

Best MANAGEMENT PRACTICES



Natural Areas

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5.1 Definition of Resource



The Seattle Park system contains more than 4200 acres of natural area or greenspaces. Natural areas are characterized as being largely undeveloped landscapes, thickly vegetated with native plant communities, and used primarily for passive recreation. Natural areas are considered to have limited or minimal human disturbance and provide habitat for plants, mammals, reptiles, birds, insects, amphibians and sometimes fish in an urban setting. In contrast, developed parks have formal landscapes and include active recreation for sports.

There are many diverse types of “natural area”. For example, more than 8 miles of urban creeks and wetlands are contained in over 760 acres of park-owned watershed. The park system has more than 21 miles of lake and saltwater shoreline. Seward Park and Schmitz Preserve together protect more than 180 acres of old-growth forest. Other park natural area sites contain evergreen and deciduous forest, grasslands, beaches, and sand dune areas. Natural areas can be found within developed parks, special gardens, and environmental learning centers. Parks identified as natural areas include greenbelts, beaches, ridges, viewpoints, preserves, and ravines.

Natural areas constitute a rich tapestry of natural environments and ecosystems that only recently have begun to receive the management attention they deserve. Thoughtful management of park natural areas is essential to ensuring the quality of life enjoyed by Seattle residents and to sustain biodiversity in the urban environment.

5.2 Goal Statement

Our goal is to develop a sustainable resource that protects, optimizes, enhances, and increases our natural environments. These environments will provide opportunities for observing and enjoying urban wildlife, engaging in environmental education, and participating in restoration activities.

Our maintenance programs will incorporate staff expertise and adaptive management strategies based on the best available science of the Pacific Northwest ecosystem, wildlife, and vegetation management. We will create Vegetation Management Plans (VMPs) for individual forested areas and parks, in order to standardize our planning, design, and maintenance activities. We will strive to enhance public safety, optimize tree canopy, improve our trail system and ecosystem health, and manage green infrastructure assets effectively in all natural areas.

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5.3 Definitions

Class "A" Noxious Weeds: Class A noxious weeds are non-native species with a limited distribution in Washington State. Preventing new infestations and eradicating existing infestations is a high priority in managing these weeds.

Ecological Weeds: any weed such as English ivy or Himalayan blackberry that threatens the balance within an ecosystem.

Environmentally Critical Areas (ECA): are areas determined by the City's Department of Construction and Land Use (DCLU) to be particularly environmentally critical. These areas include steep slopes, wetlands, and other critical areas.

Forests: these natural areas are undeveloped landscapes that do not fall into any of the classifications above. Forests contain tall and predominantly woody vegetation.

Marine Reserve: A marine reserve is any stretch of beach or water that is protected, preventing over harvesting of shellfish and damage to local marine habitat.

Meadows: Non-forested areas having 25% or less tree cover. Meadows include the following sub-classifications: sparsely vegetated, grassland forbs, shrub savannah, shrubland, and tree savannah.



Natural Areas: Any City-owned property with critical environmental resources. Natural areas shelter native ecosystems and wildlife habitat. These sensitive areas and habitats include nearly all classifications in the City's Regulations for Environmentally Critical Areas or ECAs. Natural areas fall into a number of categories, which include steep slopes and slide prone areas. For this BMP manual, these resource assets are divided into three major groups:

- Forests
- Meadows
- Wetlands, riparian corridors, shorelines and aquatic habitats

Riparian Corridors: wetland and terrestrial areas within the influence area of the adjacent stream. Technically they are defined as:

All areas within 100 feet measured horizontally from the top of the bank, or if that cannot be determined, from the ordinary high water mark of the watercourse and water body, or from a 100-year floodplain as mapped by FEMA, as regulated by the Seattle Floodplain Development ordinance, whichever is greater.

Shoreline and Aquatic Habitats: areas affected by the hydrology of a water body (pond, lake, sound, etc.). The area 200 feet landward of a waterbody is the shoreline zone. Shorelines include several sub classifications:

- Estuarine – the zone where fresh and salt water mix, brackish water between 0.5 and 30 parts per thousand (ppt) salinity

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- Lacustrine – fresh water lakes and ponds
- Marine – salt water of greater than 30 ppt salinity
- Palustrine – includes open water and emergent habitats, including freshwater wetlands (see "wetlands" definition above).
- Riverine – same as riparian corridor (see "riparian corridors" above)

Social Trail: A trail within any natural area formed by casual use rather than by design.

