with w redcedar tree and dead snags, NE is nightshade. Big stump with salal & red huckleberry, tall snag with lots of holes; scattered shield ferns. Open mud and water in lower area, tracks in mud (see photo) probably beaver (?) Mosquitoes and nearby songbirds (see sketch of mound).
Sector 258: 8/30/11 Marian (was #164): Red alder canopy; deep mud in trench, standing water & skunk cabbage (sector N edge). Then higher & dry with red alder, salmonberry, a few HBB, shield ferns, sword ferns scattered amongst woody branch debris and 1 young w redcedar; buttercups west trench edge, then up ~3' higher elevation to salmonberry & path with buttercups.
Sector 259: 8/31/11 Marian: Begins at HP 10' east of N/S path on hard dry rocky soil. Med-tall red alder canopy; several scattered sword ferns and salmonberry. Then drops down into a 3' wide trench with mud and 1-2" standing water. It goes up gradually 3' to moist but firm organic soil with 2" thick leaf litter and a thin but continuous GC of FLOV under red alder and vine maple canopy, salmonberry with scattered shield ferns. Then ground very soft but firm with OM piles of woody branches with mounds 3' tall and low areas very wet but no standing water currently; mole hills.

Sector 260: 8/31/11 Marian: Can hear squirrels in nearby trees to south. Woodpile next to a very large vine maple with trifurcated trunk (complete canopy). Mounded areas, but lower elevation eastward; lots of soft OM ground. Salmonberry, FLOV, scattered skunk cabbage, two 10' ivy vines climbing the vine maple (I pulled them). Then LP after vine maple with open mud and thin buttercups, shrub layer of salmonberry, smaller vine maple, stinging nettles, scattered skunk cabbage & shield ferns; area very wet.
Sector 261: 8/31/11 Marian: "Jurassic Park" – canopy opens to dead tree snags and broken alder trees. Then soft mud with 2-4" standing water, duck weed and buttercups with very large skunk cabbages and a few carrot-like plants; north end is covered in nightshade. Central area is also open with a large 1'+ (animal?) hole under a stump (creepy). Everything is large here – very large red huckleberry growing out of old large stump with salmonberry, licorice ferns and shield ferns; some flies and bees here. Large Pacific ninebark; nightshade covers plants in north. Sector ends east side of the stump in 10' tall red-osier dogwood with broken red alder trees, & a few salmonberries; frog, large woody decaying debris & logs.
Sector 262: 8/31/11 Marian: 10' tall red-osier dogwood patch continues through mossy decaying woody debris over 2-4" standing water and scattered shield ferns and buttercups, light nightshade. Many large skunk cabbages here; songbird on decayed log (a beautiful song). Large stump with salal and salmonberry on top. Wet mud and 6" standing water, large decaying wood with many skunk cabbage growing between in water; duck weed in water. Shield ferns & moss growing on wood, buttercups light throughout, FLOV at stump base; 1 patch 15' red-osier dogwood mid canopy, open canopy above, nearby tree snags.
Sector 263: 8/31/11 Marian: Continues under red-osier dogwood then becomes tall salmonberry in east. North is solid salmonberry with nightshade tangled throughout. Light red alder canopy, skunk cabbage in water throughout. FLOV on higher soil/wood debris and on logs, 2 small red elderberries, scattered shield ferns, nearby dead snags, large woody debris in places.
Sector 264: 8/31/11 Marian: Then standing water with solid nightshade covers everything. Dead snags above and salmonberry; skunk cabbage & light shield ferns. HP is a 3-4' mound with red alder, salmon-berry, FLOV and horsetails. Wet, water pond area just north with duck weed; nearby birds (see sketch).
Sector 265: 8/31/11 Marian: Light red alder canopy, dead tree snags. Salmonberry and twinberry with some red-osier dogwood & nightshade, RCG and a few skunk cabbages. Patches of shield ferns and FLOV on higher areas; nearby song birds; then thick with nightshade on west half with standing water & snags.
Sector 266: 8/31/11 Marian: Deeper standing water 4-6", lots of large decaying wood with moss, skunk cabbage. Light red alder canopy; salmonberry w/nightshade & some shield ferns, FLOV. Then back into red-osier dogwood.
Sector 267: 8/31/11 Marian: Wet mud and standing water, similar to 266 with nightshade on shrubs. 1 6' vine maple, salmonberry, twinberry, red-osier dogwood, shield ferns, duckweed on water, buttercups, scattered large skunk cabbages.
Sector 268: 8/31/11 Marian: Red alder canopy, downed decaying trees with moss, FLOV and shield ferns. Thick mud, standing water w/duckweed, and 1'wide moving water; frogs to north. Skunk cabbage throughout area with thin GC of buttercups, scattered carrot-like plant, thick tangle of tall shrubs – twinberry, red-osier dogwood and salmonberry; mosquitoes.
Sector 269: 8/31/11 Marian: More standing water and thick mud with duckweed in north end. Light red alder canopy, large vine maple, thick shrub layer of salmonberry. Skunk cabbage and buttercups in open wettest areas with no shrubs here, FLOV in higher drier areas; shield ferns sprinkled throughout. It would be easy to get stuck in here. 1 tipped red alder (still alive).
Sector 270: 8/31/11 Marian: Vine maple area, similar to 269 with salmonberry, skunk cabbage and buttercups. Creepy large hole in a stump just south of wood pile under the vine maple (looks like a hobbit entrance), smaller 8" hole in back of stump (see sketches). Mounding areas; red alder and salmonberry thicker here with 1 red elderberry. Buttercups in LP with mud, young vine maple, shield ferns and FLOV in higher moist, not wet areas. Standing water trench runs south, 2-3' wide with 1-3" water, then ground is higher near path edge. Tall vine maple, thinner salmonberry, large sword ferns, light FLOV, and NBB. Thin wood debris here; dry rocky soil.
Sector 271: 9/1/11 Marian: 10' south of north edge the trench curves SE and gets wider and deeper (see sketch). The duck family is here with water covered by duck weed, then they moved thru forest. Med to tall red alder canopy, mid canopy 3-4" diameter red alders. Salmonberry shrubs 70% with FLOV, sword and shield ferns scattered throughout. Mounded soil near water embankment, LP area covers a third to half. LP

– wet, deep mud with 1" standing water in places, large skunk cabbages, carrot-family plant and patches of piggyback plants nearby. HP – lots of leaf litter and OM, a few large logs growing licorice ferns and moss; red huckleberries on stumps and a few other mixed plants, 2 elderberries; comes to edge of pond with duckweed; found a blue balloon here.

Sector 272: 9/1/11 Marian: Marshy area filled with very large skunk cabbage (2-3' tall and 8' wide). Open red alder canopy as some of the alder trees have tipped over here, some duckweed. A third of area is higher and drier with salmonberry and scattered twinberry, sword ferns and shield ferns; light GC in mud of buttercup and carrot-family plant mixed. The LP mostly open very wet soft mud, then mostly buttercups in muddy, sunny area. Can hear blue jays and other bird species to the west, saw 2 frogs (see photo). Woodpecker to north, robins to SE; mosquitoes, some flies and bees. Woody debris with licorice ferns, shield ferns & FLOV; Some nightshade coming in from north; easy to get stuck here (see sketches).

Sector 273: 9/1/11 Marian: Red alder canopy, thick tall salmonberry. Wet mud, moving water 1 ½ ft. wide and 2" deep throughout (easy to get stuck). Song birds within and woodpeckers. Many downed trees crisscross in here; scattered large skunk cabbage & buttercups. Shield ferns, licorice ferns and sword ferns on woody debris; shrubs thin in muddy areas, most of area is low and muddy. Shrubs thicker in HP mounds with salmonberry, twinberry, red-osier dogwood. Duck weed in places; sector ends under red alder, willow, red-osier dogwood.

Sector 273X: 9/1/11 Marian: Adjacent to the NE is lowland and wet areas continue. To the SE elevation begins to rise and gets drier (needs more photos here).

Sector 274: 9/1/11 Marian, 9-7-11 Marian: Tall red alder canopy, mid canopy vine maple; shrub layer of smaller vine maple and salmonberry. Many downed and decaying logs with moss; large stump with red huckleberry. 1 smaller shrub with whirled-like leaves and small green berries (bunch berry?) Area slopes down to east pond north shore where margins are very wet w/skunk cabbage. FLOV light GC on all HP areas; mosquitoes, song birds & woodpecker nearby. Higher area to west under large w redcedar tree & at least 15 mole hills here. 1 mud colored frog (see photo) jumped out of my old footprint full of water
2 young cedars nearby (2" and ½" diameter), thick leaf litter in places. FLOV lightly over all, 1 young red elderberry; shrub layer mostly salmonberry and vine maple mix.

Sector 275: 9/1/11 Marian, 9/7/11 Marian: Halfway across is an isthmus, then an island with pond water on north and south. Pond area with duckweed continues and heads south through 2' wide trough between 2 HP mounds to the south pond in this sector (see sketch). HP 3-4' mound between ponds with red alder, salmonberry, FLOV, sword & shield ferns. Second mound similar with Pacific ninebark, Pacific crabapple and deer ferns also.

Sector 276: 9/1/11 Marian, 9/7/11 Marian: Pond turns south of this sector (see sketch) with thick mud and duckweed in a 8' wide channel between 275-276, then more mud deeper than my boots next to pond with very large skunk cabbages and some downed tree logs next to north edge of pond. Then into thick salmonberry beyond mud, nightshade in shrubs. Light red alder and willow canopy, mid canopy of red elderberry, willow and live red alder branches coming up from downed tree; thin RCG along water edge. Shield ferns mixed in with skunk cabbage, then shield ferns increase with woody debris. Tall willow, skunk cabbages, FLOV, herb-Robert, shield ferns, whirly weed and salmonberry; downed trees here and lots of dead tree branches.

Sector 277: 9/1/11 Marian, 9/7/11 Marian: Standing water and some bare mud in 1/3 of area; higher areas are firmer and drier. Lots of OM from leaves in HP mounds which have FLOV, salmonberry, shield ferns & some nightshade; skunk cabbage in wetter LPs. "Picture frame" root stump, lots of downed branches and trees with red huckleberry. Red alder/willow gives way to lighter red alder canopy; mosquitoes, 3 songbird species.

Sector 278: 9/1/11 Marian: Light tall red alder canopy, mid canopy of vine maple. 7' tall tangle salmonberry 100%, with solid RCG on other side of stump at sector edge; many woody tree and branch debris (I am standing on a downed tree 6' above ground to take these photos here); open mud in places with skunk cabbage; slightly higher areas of FLOV, shield ferns and OM.

Sector 279: 9/1/11 Marian: Open canopy surrounded by red alders; mid canopy some vine maple; light nightshade. 100% salmonberry cover with lots of downed wood; moist ground is soft but firm. Few GC plants, scattered skunk cabbage; FLOV and whirly weed on wood debris. GC is mostly woody debris; downed log with other side of the "root wall tree" halfway pt.

Sector 280: 9/1/11 & 9/7/11 Marian: Thick tall salmonberry (sl. thinner in north than 279) and there is more vine maple. Light red alder canopy, 1 red elderberry; south half is thick salmonberry. Mud is soft and very wet in places, easy to get stuck here, 2/3 is just open mud w/no GC. A little more shield ferns and skunk cabbage here.
Sector 281: 9/1/11 & 9/7/11 Marian: Red alder canopy, salmonberry covers higher areas with a little nightshade mixed in. Woody debris, more OM on HPs; pond trench is 4' wide and ends here with duckweed. Very large skunk cabbage in wet areas (see sketch).
Sector 282: 9/1/11 & 9/7/11 Marian: This area mostly the pond with duck weed, very large skunk cabbage line pond/trough. Red alder and very tall willow canopy, thinner salmonberry here, a little FLOV on HPs. Downed trees, some shield ferns, a little RCG along water's edge. Then a trench with deep mud (over the top of my boot). Carrot family plant in water, across deep trench, tree snags to south.
Sector 283: 9/1/11 & 9/7/11 Marian: Small island HP with ferns, pond to south, water 6-8' wide here. Tall red alder canopy, salmonberry, FLOV and ferns on island, same on other side in HP. Can hear frogs and 1 robin; 2 dragonflies hovering water & splashing at times. Large skunk cabbage thick at water's edge, a little RCG on south pond edge. Pond curves here and heads SE.
Sector 284: 9/1/11 & 9/7/11 Marian: Red alder and w redcedar canopy, vine maple mid to tall, 1 large red alder covered with thick ivy. Light salmonberry, 8' tall twinberry; shield ferns 6' tall and full (huge in places), 1 tree snag, a few huckleberries and sword ferns in HP. Mud deep in places with skunk cabbage and buttercups. FLOV, some buttercups GC in HP, thick leaf litter and some branches. Pond ends in here, may connect to LP at trench; dragonfly hovering over pond.
Sector 285: 9/7/11 Marian: LP with skunk cabbage and mud on east side, then 2' higher to west with tree line. Red alder and w redcedar canopy, vine maple and snags on west 10' of sector with red huckleberries, skunk cabbage; then salmonberry and FLOV covering HP.
Sector 286: 9/8/11 Marian: NW corner starts in w redcedar and vine maple, then goes into light red alder canopy which includes the red alder that is covered in ivy (probably the seed source for the nearby ivy scattered around). Salmonberry, shield ferns and FLOV on HPs; skunk cabbage, buttercups and mud in LPs. Moss & FLOV on logs; red huckleberries on stumps, then into nightshade & the ivy tree. "Tugboat bench log"; l loud frog.
Sector 287: 9/8/11 Marian: Light red alder canopy with tree snags; nightshade covers shrubs. Salmonberry, shield ferns, scattered large skunk cabbage and stinging nettles. Open meadow north center with buttercups, 2-3" standing water and duckweed. NW corner is the large cotoneaster with red berries (see photo) and nightshade; bees, flies and a few moths.
Sector 288: 9/8/11 Marian: Marshy, muddy area with a 1 ½' diameter large downed w redcedar with branches that are still alive growing upward like small trees, and roots still covered with soil. Surrounded by salmonberry and nightshade with some skunk cabbage and shield ferns. Salmonberry is growing through tree branches but the nightshade is not over it yet. The root wad has red huckleberries and shield ferns growing on it with ivy. RCG growing in soft mud with skunk cabbage in NE LP
Sector 289: 9/8/11 Marian: W redcedar and tall red alder canopy slightly higher elevation. 100% thick salmonberry except barer under cedars, scattered shield ferns, FLOV throughout with lots of leaf litter. Some small woody debris and occasional logs; mounding irregular ground surface; robins and nearby songbirds.

Sector 290: 9/8/11 Marian: West side begins at stump covered with licorice ferns. Tall red alder canopy, 1 red elderberry, thick salmonberry, scattered shield ferns. FLOV, woody debris and stumps with thick leaf litter for GC. West is lightly higher elevation with damp soil, soft with OM but firm. East end in slightly lower, moist area but otherwise same as west side.
Sector 291: 9/8/11 Marian: Continues through tall red alders and thick tall salmonberry with a few vine maple. GC is mostly thick OM with scattered FLOV. Then w redcedar with mossy logs, stumps and FLOV; lots of mosquitoes; then a wide ~15-20' "Cedar Gully" LP (1-2' lower) heading SE from 280 (see sketch).
Sector 292: 9/8/11 Marian: Edge of w redcedar to light red alder canopy; 95% thick salmonberry 60% FLOV; OM leaf litter and small branches throughout; 1 stump with red huckleberry.

Sector 293: 9/8/11 Marian: Gully in SW corner runs NW/SE, large woody pile in middle of gully (old downed w hemlock); light red alder canopy, a few red elderberries. Thick w/salmonberry beyond the gully (6-8' tall), twinberry growing near alder. Very little GC of scattered FLOV, dark under thick salmonberry.
Sector 294: 912/11 Marian: Light red alder canopy, but mostly open. Can hear 3 species of song birds in trees. 85% salmonberry, 15% twinberry, red huckleberry on stump. Scattered shield ferns, some woody debris below.
Sector 295: 9/8/11 & 9/12/11 Marian: Downed large red alder, east half LP mud with shield ferns & FLOV on woody debris. Open canopy, 100% tall salmonberry, little GC, mostly woody debris. Then into lower channelized area (probably seasonally wet).
Sector 296: 9/8/11 & 9/12/11 Marian: West half is an open canopy, 100% tall salmonberry, little GC except woody debris. LP – muddy trench continues south on east half of sector. East half is 70% tall salmonberry and light red alder canopy; FLOV on HPs. GC thicker here with moss, scattered small shield ferns, buttercups, stinging nettles, and 2 weed species mixed with open mud; downed tree and branch woody debris. Scattered smaller skunk cabbages, nearby robin, huckleberry on stump.
Sector 297: 9/12/11 Marian: A little ground bird hopped full circle around me 5' away (bushtit). Open canopy, salmonberry, RCG, shield ferns, sedge, 1 weed species; mosquitoes. FLOV on woody drier areas, RCG with sedge mixed in sunnier south third where salmonberry is thinner. A little nightshade in NW corner; still low and muddy.
Sector 298: 9/14/11 Marian: Light red alder canopy, mid canopy vine maple; 15-20' tall red huckleberries on stumps. 90% salmonberry, scatter shield ferns; GC of FLOV, moss and woody debris. LP – trough area of open mud, logs, branches, leaf litter and some sedge. Robins and 2 other bird species to north.
Sector 299: 9/14/11 Marian: Open canopy with peripheral red alder, 95% salmonberry (similar to 300). Large red huckleberries on stumps, lots of downed branches and small trees. Moss and FLOV on woody debris, thin FLOV GC but mostly thick leaf litter OM.
Sector 300: 9/14/11 Marian: Light red alder canopy (broken in places w/wood chips below). 100% salmonberry cover; FLOV thin GC. Lots of thick woody debris, stump, small logs, branches & leaf litter.
Sector 301: 9/14/11 Marian: HP salmonberry, 1 red elderberry and thin FLOV. Then drops into LP trough of thick mud (easy to get stuck) with large skunk cabbage with patches of carrot-like plants. Light peripheral red alder but mostly open canopy with some dead tree snags. Salmonberry 70% east after trough w/FLOV, moss & shield ferns on higher woody areas. Leaf litter and small woody debris alternate with open mud; nearby frogs to NE.
Sector 302: 9/14/11 Marian: Higher w redcedar area (large and small cedars) with large curved branches. Cedar debris GC; FLOV, sword ferns, moss on woody debris and branches. Stump with salal & salmonberry growing on it; isolated small salmonberry on wood. Pulled 1 ivy plant; mosquitoes. HP cedar mound surrounded by low area with thick mud and some standing water. Sector ends at east edge of mud, light horsetails and 1 tall red alder (see sketches).
Sector 303: 9/14/11 Marian: Red alder canopy, mid canopy vine maple in north; w redcedar canopy in NE. Salmonberry scattered in tall shield ferns; large skunk cabbage, buttercups. 2-6" standing water with duck weed; nearby songbirds, mosquitoes. Large logs covered in moss, a little FLOV and small red huckleberries. Large clump of iris in water, nightshade along south border. Standing water flowing SE in places with carrot family plant mixed with buttercups. NE cedar area gently slopes to 1' higher and drier.
Sector 304: 9/14/11 Marian: Peripheral red alder canopy on west edge, mid canopy of 3" diameter red alders (15' tall). Salmonberry 50%, open in center with tall shield ferns, large skunk cabbage, 80% buttercups and duck weed scattered in places; ivy mixed in NW area near the donor tree. 2-4" standing water and mud deep in places; water moving south at west edge. Large red huckleberry plants on stump, moss on woody log debris. Mosquitoes, can hear nearby frogs and songbirds.
Sector 305: 9/14/11 Marian: Heading west from west N/S line – found a pink children's "Aladdin" ball at N/S line. Red alder canopy and then into w redcedar. Between the 2 is LP trough area of deep mud and 1" standing water. Solid shield ferns on east side with a little ivy. Skunk cabbage, shield ferns, RCG, butter-cups in muddy area. Then 1' higher under cedars with mostly cedar debris w/FLOV along margin near mud, then salmonberry in shield fern area and red elderberry under red alder.
Sector 306: 9/14/11 Marian: The "Cedar Cathedral" w/tall w redcedar canopy, 1 tall Douglas-fir and 1 red alder. Open underneath; mostly cedar debris for ground cover with some moss in places. Moss on some

woody debris, FLOV on tree root areas. Red alder has "Bill" carving and wood chips around from woodpecker on dead snag top. Camper "artwork" rock and stick city design; peeled bark on cedars (human or animals?)

Sector 307: 9/14/11 Marian: Tall w redcedar canopy and tall Douglas-fir. Salal and sword fern GC with moss, FLOV and NBB mixed in. 6' patch of holly on north side of Douglas-fir; moss on woody debris. Ground is dry here and undulating mounds due to large tree roots. Nearby songbirds to west and north; salal leaves have chewed edges (weevils?)

Sector 308: 9/14/11 Marian: Tall w redcedar canopy; 6 x 10' pothole damp area ringed with small shield ferns, moss and 1 deer fern, then larger sword ferns on HPs around it. GC is woody cedar debris, downed rotting logs and nearby stumps with shield ferns and red huckleberries, then a 6 x 6' patch of piggyback plants, sword ferns, FLOV and moss surround the patch with some NBB mixed in. Large stump with red huckleberry and logger notches in sides

Sector 309: 9/14/11 & 9/16/11 Marian: Begins 6' from edge of bank above North Creek (see sketch of 9-16-11). Tall w redcedar and Douglas-fir canopy, mid canopy of vine maple that hangs over creek. Large sword ferns with some scattered shield ferns, FLOV and NBB, 1 small rhododendron. Shield ferns, red huckleberry, sword ferns, FLOV, and moss on large stumps. Moss covers ground & woody debris; water skippers in creek which pools next to stump. West edge of sector is west bank of creek – moss, shield ferns and sword ferns edge creek. North Creek runs through west half of sector with small <1 to 3" round river rocks and sand on both sides and as its creek bed, and some large woody debris (see sketch). 1 squirrel in trees, songbirds nearby SE.

Sector 310: 9/14/11 & 9/16/11 Marian: Just west of North Creek; tall red alder and w redcedar canopy. Mid canopy vine maple & red elderberry; moles, nearby songbirds. Large stump with w redcedar and red huckleberry growing from it. Shield ferns and sword ferns on HPs; moss on ground and woody debris, GC of sword ferns, piggyback plants, FLOV on HPs; skunk cabbage in LP.

Sector 311: 9/16/11 Marian: 1 South of 310, tall red alder and w redcedar canopy, mid-canopy vine maple. GC is 50% shield ferns and 50% skunk cabbage LP with a little open drier soil and cedar tree debris, 2 salmonberry SE corner near creek edge, small birds in trees.

Sector 312: 9/16/11 Marian: North Creek runs under log west half of sector, 2' higher and drier creek banks. Tall Douglas-fir and w hemlock canopy, light vine maple mid-canopy, scattered HBB, salmonberry and native blackberry. Shield ferns and sword ferns next to cedars and the rest is buttercups. Cedar tree debris with a few RCG, 3 x 5' patch of holly at base of 1 tree. Tree cones from w hemlock, w redcedar, red alder and Sitka spruce on ground (see photo), and 1 white bird egg (approx. 1 ½" - smaller than chicken egg?) Red huckleberry and moss on stumps, rocky and sandy creek bed.