Vegetation Management Plan (VMP): A plan for the long-term restoration, renovation and care of the vegetation within the boundaries of a particular park.

Volunteer Steward/Docent: A citizen volunteer who donates their time to work on specific activities for public education or maintenance programs. Examples include Wetland Steward, Beach Naturalist, and Adopt-an-Area.

Wetlands: those areas inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

5.4 Policies and Guidelines

ANSI A300-1995 for Tree Care Operations-Tree, Shrub and Other Woody Plant Maintenance-Standards Practices. 1995. American National Standards Institute.

AQC - is an environmentally advanced copper and quat wood preservative system that is arsenic-free and chromium-free. It provides long-term protection for wood structures from rot and decay.

City of Seattle Greenbelt Ordinance No. 111568. 9.

City of Seattle Regulations for Environmentally Critical Areas. 1992, amended 1994, 2004.

Construction Best Management Practices Manual. City of Seattle.

Council Resolution 28653 Greenspaces Policy 1993.

Director's Rule 3-94. 1994. Seattle Department of Planning and Development.

The Mayor's Environmental Action Agenda (EAA): The EAA presents the City's environmental goals and creates a framework for integrated City departmental environmental action. It addresses conservation through mandates for increased energy and water efficiency of City buildings and facilities. The City has a continuing commitment to the Mayor's Environmental Action agenda

Public Involvement Policy for Proposals to Acquire Property, Initiate Funded Capital Projects, or Make Changes to a Park or Facility. 1999. Seattle Department of Parks and Recreation.

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Seattle Department of Parks and Recreation Tree Management, Maintenance, Pruning And/Or Removal Policy, Number 060-P 5.6.1, June 1, 2001
<http://parksweb/refs/policy/index.htm>

Sustainable Infrastructure Initiative (SII): The SII is a component of the Mayor's Environmental Action Agenda. It encourages application of innovative approaches that provide basic services in ways that are resource-efficient and environmentally responsible through a variety of incentive programs. Sustainable design encompasses the following broad topics:

- Efficient management of energy and water resources
- Management of material resources and waste
- Restoration and protection of environmental quality
- Enhancement and protection of health and indoor environmental quality
- Reinforcement of natural systems
- Analysis of the life cycle costs and benefits of materials and methods

Trails Classification Hierarchy: This document describes the types of trails, types of materials used, typical locations, and construction standards
<http://www.cityofseattle.net/parks/projects/standards/trails.asp>

Tree-Pruning Guidelines. 1995. International Society of Arboriculture.

Urban Wildlife and Habitat Management Plan. 1994. Seattle Department of Parks and Recreation.

SMC 18.12.030 Definitions -- Rules of construction (leash length): Domestic pets can potentially cause more damage than people. Dogs and cats can destroy vegetation and kill or maim wildlife. Pets in parks must be on an 8-foot leash except for designated off-leash areas or other permitted activities.

Viewpoint Policy (from Tree Policy) Number 060-P 5.6.1, 4.8: Views from designated public view parks and viewpoints will be preserved through maintenance and management of parks vegetation in front of or below the viewpoint.
<http://www.seattle.gov/parks/parkspaces/Viewpoints/VMP.htm>

City of Seattle Park Code Section 18.12.070, Subchapter II: protects resource assets from vandalism, graffiti, or removal from parks. All living and non-living resources found in natural areas are the property of the City of Seattle. Cutting trees, collecting or removing plant material, branches or wood, shells or rocks, harassing wildlife and gathering firewood are all prohibited.

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5.5 Planning and Design

All persons and entities planning, designing, or overseeing construction and installation projects within natural areas will consult with staff directly responsible for maintenance and management of these areas prior to and during every phase of the process. Such projects include but are not limited to: Forest restoration, Invasive plant removal, Habitat rehabilitation, Plant installations, Trails work and Interpretive/Educational Program fieldwork projects of any kind.

Natural areas planning and design BMPs will provide guidance for the maintenance, enhancement and expansion of existing plant communities, wildlife features and structural assets within designated areas. Habitat needs of native vegetation and wildlife will be considered when developing long-term maintenance, restoration or other planning documents. As such, landscape design and vegetation management planning shall consider natural ecological cycles of succession and disturbance whenever and wherever possible.

Design and planning will accommodate human uses such as recreation, accessibility, movement, and stewardship. When resources are available, it is important to add environmental education through development of Interpretive program areas. Educated park users are much more likely to preserve and protect a site.

Planning and design BMPs will be incorporated into crew projects and renovations as well as capital projects. Planning and design is divided into a number of steps and include, but are not limited to the following topics. Use this checklist to plan project work in natural areas.

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Planning and Development Checklist for Natural Areas	
1	Refer to existing Vegetation Management Plans to develop design and management goals
2	Set goals with SPR staff directly responsible for the site's maintenance and management and community stakeholders/constituencies
3	Inventory the site's natural resources and human-use patterns
4	Analyze where site resources are not achieving intended goals
5	Define a scope of planning work based the Vegetation Management Plans and staff/public constituency input
6	Develop recommended strategies for correcting deficiencies. Set priorities according to both natural resource, pest management and human-use issues
7	Present these recommendations to the general public for comment. Modify them as necessary.

Critical Design Considerations

The following design considerations preserve the aesthetic and environmental value of natural areas.

1. Vegetation Management

SPR has over 50 completed Vegetation Management Plans (VMPs), written to guide the growth, development, and maintenance of specific parks, sites within parks and selected open spaces. These plans provide references for historical information, and outline the SPR design and resource management goals and objectives for each particular. The planning associated with each VMP includes a public involvement process. Each process brings together stakeholder groups representing the diversity of interests associated with each park space. The outcome of each process is intended to direct the actions of the governing bodies (City of Seattle Departments, King County, etc...) and organizations and individuals (Community Stewards, Groups, NGOs) that manage park sites. VMPs are available through the Urban Forestry Program. A complete plan includes the following:

- ✚ Site Inventory and Assessment including maps which illustrate existing topography, vegetation, trails and other pertinent natural and recreational resources or constructed features.
- ✚ Proposed Tree Work Inventory (*pruning or removal*) having been conducted by hazard analysis or in the specific case of City Designated, SEPA exempted viewpoints, through view interruption analysis as well as hazard

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analysis. Only in the case of such designated SEPA exempted viewpoints shall view interruption be considered as reason for removing trees designated as significant by SMC within natural areas.

- ✚ Plant Community Protection and Enhancement Strategies with plant species, size and location and any necessary erosion control/slope stabilization methods.
- ✚ Public Involvement Plan, if applicable, in compliance with SPR Public Involvement Policies and Procedures.
- ✚ Maintenance plan that includes necessary tasks, frequency, and resources. Such tasks shall include replacement and infill planting, seasonal irrigation needs, integrated pest management including invasive plant control and periodic weeding, annual mulching, and occasional pruning.

2. Interpretative Program Areas

Special attention needs to be paid to maintaining the integrity of Interpretive Program Areas (IPAs). These areas are historically used for naturalist programs explaining the site's notable and special plants, animals, birds, reptiles, amphibians, geology, ecology, and/or natural history. Work with naturalists to develop goals, objectives to develop, enhance and preserve a high quality of habitat in these specific sites. A list of interpretive sites should be available for each natural area or park with an explanation of appropriate maintenance procedures and tasks.

3. Boundary Delineation and Inspection

- A registered surveyor from SPR should locate City-owned boundaries. Indistinct boundaries should be signed by the surveyor with labeled, white fiberglass boundary stakes or by other visible and durable means.
- City property boundaries should be inspected annually. A geographic positioning system (GPS) attached to a data logger can be use to inspect boundaries. is. The information can be used for typical boundary issues such as tree liabilities or non-park uses.
- Sensitive area boundaries such as riparian corridors and wetlands should be clearly located on City maps. This requirement goes beyond that of the City Critical Areas Inventory, which does not identify all "sensitive areas."