Sector 313: 9/16/11 Marian: Tall w hemlock, w redcedar and Douglas-fir canopy, mounded terrain due to large tree roots. HP woody debris, stumps with moss, FLOV, shield ferns, sword ferns, huckleberries, deer ferns and native blackberry. LP mostly tree debris OM with scattered FLOV, sword ferns and moss; mosquitoes.

Sector 314: 9/16/11 Marian: Continues east through SW corner of "cedar cathedral", tall w redcedar canopy. GC mostly sword ferns, cedar debris and some moss, dry here. Scattered salal, native blackberry and a few 1 ½" holes in ground; small red huckleberries on old logs.

Sector 315: 9/16/11 Marian: Tall w redcedar canopy; few plants underneath, mostly woody cedar debris with patches of moss. A few small native blackberries, salmonberry, 1 small sword fern; red huckleberry and shield fern on woody debris.

Sector 316: 9/16/11 Marian: Tall w redcedar canopy, woodpecker half way up. GC mostly tree debris then edge of HP with sword ferns, shield ferns, 1 huckleberry; GC of FLOV, then moist edge of buttercups and piggyback plants.

Sector 317: 9/16/11 Marian: LP of firm mud and open between tall cedar and red alder canopy then 1-2" wide and 2" deep south moving water and soft mud; skunk cabbage & buttercups, RCG, carrot-family plant mix; then higher damp area of red alder, shield ferns, sword ferns, salmonberry, FLOV, then drops into wet standing water trench w/buttercups mostly & skunk cabbage.

Sector 318: 9/10/11 Marian (& husband Mark): Open canopy of salmonberry 95%, buttercups and shield ferns w/nightshade covering all. Mud and standing water under tangle of plants.

Sector 319: 9/10/11 Marian (& Mark): W redcedar canopy, salmonberry, FLOV and moss.

Then elevation drops to moist open area of salmonberry, twinberry, shield ferns and skunk cabbage with sword ferns, FLOV and moss on woody debris. Then drops into channel with mud and 4" standing water with buttercups and carrot family plant mix, duck weed and 1 downed red alder tree; mosquitoes
Sector 320: 9/10/11 Marian (& Mark): W hemlock, w redcedar & red alder canopy; Pacific crabapple mid canopy salmonberry 60% and twinberry 10%; red huckleberry on log. GC FLOV on thick leaf litter on higher drier areas, moss on woody debris. Skunk cabbage & shield ferns in open firm mud areas.
Sector 321: 9/10/11 Marian (& Mark): W hemlock and red alder canopy; Pacific crabapple mid canopy, salmonberry shrub layer 80%; red huckleberry on stump, elevation drops at center, 90% FLOV GC with scattered shield ferns and sword ferns.
Sector 322: 9/10/11 Marian (& Mark): W red cedar, salmonberry and FLOV on higher woody areas. 2 (10') tall trees (see photo); mosquitoes in lower areas. Muddy area with skunk cabbage and scattered shield ferns, 2 (5') ivy (pulled), 1 holly.
Sector 323: 9/10/11 Marian (& Mark): Light red alder canopy, salmonberry, red huckleberry on stump. Broken tall red alders, otherwise similar to 318 with salmonberry, nightshade, buttercups and scattered skunk cabbage with standing water.
Sector 324: 9/16/11 & 9/17/11 Marian: Light tall red alder canopy, mid canopy of vine maple, salmonberry 40%, tall shield ferns, buttercups, wet mud firm on west side and soft on east, thick in places (see sketch). 2" south running water that merges with other south flowing water trench w/a little duck weed, mud firmer on west side and softer on east side. Large evergreen blackberry, scattered large shield ferns; can hear a frog to SW.
Sector 325: 9/17/11 Marian: South of cedar cathedral; moss bird's nest in sword fern and salmonberry that tipped over. Undulating ground with 3-4' mounds with large potholes (decaying logs and stumps?)
OM from trees thick in places; ground drier. Tall w redcedar and Douglas-fir canopy, vine maple mid canopy & 1 4" diameter cedar. Is mostly a mix of salal, sword ferns with a few shield ferns and NBB.
Moss & red huckleberry on stumps & a few FLOV; 1 ground bird (bushtit); scattered salmonberry.
Sector 326: 9/17/11 Marian: Similar to 325 but with dwarf dogwood bunchberry on stump and a 3 x 5' patch of 6' tall holly with lots of cobwebs and fallen tree debris. Tall w redcedar and Douglas-fir canopy, vine maple mid canopy & 1 4" diameter cedar. Mostly is a mix of salal, sword ferns with a few shield ferns and NBB. Slightly less salal & GC plants, with more sword ferns than 325.
Sector 327: 9/17/11 Marian: Tall w redcedar & w hemlock canopy, more open with tree debris covering ground. Logs covered in moss w/red huckleberry; FLOV, sword ferns & shield ferns next to them.
10 x 10' area of 2-3" tall young cedars; pulled out 1 ivy plant. Scattered moss, FLOV & NBB on ground w/some branches.
Sector 328: 9/17/11 Marian: Tall Douglas-fir, w redcedar, tall red alder, w hemlock canopy, some with moss. Mid canopy of Pacific ninebark. 1 downed dead tree imbedded in a red alder tree. Sand, gravel and rock bar area near creek formed from high water level (per Tom). HP area NW part of sector covered with stinging nettles and piggyback plants with a few NBB, salmonberry, herb-Robert, sword ferns and shield ferns mixed in; very dry now. Shrub layer is fairly open here.
Sector 329: 9/17/11 Marian: Tall w redcedar and red alder canopy, but fairly open and sunny, mid canopy of vine maple and large Pacific ninebark with log debris underneath near North Creek east bank.
East bank consists of river rock, sand and gravel. Soil to east holds more Pacific ninebark, salmonberry, shield ferns and piggyback plants. 1 stink currant shrub (maple/thimbleberry leaves, light salal-like berries) (see photo). North Creek is thin, fast, rocky and shallow here today. Skunk cabbage and piggy back plants on west bank. A path runs east/west in south part connecting 2 properties. Creek diverts west under woody logs and debris here (in south part of sector) and goes under the bank at 1 point (see sketch) (this changes later w/increased winter water flow).
Sector 330: 9/17/11 Marian: Creek bank cuts into this sector in SE corner with 2 very large stumps nearby. Tall w redcedar canopy, mid canopy of vine maple and smaller cedars. Shrub layer is fairly open w/large sword ferns and some young vine maple. Shield ferns, piggy back plants and skunk cabbage near creek embankment.
Sector 331: 9/17/11 Marian: West of North Creek; tall w redcedar, w hemlock, red alder trees; mid canopy of vine maple & smaller w hemlock; large stumps with 8-10" diameter trees, red huckleberries.

Shrub layer is fairly open with some salmonberry and young vine maple. GC – 1 trillium, shiny Oregon grape, large sword ferns & FLOV mixed with a few NBB.

Sector 332: 9/29/11 & 2/4/12 Marian: Water flows slowly through east 1/3. Buttercups, mud, LP channel with 1-2" water, soft mud in LP 10' wide & some duck weed present (then goes south and spreads out just beyond south border of sector). West ½-2/3 is salmonberry, HBB mix, HP stump with salal, vine maple and w hemlock. Light tall red alder canopy in NW & NE and w hemlock in SW, open to south. Shield ferns and sword ferns mixed with salmonberry on east border. 10/18/11 – reddish brown film in water (see photos). 2/4/12 – After windstorm 14 downed red alder trees fell into watery buttercups area between 332 and 340 and onto shrubs; water 2-3" deep throughout sector today.

Sector 333: 9/29/11 & 2/4/12 Marian: Tall w hemlock & w redcedar; mid canopy vine maple, young w redcedar & red alder. Ground covered with w hemlock and w redcedar debris, moss on larger woody debris. Patches of salal on HP and woody debris, a few sword ferns & small shield ferns; 10' tall stump with salal, red huckleberry and 1' diameter w hemlock growing on it (sector ends at east side of big stump – 5' higher elevation), N is higher, S is lower. Thick salmonberry and some spirea; buttercups and water in LP. 2/4/12 Hard glacial till soil at base of water flow in LP (water flow washes away organic layer?).

Sector 334: 9/29/11 & 2/4/12 Marian: "THE stump" – is 10' tall; tall w hemlock canopy, mid canopy 80% vine maple. Undulating topography due to old large woody debris, with 2 large stumps. A channel for water (?) which is only damp now, can hear frogs to the SE. Large sword ferns sprinkled with salmonberry, (see sketch of stump area), moss on woody debris, many holes in logs & snags; stumps w/salal, red huckleberry, FLOV, NBB & w hemlock. Tall Douglas-fir tree, 1 large black cottonwood tree south of cedars.

Sector 335: 9/29/11 & 2/4/12 Marian: Crisscrossing downed trees covered with moss and decay. Tall w hemlock, Douglas-fir, w redcedar and red alder canopy. More open in center of sector. Mid canopy thick with vine maple, thick decaying wood on ground. Large sword ferns, shield ferns, salmonberry, FLOV and NBB scattered throughout; area slopes downward from south border to center. Licorice ferns on downed logs; nearby birds and frogs. GC mostly woody debris and OM with soft damp soil, then into a rockier central gulch area, then red elderberry, w red cedar and w hemlock, 2 trillium, HP south edge of sector.

Sector 336: 9/29/11 & 2/4/12 Marian: Slopes west towards creek, damp, soft but firm here. Similar to 335 but moving back into tall w redcedar, w hemlock, red alder canopy. Mid canopy thinner vine maple, salmonberry thicker here, some downed wood but less of it here. Scattered shield ferns, large sword ferns, NBB, piggyback plants, small grass-like sedges. Comes out to edge of sand/river rock bar overflow area, Pacific ninebark and downed w redcedar tree with moss and licorice ferns (see drawing).

Sector 337: 9/29/11 & 2/4/12 Marian: Sand/river rock bar, then east bank of North Creek is lower (just north of lagoon). Fairly open tall red alder canopy, mid canopy Pacific ninebark w/salmonberries mixed in. GC mostly piggyback plant with a few nettles, shield ferns, sword ferns and skunk cabbage mixed in; (see creek sketch), mosquitoes. Then ground abruptly drops ~5' to creek where it pools after the sharp jog to the west. 2/4/12: sand/rock bar is more gouged and eroded today than in Sept. Looks like it saw a lot of water activity recently (recent big snow and melt 1-2 weeks ago) with woody debris and leaf litter caught in here. Young looking w redcedar trees in here are actually branches from a downed cedar tree

Sector 338: 9/29/11 & 2/4/12 Marian: Middle of creek pool to west bank and moist soil trench between large tree stumps and through w redcedar roots (overflow area), vine maple mid canopy. W hemlock and red huckleberry growing out of stump, shield ferns ring stump base. Skunk cabbage, sword ferns, shield ferns and piggyback plants near bank; pulled 1 ivy.

Sector 339: 9/29/11 Marian: West bank of North Creek then into forest next door. Similar to 338 but bank is 3-4' higher than the creek with plants that hang over edge. W redcedar canopy, vine maple mid canopy, scattered shield ferns, large woody debris. Rocky/sandy overflow goes behind cedar trees, ground bare 60% of area, nurse stump.

Section 340: 10/9/11 Marian (& husband Mark), 2/4/12 Marian: GPS pt #N47°52'583', W122°13'513', elevation 423'. Lt. red alder canopy, 1 blue jay; 95% buttercups, 2-4" standing water and duck weed, mucky mud; scattered salmonberry, sword ferns, shield ferns, skunk cabbage; light RCG. Then 2' higher elevation with med. red alder canopy and salmonberry 90%. Downed logs, scattered sword ferns and red huckleberries on logs. Soil moist, thicker leaf litter, FLOV in patches and a 4' patch of ivy.
2/4/12 After a windstorm 14 downed red alder trees fell into watery buttercups area between 332 and 340 and onto 332 shrubs; water 2-3" deep throughout buttercup area.