4. Capital Improvement Signage

Public information signage is installed prior to and throughout the duration of a capital project. This sign is specified as a 2-by-3-foot temporary sign with customized text to inform park users of specific aspects of a project including contact information for the project manager.

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5. Plant Selection

Plant selection for restoration projects should reflect the continuing and climax forest successional stage at a site. Species will typically be native plants appropriate to the site. Planting plans will be designed to protect and enhance existing wildlife habitat characteristics, as well as, where applicable, provide safe and sensible access to or movement through a site. When selecting vegetation for a specific site, consider site ecology, including soil composition, moisture, available light, exposure, topography and in the case of a hill, the aspect and degree of slope. Refer to applicable BMPs for Trails, Viewpoints, and VMPs as well as the specific maintenance regime and potential for disturbance (human and otherwise) at a site for the most appropriate plant community selection. General plant palettes have been provided by Washington State Department of Natural Resources. These palettes are based on the overall forest community type appropriate for the Puget trough. Access these plant palettes at the following site:

<http://www.dnr.wa.gov/nhp/refdesk/communities/>

6. Overhead and Underground Utility Infrastructure

Select or preserve trees and shrubs that at their mature sizes will allow required clearances for overhead utilities such as electric and telephone wires. If existing trees or shrubs require pruning to obtain required clearance, contact the Senior Urban Forester or Forestry Crew Chief.

Contact **"Dial-Before-You-Dig" and Parks In-House Locate** at least two weeks prior to the beginning of a project to locate any underground utilities. to ensure they are not damaged during construction. Confirm that utilities have been located through a visual inspection of site.

7. Stormwater Management and Drainage Systems

Each site has unique hydrological characteristics. Preserving a site's natural hydrology protects the integrity of its other resources. Staff directly responsible for maintenance and management of a site should be aware of all drainage structures within the site. External sources of stormwater may be mitigated by detention before they enter the natural system. Site features that concentrate flow such as trails and roads should be built to re-disperse flows, if possible.

A project may include the construction of check dams, culverts, bioswales and sediment ponds to improve water quality or provide flow control. Consult with the Parks Engineer, Parks Property Management, and/or SPU before proceeding with a construction or maintenance involving modification of or installation of drainage structures and for proper procedures for private property drainage onto park sites.

Site improvements should work with the existing natural drainage patterns and maintain moisture levels that sustain plant growth.

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8. Encroachments and Illegal Drainage onto Parks property

Encroachments onto Parks or other public land from adjacent property owners from outside sources can cause many problems, including erosion and invasive plant establishment. Examples of encroachments are landscape plantings or drainage.

If an encroachment is observed or suspected, staff should determine as best they can determine, an address of the origin of the use or drainage. Staff should also research the property ownership to determine if the land actually belongs to Parks. Staff should then notify the Parks Property Management and Acquisitions Unit, as outlined below.

Property Management will coordinate evaluation of the problem and approach related removal and restoration actions as workload and policy priorities allow. Please do not approach or attempt to negotiate with private property owners yourself. If resulting park impact seems urgent, please include all information in your report to Property Management.

DO: File an Incident Report with Parks Property Management and Acquisitions. Call 233-7935. Your report will be forwarded to a Property Agent for review and action, if needed.

Special note: Parks personnel should not attempt to correct an erosion problem resulting from outside drainage.

DO NOT: Perform any work related to the drainpipe or storm water coming from it:

- Stop! Do not do anything! File a report with Parks Property Management (see above).
- Do not alter the existing drainage system.
- Do not redirect storm water flow either at the drainpipe's terminus or within the park.
- Do not install any structure designed to alter the flow of storm water – such as check dams or water bars.