Section 341: 10/9/11 Marian (& Mark): Higher & drier, med. red alder canopy, 80% salmon-berry, twin berry sprinkled in. Large woody debris w/lots of moss, red huckleberry, sword & shield ferns.
Section 342: 10/9/11 Marian (& Mark): Drops into a low muddy area w/large skunk cabbage; 3' wide trench w/4" med speed flowing water. Med red alder, tall willow canopy; spirea, salmonberry & red elderberry mix; buttercups and light RCG; mud firm to soft; nearby songbird in SW; 1 beer bottle.
Section 343: 10/9/11 Marian (& Mark): Then slightly higher, soil firm & not muddy; open canopy with 100% solid tangle of salmonberry with light understory of FLOV, shield ferns, skunk cabbage.
Red huckleberry on mossy stump wall and woody debris. Trench comes in from north (see diagram) with thick mucky mud and 2" standing water. Soil firm, moist with leaf litter, then lots of woody debris.
Section 344: 10/9/11 Marian (& Mark): Open canopy, 100% solid salmonberry, little GC;
stumps with moss, shield ferns, red huckleberry and patches of FLOV.
Section 345: 10/9/11 Marian (& Mark): Thick salmonberry (similar to 344), scattered red elderberry. Then into red alder canopy with crabapple thicket mid canopy, and 1 large willow with
1 large section fallen into large red-osier dogwood.
Section 346: 10/9/11 Marian (& Mark):
Continue through crabapple canopy and then out into an open sunnier and drier area 90% salmonberry, understory mix of RCG, twinberry, shield ferns, small sword ferns, FLOV, and (1 weed); tall stumps with red huckleberry and dead branches with moss. Very wet soil but firm & soft; songbirds, nearby frog to SE.
Section 347: 10/9/11 Marian (& Mark): Open canopy, thick salmonberry 80% with scattered twinberry; understory mix of shield ferns, (1 weed), stinging nettles; FLOV on woody debris, leaf litter over wet firm but soft mud.
Section 348: 10/9/11 Marian (& Mark): 3' wide trench with 1-2" flowing water and mucky mud.
Lt. red alder canopy north half, open to south, 6' tall holly tree clump 10' wide. Thick salmonberry, small shield ferns west bank, small sedges on east bank. Carrot-like plant in water.
Section 349: 10/9/11 Marian (& Mark): Open area with soft mucky mud (easy to get stuck), stump with red huckleberry. 1" standing water and skunk cabbage, muddy trench LP in center of sector water area. Light red alder canopy, 70% salmonberry with a little twinberry and a little nightshade.
Section 350: 10/9/11 Marian (& Mark): 5' wide muddy trench with 4-6" SW flowing water (see diagram). Slightly higher and drier otherwise here with tall red alder canopy; mid canopy of red elderberry and thinner/shorter salmonberry; GC thick leaf litter and 90% FLOV; licorice ferns and moss on wood/
Large skunk cabbage and shield ferns scattered around; carrot-like plant in water.
Section 351: 10/9/11 Marian (& Mark): Tall red alder canopy and then into edge of w redcedar with salmonberry, FLOV. 5' wide trench runs through NW corner with 4'6" flowing water.
Section 352: 10/9/11 Marian (& Mark): Tall red alder into w red cedar canopy in north with salmonberry, FLOV, scattered skunk cabbages (LP) & shield ferns. W redcedar canopy south, mostly open underneath.
Section 353: 10/9/11 Marian (& Mark): W redcedar, red alder and w hemlock canopy, shield fern, salmonberry (similar to 352). Soft but firm mud & soil, open cedar area just south; owl in nearby tree.
Sector 354: 10/12/11 Marian: W redcedar w/dead branches in low to mid canopy; woody debris of logs and stumps. 1/3 patches of moss and FLOV, alt. with 1/3 lower open mud areas, 1/3 just cedar debris
East edge shield ferns, sword ferns and salmonberry; red huckleberry on stump. A few bunch berries (dwarf dogwood) scattered; 5" wide trench of water N to SW.
Sector 355: 10/12/11 Marian: North half w redcedar canopy continues w/woody stumps, branches & GC mostly cedar debris. South half is mid canopy crabapple tangle with wet depression under it. GC is FLOV, small shield ferns, moss & wood. Standing water to open mud (soft & mucky) in places, cedar tree debris.
10/18/11 In W redcedar area a group of small blue jays were sassing at me (possibly their territory?)
Sector 356: 10/12/11 Marian: W redcedar canopy, open underneath, stumps with red huckleberry. Shield ferns, FLOV, moss and small wood in woody debris area. West edged with shield ferns mixed with a few scattered hollies, sword ferns and a few salmonberry. Wet soil to mud, firm to soft and mucky.
Sector 357: 10/12/11 Marian: 1 tall willow, downed w redcedar clump. West edge of tall cedar canopy, turns into tall red alder canopy with med w redcedar mixed in, salmonberry and shield ferns, scattered spirea. Moss and red huckleberry on woody debris. FLOW and shield ferns, lighter and open firm mud to standing water lower points
Sector 358: 10/12/11 Marian: 4-5' wide mud trench with 3" deep and 3' wide moving S-SW water.

Tall red alder, med. w redcedar canopy, 70% salmonberry 7' tall. Wet GC, sword and shield ferns, FLOV and moss, humus, scattered skunk cabbage. Heard a hawk (?)

Sector 359: 10/12/11 Marian: LP on east side of sector with firm mud and skunk cabbage, similar to 358 w/o stream but with a large white birch and a few spirea near mud.

Sector 360: 10/12/11 Marian: Edge of red alder and birch canopy with salmonberry 5' tall.
Then into solid 10' tall spirea, 2 Pacific crabapples in low area with duff; salmonberry, twinberry mix. Moist to wet, firm but soft organic soil with lots of leaf and brush litter.

Sector 361: 10/12/11 Marian: Same thick spirea & salmonberry mix. Sprinkled with skunk cabbage but GC mostly leaf littler and branches with thick OM. Mossy wood, ends at 2 Pacific crab apples

Sector 362: 10/12/11 Marian: Red alder & w redcedar canopy. Stumps with moss, shield ferns, FLOV, and lichens. GC mostly patches of FLOV, moss on woody debris, scattered skunk cabbage. Moss and open soil with tree litter under w redcedars, dark humus soil, several mole hills. Red alder and tall willow to north; salmonberry, shield ferns and FLOV south of w redcedar.

Sector 363: 10/12/11 Marian: Tall w redcedars and red alders, mid canopy of vine maple. Moles, mass of mushrooms on tree snag, mossy woody debris and shield ferns; scattered 1-3' tall holly trees. North is red alder, tall willow and salmonberry. 1 downed scouler's willow tree with (oval/teardrop shaped leaves). Then into med w redcedar forest central west side with mounding surface with little GC. To north continues red alder, tall willow, salmonberry, scattered sword ferns and shield ferns.

Sector 364: 10/12/11 Marian: Thick moss on dead tree branches, 1 species of mushroom. Low area with moist soil and moss around perimeter of w redcedar trees. Light red alder and salmonberry to south.

Sector 365: 10/12/11 Marian: Lt red alder canopy, thick salmonberry 90%. Large woody logs and stumps with moss, FLOV, sword ferns, shield ferns, red huckleberries and lichen on them.

Sector 366: 10/12/11 Marian: Elevation steadily declines westward with lower muddy areas and standing water in LP. Nearby birds (4 species), red alder canopy (4-10" diameter mid to tall), 85% salmonberry with a little spirea; GC – buttercups and a little RCG mixed in. Downed smaller logs and tree branches throughout, 1 woodpecker working on a tree snag. Then opens to buttercups/carrot-like plant, a perimeter of RCG and slowly flowing water 4-6" deep with soft mud (swampy area). Large tree roots covered in large sword ferns, water flows south under it. Water flow is 4' wide in north and 10-12' wide center to south (see sketch).

Sector 367: 10/12/11 Marian: At the west N/S line, 2-4" standing water slightly moving SE. Med. to tall red alder and tall willow in south half at west border. 30% salmonberry, 50% twinberry, 10% spirea mix, open sticky mud and slowly moving/standing water; thin GC buttercups, RCG, carrot-like plants, scattered skunk cabbage and shield ferns; thick moss on woody debris, nearby song birds. Rusty orange patch in water 10' from west line (similar to patch west of trout stream) (possibly algae or fungus?)

Sector 368: 10/16/11 Marian: East side is west N/S line, standing water and mud puddles, slowly flowing SW. Tall willow & red alder canopy, mid canopy of vine maple & crab apples. Ground is mostly ankle deep open mud with water moving S along N/S line. Salmonberry, shield ferns, large skunk cabbage, butter-cups, RCG and carrot-like plant (1 unknown shrub species). Lots of mossy woody debris & leaf litter, sword ferns on wood, large log w/many FLOV, licorice ferns, huckleberry & possible animal activity (see photo).

Sector 369: 10/16/11 Marian: Higher and drier, soft humus and leaf litter. Red alder canopy, mid-canopy Pacific crab apple central west side. 85% salmonberry, 10% tall twinberry mixed in. Woody debris with moss and FLOV on it. A red alder snag fell over as I walked by w/o touching it.

Sector 370: 10/16/11 Marian: Salmonberry 95%, light red alder canopy, lots of mossy woody debris.
Ends with the "clump stump" a stump with an entire forest ecosystem growing on it of salal, salmonberry, licorice ferns, red huckleberry, moss, FLOV and a tree clump (oval/teardrop-shaped leaves) (willow or bitter cherry?) (see photo). Is next to edge of w redcedars with open understory & a little vine maple mid-canopy with a large old stump and tall w redcedar tree growing out of it.

Sector 371: 10/16/11 Marian: Light red alder canopy with w redcedar to north and south.
Mid canopy of red elderberry and vine maple, 80% salmonberry, 10% twinberry, scattered shield ferns and sword ferns. FLOV, licorice ferns black lichen and thick moss on woody debris; thick leaf litter and humus, damp soil soft but firm.

Sector 372: 10/16/11 Marian: Tall teardrop leaf scouler's willow in north, w redcedars E & red alder canopy; vine maple and red elderberry mid canopy, tall salmonberry 80%, with a little twinberry.

Shield ferns and skunk cabbage in LP trench area, licorice ferns on tree. Shield ferns and FLOV scattered in higher areas, thick leaf litter and humus, lots of downed wood, thick moss.
Sector 373: 10/16/11 Marian: Similar to 372 for west half, (see photo of 1 tree). Then open canopy, thick spirea in north and thick salmonberry in the south. LP trench with firm mud, skunk cabbage, shield ferns, grass-like sedge. Thick moss, licorice ferns, red huckleberry, salmonberry & shield ferns on woody debris.
Sector 374: 10/16/11 Marian: Continue with same into white birch trees, small black swamp gooseberry, and 1 tree. Spirea to north, salmonberry to south, scattered skunk cabbage and damp soil.
Sector 375: 10/16/11 Marian: White birch & red alder canopy, spirea to north, south salmonberry, FLOV in higher area, skunk cabbage sprinkled in low areas w/sedges that look trampled (probably weather?)
Sector 376: 10/16/11 Marian: 10' wide water trench slowly moving SW, red alder, white birch canopy west of water. W hemlock, w redcedar hanging over the east side of water trench; salmonberry and spirea mix, scattered sword ferns, skunk cabbage; FLOV higher areas.
Sector 377: 10/16/11 Marian: W redcedar in north half, low muddy area is firm south of w redcedar trees. GC skunk cabbage, sword ferns, shield ferns, low trench area; FLOV under w redcedar. Then thick 8' spirea w/some salmonberry & twinberry mixed in, 20-30' willow in south.
Sector 378: 10/16/11 Marian: GC skunk cabbage, sword ferns, shield ferns, low trench area. Light w redcedar and willow canopy, salmonberry to north and thick spirea to south. Skunk cabbage, sword ferns and FLOV; thick moss on wood.
Sector 379: 10/16/11 Marian: W redcedar north, thick crabapple mid canopy, spirea to south, red-osier dogwood clump. Small shield ferns and FLOV, alternate with open firm mud, and 2" standing water in places with soft mud.
Sector 380: 10/16/11 Marian: Red alder canopy (4-8" diameter), 80% crab apple mid canopy continues. W redcedar perimeter to north and east, 2 aggressive owls (territorial dispute?) FLOV hp, water and mud in LP trench with soft mud; firm mud in other areas.
Sector 381: 10/16/11 Marian: W redcedar canopy, thin salmonberry, FLOV GC or bare with skunk cabbage LP to south under w redcedar; standing water east side with a few bunch berries (dwarf dogwood).
Section 382: 10/18/11 Marian: North half is w redcedar, salmonberry and a few skunk cabbages. Central to south is a more open canopy of red alder, and a black swamp gooseberry. LP area with mud and 1-2" standing water, thick with 6' tall shield ferns, RO dogwood and Pacific crab apple trees mid canopy, a little RCG and horsetails mixed in, spirea, a little salmonberry and red elderberry. 10' red huckleberries grow on some stumps.
Section 383: 10/18/11 Marian: Red alder, w redcedar canopy, Pacific crab apple mid canopy in north; open to south. Med to thick 8' spirea and crab apples with a little shield ferns and salmonberry mixed in; med. to soft mud.
Section 384: 10/18/11 Marian: W redcedar canopy, open in center, Pacific crab apple & spirea tangle in center with mud. HP w redcedar area, GC of buttercups, skunk cabbage, FLOV, shield ferns and scattered salmonberry; ends under the white birch.
Section 385: 10/18/11 Marian: "Secret Garden" (open low area under trees). White birch and beaked hazelnut tree canopy (see photo), w redcedar to south edge, 5" tan mushroom, LP of buttercups, skunk cabbage; salmonberry throughout, then a midstory of Pacific willow to north with tangle of spirea and salmonberry and lots of small-med woody debris tangled underneath. LP buttercups to mud, FLOV on higher areas.
Section 386: 10/18/11 Marian: Pacific willow canopy, spirea 80%, salmonberry 20%, lots of downed wood and trees. GC of buttercup and skunk cabbage, then ground bare under spirea. Licorice ferns and moss on wood, white mushrooms/fungus on small wood.
Section 387: 10/18/11 Marian: Red alder, black cottonwood to north and Pacific willow ends here; w redcedar to south. Thick 8' tall spirea with buttercups; scattered skunk cabbage and sedge; then comes out to more open underneath, twinberry and salmonberry west edge of spirea.
Section 388: 10/18/11 Marian: W redcedar clump in center, 15' wide sedge marsh goes around it (looks trampled or weather damaged) from north of black cottonwood. Mud, buttercups & skunk cabbage; FLOV higher areas under w redcedars. Twinberry and salmonberry where sedge isn't; nearby birds, wood-pecker, & frog. Heard a tall tree break and fall near woodpecker sounds.
Section 389: 10/18/11 Marian: Out into more open canopy with 10' twinberry, tangle of downed trees.

Red alder to north, w redcedar to south, buttercups GC; soil damp but firm.
Section 390: 10/18/11 Marian: Large downed willow (a bushtit bird in it) with several shoots up all along trunk and topside of branches (see photo). Buttercups, nettles and shield ferns mixed GC. Tall willow to north, w redcedar to south, soil damp but firm. Red elderberry, 1 tree (bitter cherry?), open area 20' wide with wet firm mud. Buttercups, RCG, nettles and 1 weed species mix then into 10' to tall willow mixed with thick salmonberry.
Section 391: 10/18/11 Marian: Tall willow canopy, mid canopy of willow shoots from downed willow tree, thick 10-20' tall Pacific ninebark with some salmonberry, short red elderberry; buttercups mixed with RCG; soil moist but firm.
Section 392: 10/18/11 Marian: W redcedar and willow canopy, mid canopy Pacific ninebark to south with twinberry, and little GC plants; woody debris and moss; some red elderberry. Scattered small sword ferns and FLOV on wood, salmonberry to north. 1 tall (bitter cherry?) tree (hard to tell as leaves are high and bark is covered with moss), ground slopes to SW.
Section 393: 10/18/11 Marian: Tall willow, red alder and 1 very tall tree (bitter cherry?-see leaf photo) Mid canopy of red elderberry, Pacific ninebark and 1 small tree (see leaf). Damp soil firm but soft, thick leaf litter and humus, downed trees with moss. Thick salmonberry/Indian plum tangle, FLOV & 1 trillium.
Section 394: 10/18/11 Marian: Tall red alder canopy, willow on east edge of sector, mid canopy of red elderberry. Salmonberry, shield ferns and FLOV; moss on wood thick leaf litter and small woody branch debris for GC.
Section 395: 10/18/11 Marian: W redcedar canopy, large downed tree to north, smaller logs to south. Red elderberry mid canopy, large logs with moss and red huckleberry. Salmonberry, moss, FLOV, scattered shield and sword ferns; ground slopes to SW. Tall w redcedar open area to south with signs of camping. Mucky muddy area can sink to boot tops, 2-4" water flows SW, near N/S line with skunk cabbage and small sedges.
Sector 396: 10/23/11 Marian: Tall w redcedar canopy, open center with area used as a camp site (sleeping bags) and dumping ground (garbage thrown around). Mid canopy of beaked hazelnut trees, scattered larger sword ferns. Ground in undulating mounds, firm and damp with large patches of moss in places. 1 bird house in w redcedar tree, 1 tall stump (12' tall), woodpecker marks on cedar.
Sector 397: 10/23/11 Marian: Tall w redcedar canopy, more open to north. Salmonberry, shield ferns and FLOV in open areas, central area moss and cedar debris. Small standing water pools near cedar LP with 4-8" water, large log woody debris.
Sector 398: 10/23/11 Marian: W red cedar, bitter cherry (?) mix, large bitter cherry fell over and has tall upright branches forming a "forest" mid canopy; 70% salmonberry, red huckleberry on decaying wood; LP trench runs through the center with standing water in places and mud. Licorice ferns, thick moss, mushrooms & lichen on dead wood downed trees and stumps
Sector 399: 10/23/11 Marian: Center is w redcedars with 4-6" standing water in LP trench and little GC. North light canopy tall Pacific willows, Pacific ninebark mid-canopy, scattered salmonberry. South open canopy with mostly vine maple and scattered salmonberry. Firm mud and soil
Sector 400: 10/23/11 Marian: Tall w redcedar ends and then tall willows run north to south. Salmon-berry and Pacific ninebark mixed to north with patches of RCG and sword ferns. South is Pacific willow mixed with vine maple and a little salmonberry, piggyback plant GC, shield ferns, sword ferns and FLOV with mole holes. Downed willow & large downed Pacific crabapple growing upright branches as a "forest." Thick moss on trees and woody debris, firm soil.
Sector 401: 10/23/11 Marian
Tall bitter cherry and/or crabapple, mid canopy of red elderberry and other (sorbus?) (See photo.) Then into w redcedar with mud and pools of standing water 6" deep. Many downed trees and woody debris with moss. Salmonberry and vine maple to south with buttercups at water's edge, firm mud and small sword ferns. W redcedar to north and downed trees
Sector 402: 10/23/11 Marian: 2 east/west trenches of water continues through open w redcedar area. Tall willow and bitter cherry (?), tall red alder, but mostly w redcedar. Trench mud is firm, nearby bird and squirrel, downed cedar, water 6-8" deep here.
Sector 403: 10/23/11 Marian: Mostly open under tall w redcedar canopy, cedar debris GC. HP mounds, damp moss, FLOV, sword ferns, LP water with skunk cabbage. Sword ferns, salmonberry scattered in open,

salmonberry and 1 willow (?) to north. W redcedar canopy to south with salmonberry in places. A few scattered 2' holly shrubs, machete blade stuck in cedar tree, and a possible campsite.
Sector 404: 10/23/11 Marian: Tall to med w red cedar forest continues, 1 tall tree snag with wood chips at base. Salmonberry and FLOV in sunnier areas and 1 willow (?) to north; little GC, bare under thick trees with potholes of 2-4" water in LP. 7' holly shrub to north edge and smaller 1' plants nearby.
Sector 405: 10/23/11 Marian: W redcedar open area halfway in then thick salmonberry and twinberry and scattered skunk cabbage, thicker to south. More open canopy with red alder and willow to north and tall red alder to south. Scattered stinging nettles, soft but firm OM in places.
Sector 406: 10/23/11 Marian: Thick twinberry with salmonberry, scattered shield fern. GC of buttercups and scattered skunk cabbage; licorice fern on woody debris. Soft soil but firm, then soft and sticky with 1-2" standing water in LP; open canopy and w redcedar to north.
Sector 407: 10/23/11 Marian: 2-4" standing water in soft mucky mud. Salmonberry, twinberry, shield ferns; skunk cabbage scattered, then into med to tall w redcedar in muddy trench. Red huckleberry on stumps, slow moving water going SW; FLOV, shield ferns and sword ferns on HPs, thick moss on tree branches and tall red alder mixed in. Songbirds nearby (3 species?)
Sector 408: 10/25/11 Marian: N area is LP with shrubs similar to #406-7, w/scattered skunk cabbage & horsetails. Shrubs mostly red-osier dogwood with some salmonberry. Lots of moss, 1 tall red alder, GC either mud, moss and/or scattered ferns. Center and south is w redcedar canopy.
Sector 409: 10/25/11 Marian: Similar to 408; N area is LP with shrubs similar to #406-7. Shrubs are mostly red-osier dogwood with some salmonberry. Lots of moss, 1 tall red alder, GC either mud, moss and/or scattered ferns. Center and south is w redcedar canopy; moist to wet mucky mud.
Sector 410: 10/25/11 Marian: Light red alder canopy, mid canopy of red-osier dogwood coming up from a large downed red-osier dogwood tree covered with moss. Light salmonberry, scattered shield and sword ferns. Wet mud and standing water, scattered horsetails and FLOV HPs. Mid canopy of Pacific crab apple to west half & sending small shoots up all around it.
Sector 411: 10/25/11 Marian: Then into Pacific crabapple tangle with red-osier dogwood; mud and standing water, sticky/mucky and deep; scattered small salmonberry and moss on woody debris; then spirea and salmonberry mix.
Sector 412: 10/25/11 Marian: Light red alder canopy, mid canopy red elderberry, spirea and salmonberry mix; red huckleberry on stump; scattered shield ferns and FLOV on HPs, licorice ferns on trees. Soft wet soil with standing water in LPs, thick leaf litter & moss. Then large skunk cabbage, shield ferns, horsetails & some RCG mixed with twinberry and salmonberry in 2-4" standing water in south.
Sector 413: 10/25/11 Marian: Light red alder canopy, mostly large skunk cabbage GC with mud; 1 Pacific crabapple in center. Salmonberry, twinberry, shield ferns and FLOV cover mounded areas. Low trough of mucky mud (easy to get stuck) w/2-4" standing water (heads south past sector).
Sector 414: 10/25/11 Marian: Mucky mud, 2-4" standing water filled with large skunk cabbage. Scattered mounds of tall red alder and w redcedar canopy, scattered salmonberry. Many cedars have tipped over here (similar to 412-413).
Sector 415: 10/25/11 Marian: Mud trough ends halfway in at tipped cedar, then into 2' higher w redcedar, thin salmonberry, FLOV, and 4' holly shrub in center and north. Low areas with skunk cabbage and mud to south with Sitka spruce and 2 other species of trees (see photos).
Sector 416: 10/25/11 Marian: W redcedar, Sitka spruce and red alder canopy; skunk cabbage LP trough continues w/downed Sitka spruce. Salmonberry, FLOV and shield ferns HP, plus a little nightshade.
Sector 417: 10/25/11 Marian: Sitka spruce SE to open canopy, 40% salmonberry, 60% skunk cabbage with shield ferns and light RCG mix in center. 2-4" standing water and thorny black swamp gooseberry.
Sector 418: 10/25/11 Marian: Light tall red alder canopy, thicker salmonberry with mix of skunk cabbage, shield ferns, RCG and higher elevation ground here. Then area slopes S-SW with scattered sword ferns and FLOV on wood, a little nightshade; skunk cabbage then salmonberry to south in mud.
Sector 419: 10/25/11 Marian: Tall light red alder canopy, mid canopy mostly vine maple (heavy to north), 50% salmonberry, skunk cabbage in low areas; FLOV and shield ferns on HPs. 1 trillium plant, 10-ft. patch of shiny Oregon grape (but short like 'nervosa?'); licorice ferns on trees and a little sorbus (?) (see photo). Pulled 1 ivy.