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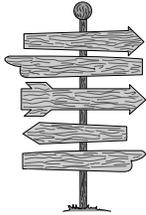
Sources for Resource Inventory Information		
Site Boundaries	The best tool for approximating boundary locations is our Geographic Information System (GIS). Aerial photos can be superimposed on property boundary files to locate right-of-way or park limits.	
Site Description & History	Several sources can give you this data: SPR or DON Community Planning documents and the Special Collections Library at the UW are good places to start.	
Parks Department	Start with SPR's Property Management and Real Estate Section. Try to find site plan or site files at the Facilities Maintenance and Development Division.	206-684-7031
Department of Transportation	For street right-of-way projects and for general property maps, visit the City's engineering records vault.	206-684-5132
City Archives	City Archives contain much historical information, including old aerial photos and newspaper articles. Be sure to look for the Sherwood documents for park sites. Copies are also available in the Seattle Public Library's Northwest Collection.	206-684-8353
Staff historians	City staff can give you detailed information on site history. Get in touch with a Crew Chief or a Senior Gardener who maintains the site.	
Community historians	Seek out long-time residents through your community council, Neighborhood Service Center, or local historical societies. They can probably give you some unique history.	
Public Utilities ' GIS	The GIS system maps critical areas (e.g., steep slopes).	
Vegetation management plans	Link	
Trails	Existing trail maps (link)	
Interpretive Program Areas	Existing lists	

9. Signage

Standards currently used for natural areas:

1. **Open Space Rainbow Sign.** This is a variation on the standard SPR rainbow sign that signifies the main access point for an open space site.

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2. **CIP Project Sign.** This is an approximately 2-by-3-foot temporary sign with customized text to inform park users of specific aspects of a project.
3. **Kiosk.** This is a large-format glazed bulletin board in a shelter for posting current information and seasonal interest items for park users. In each location, determine a responsible person for information management.
4. **Trail Directional Sign.** This is a 1-by-1-foot post-mounted plaque that directs trail users to various destinations within a park.
5. **Interpretive Environmental Education Sign.** These are customized signs in various formats that provide specific information on natural resource topics. They are typically porcelain enamel, etched stainless steel, coated, or otherwise constructed to resist vandalism.
6. **Regulatory Sign.** These include but are not limited to Parks Code information such as dogs on-leash, no bicycles, and no dumping signs. These should be combined with other permanent signs where possible to minimize sign clutter.

5.6 General Maintenance Practices

Maintenance activity in natural areas should sustain or increase plant community value and enhance habitat features whenever and wherever possible. The goal of routine maintenance in natural areas is to conserve and enhance water, soil, and wildlife resources in a given habitat and balance these needs with recreational or educational activities.

Staff will consider the impacts of maintenance to natural cycles of succession, disturbance, and wildlife habitat needs. For example, dead or declining trees in a natural area may create opportunities for standing snags, nurse logs and brush piles. Aquatic features like pools or in stream woody debris are maintained even if doing so decreases drainage. Every effort should be taken to retain or increase available enhancement resources on a given site.

Maintenance strategies are specific to a feature or a function and include educational programming, social, and environmental objectives. Specific maintenance features include but are not limited to: (1) viewpoints, (2) wetlands (3) trails and (4) Interpretive Program Areas.

5.6.1 Routine Maintenance Activities

1. Inspection

Natural and sensitive areas in urban environments require routine monitoring of the following:



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- Public use, such as high impact, vandalism, graffiti, or illegal activity
- Public safety, such as hazard trees, police and fire access
- Natural processes such as slides, erosion, and drainage
- Silt or debris loading and drainage of wetlands, ponds, and streams
- Presence of invasive plants
- Water quality and upstream impacts
- Dog or other pet impacts to turf, trails and wetlands

2. Interpretive Program Areas

Special attention needs to be paid to maintaining the integrity of Interpretive Program Areas (IPAs). These areas are historically used for naturalist programs explaining the site's notable and special plants, animals, birds, reptiles and amphibians, geology, ecology and natural history. Staff will work with naturalists to develop goals, objectives, and specific maintenance tasks lists to enhance and preserve a high quality of habitat in these specific sites. A list of interpretive sites should be developed for each natural area or park with an explanation of appropriate maintenance procedures and tasks. Examples of these areas are the Wolf Tree Interpretive Trail and Spider Meadow in Discovery Park

3. Viewpoints

Seattle Parks maintains designated viewpoints throughout the city. The goal for managing vegetation at viewpoints is to convert view-blocking vegetation to lower growing species that will not require long-term pruning, in conjunction with goals for wildlife habitat, aesthetics, and site engineering and erosion control. Seattle Parks does not maintain private views (Refer to SPR Tree Policy, **Policies and Guidelines**, page 7-4).