Sector 420: 10/25/11 Marian: Tall red alder canopy, mid canopy vine maple (thick to north). Oregon grape continues through the sector center, licorice ferns and moss on wood. Large sword ferns and FLOV on HP, light salmonberry. E/W trench-like areas w/ FLOV, but not muddy.
Sector 421: 10/25/11 Marian: Light tall red alder and w redcedar canopy, mid-canopy vine maple, 70% salmonberry, 3' shield ferns 30% south. More Oregon grape in central west, scattered large sword ferns, FLOV ground cover, red huckleberry on stumps.
Sector 422: 10/25/11 Marian: Light tall red alder then tall w redcedar canopy. Salmonberry and FLOV, E/W trenches continue without water with firm soil. Large flock (murder) of crows and 1 sassy squirrel. Indian plum mixed with salmonberry and larger sword ferns to south, 2 trillium plants, 1 red elderberry; ends at mossy path to w redcedar area.
Sector 423: 10/25/11 Marian: Tall Douglas-fir canopy to south and tall w redcedar to north and red huckleberry on stumps. Many large sword ferns, red-osier dogwood, salmonberry and vine maple mix. Oregon grape and salal to south, ends at tall dead tree snag. 1 noisy bird.
Sector 424: 10/27/11 Marian: Tall Douglas-fir canopy, salmonberry, salal, large sword ferns; some spirea in center. Moss GC with scattered NBB and FLOV; huckleberries and salal on stumps; a little ivy. 10' clump of 10' tall cascara(?), downed large trees, licorice ferns on red alder. South half is then mostly salmon-berry, moss and FLOV, with huckleberries on stumps. West edge light tall w redcedar and red alder canopy. 1 pesky crow & nearby song birds.
Sector 425: 10/27/11 Marian: Very tall light Douglas-fir canopy. North has salmonberry, spirea, sword ferns, Oregon grape and NBB. The south has 85% salmonberry, shield ferns, NBB, FLOV with OM and small mushrooms. Soil moist not wet, soft w/OM but firm; sector center is HP then slopes to south.
Sector 426: 10/27/11 Marian: Very tall Douglas-fir and redcedar canopy on margins and open in center. Salmonberry throughout with shield ferns, FLOV and moss GC with scattered horsetails. North has salal, sword ferns, mossy large logs, 2 large stumps, mole hills. Large skunk cabbage in LP trough, heavy in south (see diagram).
Sector 427: 10/27/11 Marian: Light red alder, w redcedar canopy, 1 Sitka spruce. Slopes south to south-west, mid canopy vine maple in north. Salmonberry thick to edge of skunk cabbage area of LP trench FLOV, moss, small mushrooms, OM litter. Shield ferns scattered under salmonberry, 2 small deer ferns.
Sector 428: 10/27/11 Marian: Light red alder canopy, mid canopy vine maple north half, salmonberry 60% throughout. Large areas of wet sticky mud (easy to get stuck) and large skunk cabbage. 1 downed cedar tree, 1 tipped red alder, 1-2" standing water in LP trough.
Sector 429: 10/27/11 Marian: Tall light red alder canopy, 1 small 6' w redcedar tree. Skunk cabbages in lower wet mud and areas with 1-3" standing water throughout with a few stinging nettles and horsetails mixed in; some potholes of deeper water (<1'). Higher mounds with salmonberry, sword ferns, FLOV. Licorice ferns on trees, leaf litter and moss, downed large logs in places. Sticky mud is easy to get stuck in.
Sector 430: 10/27/11 Marian: Open canopy area (with nearby red alder, spruce and w redcedar in clumps). Open wet area with standing water throughout. Large skunk cabbages, tall horsetails and sedges; salmonberry in clumps on mounds and large logs in a big pile. Skunk cabbage trough heads south out of sight, nearby songbirds.
Sector 431: 10/27/11 Marian: Skunk cabbage marsh with standing water continued throughout. Light red alder and w redcedar canopy with clumps of salmonberry and tall shield ferns in places; sedge and horsetails mixed in. Logs and downed Sitka spruce here, woodpecker working on tree to south (see photo). Nightshade on w redcedar.
Sector 432: 10/27/11 Marian: Tall w redcedar, Sitka spruce, red alder canopy to north on higher mound. Open canopy to south. Most of this sector is large skunk cabbage in standing water and mud, with patches of salmonberry, shield ferns and FLOV on higher mounds and horsetails and a little RCG mixed in soft but firm sticky mud.
Sector 433: 10/27/11 Marian: Similar to 432; most of sector is skunk cabbage in standing water and mud Central higher mound with a Sitka spruce and a few large HBB, 1 holly and FLOV.
Sector 434: 10/27/11 Marian: 10' strip of spirea and twinberry, patch of skunk cabbage & horse-tails, and tangle of nightshade, shield ferns, salmonberry, RCG, horsetails and sedge; standing water and mud.
Sector 435: 10/27/11 Marian: 4-6' wide swaths of skunk cabbage, sedge and horsetail mix. Tall light red alder canopy; 1 tree snag with licorice ferns and 1 patch fringed lichens (see photo). Salmonberry, twinberry

to north, mixed with horsetails and RCG in standing water. Salmonberry, shield ferns and nightshade tangle to south. Sticky mud trench, large clump of red-osier dogwood to SE.

Sector 436: 10/27/11 Marian: North – spirea and salmonberry mix, then into Pacific crab apple, red huckleberries on stumps, scattered shield ferns and skunk cabbage; licorice ferns and moss on woody debris. Central – thick tangle of red-osier dogwood and Pacific crabapple, scattered red elderberry and twinberry; then south is thick 8' tall spirea in moist, spongy LP trench area.

Sector 437: 10/27/11 Marian: Continues through LP trench soft mud, patches of herb-Robert, scattered shield ferns. North is 1 tall tree (bitter cherry or willow?-see photo) and tall red alder, mid canopy of tall red-osier dogwoods. South is spirea, tall shield ferns and open canopy. SE becomes thick mix of salmonberry, shield ferns, horsetails and RCG.

Sector 438: 11/8/11 Marian: Open central area with tall red alder, 1 tall Sitka spruce, and 1 tall w redcedar. One large 20' wide twinberry with red-osier dogwood mixed in. Central low area with soft mud and 1-2" standing water. Salmonberry, twinberry mixed with RCG and shield ferns (mostly), 1 holly shrub FLOV on higher spots, horsetails nightshade thinly mixed in places with buttercups. Mushrooms on logs, large huckleberries on stumps, thick OM under Sitka spruce area with large patch of black swamp gooseberry. Moss and FLOV GC under higher area (large roots of spruce), more open under cedars with large woody debris scattered around. LP with lots of skunk cabbage mixed in. Nearby woodpecker in tree area, bright green frog, 2" animal holes, and nearby songbirds.

Sector 439: 11/8/11 Marian: Similar to 438, begins at HP Sitka Spruce with black swamp gooseberry thick in north. LP area to south, goes into thick spirea central to south area, canopy open in south. Stumps with red huckleberry, FLOV, thick moss, and bunchberry (dwarf dogwood); woody debris, thick soft OM GC.

Sector 440: 11/8/11 Marian: After spruce roots the elevation slopes down; holes for burrowing animals under roots. Then back into salmonberry, shield ferns, horsetail mix, light tall red alder canopy and RCG; red huckleberry on stumps. FLOV, buttercups and moss on higher mounds; skunk cabbage swath in south. Woodpecker on red alder dead wood top of tree. Skunk cabbage mixed with horsetails (80-85' pt), RCG and shield ferns in lower standing water trough area that haphazardly heads SE with soft mud, and 2-3" standing water in places with buttercups and shield ferns (see diagram).

Sector 441: 11/8/11 Marian: Tall w redcedar/red alder canopy with licorice ferns; salmonberry, FLOV, moss on wood. Devil's club mixed in to the south (leaves dead now in photos), black swamp gooseberry, skunk cabbage and scattered horsetails. Thick soft OM on ground; nearby song birds.

Sector 442: 11/8/11 Marian: Light tall red alder/w redcedar canopy, salmonberry, twinberry and FLOV mixed. Wet, soft mud and lots of large skunk cabbage, horsetails, shield ferns and RCG mixed in. Heavy moss and huckleberry, a little nightshade; black swamp gooseberry in south.

Sector 443: 11/8/11 Marian: Light tall red alder canopy and willow (443 similar to 442 without cedar)/ Scattered shield ferns, red elderberry, twinberry, sword ferns, shield ferns, and FLOV on HPs. Skunk cabbage is heavy and large throughout with wet soil and mud, standing water 1-2" in places. Big log caught in trees. Woodpecker and song birds to the west.

Sector 444: 11/10/11 Marian (see sketches of this area and leaves). Light tall red alder (open) canopy, shrubs mostly salmonberry. Open area with skunk cabbage and horsetails in mud. Shield ferns and FLOV on higher mounds with OM and leaf litter on HPs. 2 tree snags, thick moss on wood, log caught between 2 trees. North is half crab apple, 2/3 skunk cabbage with large woody debris and downed crab apple tangle growing upwards. Eliptical leaf tree growing up from downed branches. Wet mucky mud with 1-3" standing water.

Sector 445: 11/10/11 Marian: (Similar to 444) Light tall red alder canopy, mid canopy crabapple N, 1 red elderberry with salmonberry, skunk cabbage; licorice ferns and moss on wood. False azalea plants on stumps turning yellow with red huckleberry. Then slightly higher, firm, moist soil with 80% salmonberry to north; FLOV with scattered shield ferns and skunk cabbage. Leaf litter and black soil and humus, slightly sloping south with a few more skunk cabbage.

Sector 446: 11/10/11 Marian: East 1/3 similar to west side of 445, tall light red alder canopy, 60% salmonberry. West 2/3 is 1-2' lower with buttercups, skunk cabbage and large shield ferns. Sword ferns growing all over roots of downed tree, soil moist but very firm here.

Sector 447: 11/10/11 Marian: North half is under tall red alder canopy, 50% salmonberry with 60% large shield ferns, 10% spirea with a trough of skunk cabbage with 2-4" standing water; firm moist soil other-wise.

South half is w redcedar, tall Douglas-fir and red alder, with mostly 40% salal, 30% large sword ferns, FLOV, native blackberry, vine maple mid canopy, 15% salmonberry and shield ferns; humus & OM debris.
Sector 448: 11/10/11 Marian: Tall spruce and red alder canopy; north half is 70% spirea with 20% salmonberry. Wet fairly firm mud with 1-2" standing water, lower trench/pothole areas with skunk cabbage. Moss, FLOV and shield ferns on HPs and wood, and a little RCG mixed in. South half is sword ferns, shield ferns, vine maple, 30% salmonberry, woody debris with thick moss, OM, mushrooms and moss on ground; soft but firm humus soil.
Sector 449: 11/10/11 Marian: North half tall red alder canopy, 50% spirea and 25% salmonberry with swaths of mud/standing water 1-2" deep and large skunk cabbages. South half is tall spruce, red alder and w redcedar edge, vine maple mid canopy, sword ferns at base of trees, FLOV, red huckleberry on wood and moss covers ground. Drink bottles, broken mirror and garbage left here.
Sector 450: 11/10/11 Marian: North half is red alder canopy; perimeter edge of salmonberry, shield ferns, scattered native blackberry and FLOV; but mostly skunk cabbage in slightly firm to soft mud w/ 2-3" standing water. South half is higher w redcedar area with mostly cedar tree debris GC and scattered large sword ferns; 2 tarps (sleeping area?) near drink containers.
Sector 451: 11/10/11 Marian: Tall red alder and w redcedar canopy, 1 north and 1 south HP with w redcedar. The rest is mostly skunk cabbage in somewhat firm mud, 1-3" standing water in places or water slightly moving SW in places. Scattered shield ferns with RCG, salmonberry, nettles and FLOV on HPs.
Sector 452: 11/10/11 Marian: Water trench 2' wide, 2-3" deep, slightly moving south then SW. North is w redcedar, vine maple, salmonberry, and shield ferns. South is w redcedar, red alder, vine maple, large sword ferns, and shield ferns. Licorice ferns on downed wood, skunk cabbage in trough.
Sector 453: 11/10/11 Marian
Tall w redcedar & red alder canopy, mounded areas due to large tree roots; mid canopy vine maple to north, 2 small rhododendrons, large sword ferns, shield ferns and salmonberry lightly scattered; salal, red huckleberry, moss, sword ferns and FLOV on stumps; damp humus soil, soft but firm.
Sector 454: 11/10/11 Marian: Tall w redcedar and red alder canopy, mid canopy vine maple. Understory mostly sword ferns, native blackberry and moss. Soft humus soil and leaf litter, huge stump with salal and shield ferns. 10" coral-like cream-colored mushroom, tall stump with salal and shield ferns. South is sword ferns, salal and shield ferns mix with a few deer ferns.
Sector 455: 11/10/11 Marian: Tall w redcedar and red alder canopy with 1 w hemlock, mid canopy vine maple and smaller w hemlock. Understory mostly sword ferns with native blackberry; patches of salal, FLOV, and shiny Oregon grape. Scattered shield ferns, moss on woody debris.
Sector 456: 11/10/11 Marian: West edge of w redcedar, Pacific ninebark forest then out onto rocky/sandy creek bank. Pacific ninebark, vine maple, sword ferns, NBB and piggyback plants. North Creek (flood zone) 2-4' wide in center area where it splits between 456 and 457. West bank - tall red alder, w redcedar, vine maple, sword and shield ferns, salal, piggyback plants, salmonberry and native blackberry.
Sector 457: 11/10/11 Marian: West bank tall red alder, w redcedar, vine maple, sword and shield ferns, salal, piggyback plants, NBB and salmonberry.
(**No sectors 458-459**)
Sector 460: 11/13/11 Marian: Light w redcedar and red alder canopy, mid-canopy Pacific ninebark 30% salmonberry/shield ferns and sword ferns, 50% skunk cabbage and sedge, 20% piggyback plants; nurse stump. Clear, faster water, 4" deep, 2-3' wide running south in west half of sector. Slower moving water 2" deep moving south in east side of sector.
Sector 461: 11/13/11 Marian: Tall w redcedar canopy, large sword ferns, light salal, scattered shield ferns; native blackberry and moss on ground; GC of cedar tree debris.
Sector 462: 11/13/11 Marian: Tall w redcedar and red alder canopy, mid-canopy vine maple, salal, sword ferns, shield ferns, native blackberry, patches of Oregon grape, moss and cedar debris. Red huckleberries on woody debris; scattered mushrooms and deer ferns.
Sector 463: 11/13/11 Marian: Tall w redcedar canopy, open underneath with mostly cedar debris and moss to creek bank. Then midpoint of creek has rocks and sand, vine maple and Pacific ninebark.
Sector 464: 11/13/11 Marian: Mid-creek to west bank of North Creek with large stump and log in creek. (The creek has more water in it today.)

Sector 465: 11/13/11 Marian: Light tall red alder/w redcedar canopy, mid-canopy vine maple, light 15' salmonberry, shield ferns, sword ferns, scattered skunk cabbage and deer ferns, 2 ivy plants, patches of piggyback patches; open firm mud with 1-2" standing water; birds.
Sector 466: 11/13/11 Marian: Slightly higher ground with tall w redcedar/red alder canopy, vine maple mid-canopy, shield ferns, sword ferns; salal, huckleberry, moss & FLOV on stumps; leaf litter throughout.
Sector 467: 11/13/11 Marian: W redcedar mostly, cedar debris underneath, with undulating mounds. Stumps with salal and red huckleberry, OR grape in NE, thicker layer of humus.
Sector 468: 11/13/11 Marian: Tall w redcedar and Douglas-fir canopy, vine maple mid-canopy, thick salal, Oregon grape, large sword ferns, native blackberry and moss; red huckleberry on a stump.
Sector 469: 11/13/11 Marian: Tall Douglas-fir, vine maple mid-canopy, salal, sword ferns, native blackberry, tall stump with red huckleberry, 20% salmonberry, native blackberry and scattered bracken fern; thick OM, soft but firm.
Sector 470: 11/13/11 Marian: Light tall red alder canopy, tall stump with salal and red huckleberry, 1 vine maple, native blackberry, FLOV, sword, shield and bracken ferns. Then 80% salmonberry, thick OM/leaf litter, LP area wet mud w/some skunk cabbage.
Sector 471: 11/13/11 Marian: Tall open red alder canopy, 50% salmonberry, twin berry, shield ferns, and piggy back plants. Skunk cabbage in 3" standing water in places, patches of RCG in wet areas, FLOV in drier areas; can hear songbirds.
Sector 472: 11/13/11 Marian: Tall open red alder canopy, 50% salmonberry and shield ferns; skunk cabbage in 3" standing water in places. Pacific crab apple and 1 other taller tree (see photo of tree) with licorice ferns. Small patch of black swamp gooseberry, small brown mushrooms on woody debris; can hear nearby songbirds.
Sector 473: 11/13/11 Marian: Tall red alder/w redcedar light open canopy, Pacific crab apple, and same tall tree (type? see photo) w/licorice ferns. Half is skunk cabbage standing water, med to soft mud Other half is salmonberry with shield ferns, FLOV, piggyback plants; can hear song birds.
Sector 474: 11/13/11 Marian: Tall red alder/med w redcedar periphery, central area of sector open canopy, 2 tree snags. Salmonberry, shield ferns, RCG and skunk cabbage; standing water 3-4" deep, med to soft mud.
Sector 475: 11/13/11 Marian: Light tall red alder, salmonberry and spirea mix, small patch of black swamp gooseberry, skunk cabbage, shield ferns, sedge, horsetails, FLOV and RCG.
Sector 476: 11/13/11 Marian: Tall w redcedar/red alder canopy, crab apple mid-canopy, licorice ferns on stump, salmonberry, shield fern, FLOV, horsetails, buttercups, RCG, and soft mud.
Sector 477: 11/13/11 Marian: Open canopy, crab apple mid canopy, twinberry, salmonberry, mossy large woody debris. Skunk cabbage, shield fern, licorice fern, horsetail, piggyback plant, buttercup; wet mud.
Sector 478: 11/13/11 Marian: Continues similar to 477 with light red alder canopy, Pacific crab apple, salmonberry, skunk cabbage, shield ferns, horsetail, buttercups and wet mud. Then into w redcedar area, scattered smaller salmonberry; GC mostly cedar tree debris and drier.
Sector 479: 11/15/11 Marian: W redcedar, tall Douglas-fir and tall red alder canopy. Higher elevation center of east side (Doug-fir), salal and shield ferns. 4' wide trench of south flowing water 2-4" deep and nearby LP 1-2" deep standing water. Shield ferns, skunk cabbage, moss and soft mud in wet lower areas. Sword ferns in higher areas, SW area mostly just moss and tree debris GC under trees. Large woody debris in SE area with thick moss. 2 large stumps with salal, huckleberry and shield fern. Shrub with maple-like leaves (probably stink currant) in standing water.
Sector 480: 11/15/11 Marian: Tall w redcedar and tall red alder canopy, 40% vine maple mid-canopy, 70% large sword ferns, Salmonberry on edge of north end, moss, leaf litter, ground very firm 2-3' higher than the water with irregular mounds (tree roots). Pulled 2 ivy plants. Flowing water from 479 cuts in here with nearby milk jug, 2 beer cans and 1 ale bottle.
Sector 481: 11/15/11 Marian: Nearby song birds, tall red alder, Douglas-fir and w redcedar trees. Large stumps with salal and red huckleberry. Mostly open under trees with logs and tree debris to south. Central to north mostly vine maple mid-canopy, 80% sword ferns, and native blackberry with 10% red huckleberry, 10% salmonberry, and shield ferns.
Sector 482: 11/15/11 Marian: Tall red alder/w red cedar canopy, mid-canopy vine maple, 30% sword ferns, 30% OR grape, native blackberry, salmonberry, moss and scattered shield ferns. 30% bare GC with tree

debris; large woody debris; 10' tall stump with salal, vine maple, moss sword ferns, shield ferns, OR grape, FLOV, and 1 w hemlock growing out of it; 1 beer can.
Sector 483: 11/15/11 Marian: North Creek runs through middle of north half and then goes west around a clump of trees. Tall red alder/w redcedar canopy, mid-canopy vine maple, and sword ferns. Open mud with deep leaf litter. Rocky and sandy creek with ripples alternating with pools. Logs along bank curve around cedars and red alders; woody debris with moss, stump with red huckleberry.
Sector 484: 11/15/11 Marian: West bank of North Creek tall Douglas-fir and red alder canopy.
Mid-canopy thick vine maple; sword ferns 50%, OR grape 40%, 30% salmonberry, GC 20% piggy back plant and scattered shield ferns along the bank. Large stump to north with huckleberry, salal, shield ferns, sword ferns and licorice ferns. 1/28/12: Small deer prints near water on west bank.
Sector 485: 11/15/11 Marian: North Creek west bank, large cedar trees cut and left across the creek and into east side. 2 very large stumps and woodland trail from the west forest to the west bank; rocky and sandy west bank then tall w redcedar/red alder canopy. Mid-canopy Pacific ninebark and vine maple, sword ferns, shield ferns and piggyback plants, scattered salmonberry.
Sector 486: 11/15/11 Marian: North creek 8-10' wide here with trees down and over it. Rustic small log house or shelter (tall enough to stand up in). Tall red alder/w redcedar trees, mid-canopy of vine maple; large sword ferns, scattered shield ferns, native blackberries, red huckleberry and salal on stump, moss on wood and ground.
Sector 487: 11/15/11 Marian: Tall red alder, Douglas-fir and w redcedar canopy; mid-canopy of vine maple. Sword ferns, native blackberry, scattered shield ferns and salmonberry, moss-covered woody debris; soft, not wet, humus soil with leaf litter. Can hear song birds.
Sector 488: 11/15/11 Marian: Light tall w redcedar, Douglas-fir and red alder canopy; mid-canopy vine maple, with sword ferns and native blackberry, then opens into salmonberry, shield ferns and sword ferns. Tall stump with salal & large red huckleberry and piggyback plants surround it.
Sector 489: 11/15/11 Marian: Open canopy with 80% salmonberry, 40% large sword ferns, and piggyback plants; leaf litter and some woody debris east side with moss.
Sector 490: 11/15/11 Marian: 2' wide trench from north with moving water (can hear it), is 8-10' wide in SW area. W hemlock mid-east border, downed cedars in SE area, 1-3" standing water eastside. Skunk cabbage in trench with shield ferns, piggyback plants, and large vine maple. Salmonberry, shield ferns and w redcedar in north half. Area is a LP with soft mushy mud.
Sector 491: 11/19/11 Marian: Begins at west edge of cedar camp (sleeping bags, garbage area). Central pond takes up most of this sector (80%), water flows south into north end of pond and out of SE edge of pond; tall w redcedar canopy, 2 broken fishing poles in pond. Spirea, salmonberry and shield ferns along water margin; shield and sword ferns on HPs with NBB; tree logs with moss and red huckleberry.
Sector 492: 11/19/11 Marian: High point w red cedar north area and beyond then central pond continues. Mostly open with cedar tree debris GC under north cedars with scattered native blackberry and sword ferns. North pond edge has large downed tree, shield ferns and sword ferns with salmonberry.
South of pond is Douglas-fir and w redcedar canopy with salmonberry, sword ferns. Large stump with salal and red huckleberry.

Sector 493: 11/19/11 Marian: North area is Douglas-fir canopy, vine maple mid-canopy. Thick salal and sword ferns cover ground; huckleberry on woody debris. Central area is pond's west edge, small clump 8' tall beaked hazelnut trees. Central to south is w redcedar and Douglas-fir mix with sword ferns, salal, native blackberry, and shield fern mix. Small patch of OR grape with 1 rhododendron and group of small 3' tall cedar seedlings. Ivy was scattered around (pulled what I saw of it).
Sector 494: 11/19/11 Marian: Tall western redcedar, red alder, Douglas-fir mix but open in center. Mid canopy of vine maple and young cedars (1-3" wide diameter and smaller). Large sword ferns; downed large trees from west (creek) into here, open ground with native blackberries, moss in places near trees.
Sector 495: 11/19/11 Marian: Open canopy with tall red alders on east edge, mid canopy of vine maple. Large sword ferns mixed with salmonberry and shield ferns, patches of piggy back plants and native blackberry. Licorice ferns on old log, downed large trees from across North Creek. 3' wide trench of south flowing water, 3-4" deep with soft sticky mud that flows under the logs to the creek (it snowed last night with snow on branches)

Sector 496: 11/19/11 Marian: North Creek runs through middle (see drawing), rocks and ripples in north half, deeper pool in center with downed trees across creek here; log with mushrooms. East bank has downed trees over salmonberry and an open canopy. West bank has tall red alder and w redcedar.
Sector 497: 11/19/11 Marian: Just west of North Creek; tall w redcedar and red alder, mid canopy of vine maple in center, mostly 50% large sword ferns and 50% open spaces on slope.
Sector 498: 11/19/11 Marian: West bank of North Creek, tall w redcedar canopy, tall snag. Salmonberry, sword ferns, shield ferns, piggy back plants and red huckleberries; mostly sword ferns under west trees. Rocky bar and 3' soil width west bank to north.
Sector 499: 11/19/11 Marian: West edge of North Creek, west bank 3-4' high soil. Tall w hemlock, w redcedar, red alder canopy. Shield ferns, sword ferns, vine maple and salmonberry hang over creek from both banks. Creek bottom – 2-4" river rocks and sandy soil. THE BEST W. HEMLOCK OLD GROWTH NURSE STUMP with salal growing all over the decaying log (see drawing and photos).
Sector 500: 11/19/11 Marian: Tall red alder, Sitka spruce & w hemlock; mid canopy of vine maple and younger cedar. Another good nurse stump with w hemlock in north half; bird house on spruce. Salmonberry and shield ferns; sword ferns scattered, piggyback plants throughout, scattered skunk cabbage in wet areas. Water flows 2" deep from underground with a trough just north, firm mud under it.
Sector 501: 11/19/11 Marian: Tall open canopy of Sitka spruce, w redcedar, red alder, and Douglas-fir. 40% salmonberry, scattered shield and sword ferns, NBB 80% groundcover; 2-3' higher elevation, huckleberries and deer fern. Licorice fern on red alder, w redcedar open in NE area, humus soil, leaf litter.
Sector 502: 11/19/11 Marian: Hear owl in east distance. Tall w red cedar, Douglas-fir & red alder canopy, mid canopy vine maple. Salmonberry, sword and shield ferns in north half with standing water trench. Salal, sword ferns and native blackberry in south half. Scattered deer ferns, thick moss on woody debris.
Sector 503: 11/19/11 Marian: Tall red alder, w redcedar canopy in north half with salmonberry.
Open w redcedar canopy, ground mostly bare with cedar tree debris and moss; shield ferns, sword ferns and salal on periphery of cedar grove. Low point 2-3" standing water with firm mud in middle north half.
Sector 504: 11/19/11 Marian: Tall red alder and w redcedar canopy, mid canopy younger w redcedars (7" diameter), and 1 beaked hazelnut tree. Salmonberry, large sword ferns, central to south area. Soft but firm soil humus and leaf litter: woody debris with moss. Standing water with skunk cabbage in places.
Sector 505: 12/1/11 Marian: Med. tall willow (30-40'), and light red alder canopy, vine maple mid canopy. 1-2" standing water in lower areas, low pt trough with 2-3" slow-flowing water. Moss, shield ferns, sword ferns, licorice ferns, and lichen on wood debris and trees. 75% salmonberry, 20% spirea, salal on top of stumps; song birds in trees and shrubs.
Sector 506: 12/1/11 Marian: (Similar to 505) Many nearby song birds. Light red alder and willow med tall canopy; 1 clump young cedars and vine maple mid canopy; 10% spirea, 70% salmonberry, scattered large sword ferns; GC of buttercups, piggyback plants and open mud in places with leaf litter. Med. woody debris covered with moss, licorice ferns, lichen and red huckleberries.
Sector 507: 12/1/11 Marian: Lt. red alder canopy; large w hemlock fell in from the south with salal along the base. 70% salmonberry, scattered sword ferns, patches of piggyback plants; buttercups and mud with standing water; thick moss and some lichen on woody debris, FLOV in places. 10' wide LP trench with 2" south flowing water and mud. Can hear water flowing under ground and debris through a small hole (see photo). Tangle of Pacific crab apple west center just before ground starts sloping west where soil is damp but no surface water.
Sector 508: 12/1/11 Marian: Red alder canopy, slight slope to SW, downed trees and a few broken tree snags. 80% salmonberry, scattered large sword ferns, FLOV in places. Native blackberry, moss and piggyback plants on upturned tree roots. No mud, soil firm with leaf litter.
Sector 509: 12/1/11 Marian: Tall red alder canopy and 1 large w hemlock, 1 dead tall Douglas-fir tree snag with holes. Mid canopy vine maple, huckleberry on woody debris, large sword ferns, 50% salmonberry; under w hemlock are piles of woody debris, devils club (dormant now). Thick native blackberry and salal on stumps and ground, with a few FLOV.
Sector 510: 12/1/11 Marian: Tall w redcedar and red alder canopy and 1 dead cedar tree snag.
Mid canopy of younger w hemlock forest growing out of a stump and vine maple; thick salal and shield ferns growing out of nearby stump roots. Large sword ferns, leaf litter, thick moss on woody debris and piggyback plants cover most of ground here, especially under cedar canopy.

Sector 511: 12/1/11 Marian: East bank of North Creek and the creek, water is very clear (and creek is fuller today with ripples N/S and smoother in central area), rocky and sandy west bank edge. A trench runs eastward into the NW corner of this sector with little water in it today. Tall and short w redcedar, vine maple and Pacific ninebark mid canopy. Devils club mixed with salmonberry, scattered sword ferns; piggyback plant covers ground; woody debris covered with moss.
Sector 512: 12/1/11 Marian: West bank then west into neighboring forest; tall w redcedar, red alder & w hemlock canopy; mid canopy of young w redcedars and vine maple. Understory of sword ferns and salal with some deer fern, shield fern, and salmonberry. Piggyback plants near shore edge and Pacific ninebark.
Sector 513: 12/4/11 Marian: Light, mid-height red alder canopy; standing water, mud and buttercups. Flowing water from north buttercup meadow, 2-4" deep, 4" wide. 70% salmonberry, 5% spirea patch. Old woody log debris with moss, a few sword ferns, shield ferns and buttercups on them. Native blackberry scattered throughout, red huckleberry on wood.
Sector 514: 12/4/11 Marian: Light, mid-height red alder canopy, 50-60% salmonberry, scattered sword ferns and skunk cabbage, 1 patch spirea (golden fall color), 30% shield ferns, 10% RCG; GC mostly buttercups and piggyback plant mixed with some smaller bunch grasses; native blackberry mixed in shrubs and a few Himalayan blackberry in north half. 1-4" standing and S-SW slow flowing water throughout with shallow 2" mud.
Sector 515: 12/4/11 Marian: Tall Douglas-fir to north, and smaller redcedar with salal. Lt tall red alder and (poplar?) canopy (poplar leaves on the ground). Tangle of HBB, NBB, evergreen blackberry, RCG and salmonberry mix. (A few big leaf maple leaves on ground but don't see the tree.) Scattered deciduous trees 8-10'tall (Cascara? – 2 gold fall leaves). GC of native blackberry & buttercup mix, scattered sword ferns; soil moist but very firm. 1 BEAUTIFUL mid canopy tree with reddish-orange leaves and small red fruits (cotoneaster? see PHOTO).
Sector 516: 12/4/11 Marian: Tall Douglas-fir, red alder, w redcedar and w hemlock canopy. Mid canopy of vine maple, young w redcedar and w hemlock (4" diameter, 15' tall). Salal, sword fern & native blackberry GC, 30% salmonberry, invaded with HBB. Soil is very firm and moist, not wet, 2 X 3' rock (erratic? Or left behind by North Creek habitat workers?), bird house in tree. FLOV in places, scattered shield ferns, most on woody debris and ground; beautiful undulating ground with sword ferns and salal.
Sector 517: 12/4/11 Marian: Tall red alder and Douglas-fir canopy, mid canopy of vine maple and smaller w hemlock. 60% salmonberry, salal and shield ferns, 1 deer fern, and FLOV. Thick amorphous woody debris from logs with 2 large red huckleberries. Leaf litter and soft humus soil (moist not wet). Nearby song birds to east, interesting white fungus on dead brush. Higher mound to south then drops 3-4' to south beyond this section. SW half has piggyback plants and native blackberry GC. Sandy/rocky (North creek overflow area) in NW corner edged with buttercups and piggyback plants. It has seen some recent water action as plants and leaves knocked over
Sector 518: 12/4/11 Marian: Tall red alder canopy, mid canopy vine maple and Pacific ninebark. 40% salmonberry, 40% sword ferns, scattered shield ferns, GC of piggyback plants. Gravel/rock overflow creek bed in north (recent water action) connects to lagoon area.
Sector 519: 12/4/11 Marian: Lagoon area with "tide pools" and large rocks east side, connects to overflow sandy/rocky area with patches of buttercups. North Creek west half of sector, pooling to north, central ripples, then slow flow to south. Tall red alder canopy. Salmonberry and Pacific ninebark grow on log over creek with a very large red huckleberry and salal; huge stump with sword ferns. Large rocks on west side of North Creek. (Area is just SW of the "Cedar Cathedral").
Sector 520: 12/4/11 Marian: West creek edge with large rocks and a sandy shore, then goes into a tall w redcedar, red alder, and Douglas-fir forest. Sword ferns, salmonberry; log overhang begins from this side Nearby 2 small birds are hopping on the ground.