4. Stormwater Management Activities

Whenever work is undertaken, consideration should be given to reducing runoff and reducing soil particles/contaminants from leaving a site in order to protect water quality and aquatic habitat. The most cost effective way to control erosion and sedimentation is to use good housekeeping practices. Limit exposing soils in maintenance or project work. Identify the drains and drainages in a work site; isolate, cover, and protect them if needed. Soil particles or other pollutants should be kept from entering water bodies or becoming air-borne. Examples of work where stormwater management is critical are pruning projects, crew projects, irrigation, clearing and grading, ditch excavation, excavation, and planting. Depending on the activity, some or all of the following BMPs apply:

- Protect and minimize disturbed areas

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- Use low impact, least destructive strategies, to accomplish the work task
- Runoff from equipment and tool cleanup is not allowed to enter into storm sewer or surface water systems. Consider runoff potential from debris disposal or staging areas
- Have a spill prevention and erosion control plan

5. Parks Drainage Infrastructure

Existing drainage systems should be maintained according to the preventive maintenance schedule and specifications. SPR Operations crews are responsible for routinely cleaning catch basins, culverts, and other drainage structures.

Drainage features should be inspected as necessary or at least annually in (October or early November, if possible, or at the latest, November or early December to ensure proper function throughout the rainy season. Leaves and other organic debris, garbage, and excess sediment should be removed to allow unrestricted flow and optimal storage volume. This organic debris should be properly disposed of. If removed from roadway drains, it must be taken to the landfill, but if from stream drains or other drains, this material may be safely used in landscapes or composted.

6. Signage

Staff directly responsible for maintenance and management of a site are responsible for vegetation management adjacent to signage. All signs should be kept clearly visible to the intended audience. Parks facilities maintenance staff is responsible for maintenance and replacement of signs. Signs should be cleaned of algae and dirt at least once per year

7. Waste Management

Natural areas are subject to litter and dumping activity. Park visitors are less likely to or dump or litter if a site is clean and appears well maintained.

Maintenance activities may discourage this activity through these routine tasks:

- Weekly to semi-monthly inspection of trailheads and street ends
- Quick response clean-up when incidents are reported
- Inspection of dumped materials to identify the perpetrator
- Involvement of Hazmat specialists when unknown chemicals are detected
- Completing Incident Reports in all cases of illegal dumping
- Prompt removal of encampments

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8. Homeless Encampments

- Areas of known homeless encampments should be frequently inspected, and the debris removed to minimize the potential for negative habitat and vegetation impacts, biohazards, wildfires, and public safety.
- Obvious social trails to encampment areas can be mitigated in two ways: 1) Eliminating or blocking trails with hawthorn trees, roses or other thorny brush, placement of large logs 5-10 feet long on the trail but extending wider than the trail and 2) Creating or rerouting legitimate public access trails near encampments areas. This latter method reduces the hidden aspect of encampments and encourages vacation of the area by campers.
- Encampment sites should be restored to forest or pre-encampment condition, if feasible. Consult with the Senior Urban Forester or review existing VMPs for information on vegetation characteristics of a site.
- Seattle Police Department can assist in the eviction of homeless encampments. Contact your local precinct for more information.

5.6.2 Maintenance Resources

- The Seattle Conservation Corps and the Natural Area crew are available for certain maintenance tasks in natural areas. Place a Work Order request to obtain assistance.

1. Permits

The Department of Planning and Development (DPD, formerly DCLU) regulates activities related to land use and construction. Most Parks maintenance activities do not fall into this category. General maintenance activities such as invasive removal and hazard tree removal are exempt from permitting, Parks is considered a Best Manager of these areas as long as Best Management Practices are followed. This is especially important in Environmental Critical Areas (ECA). Vegetation and tree removal occurring in ECAs should conform to the basic themes presented in the following statement:

SMC 25.09.320 Vegetation and tree removal permit in environmentally critical areas.

A. Removal, clearing or any action detrimental to trees or vegetation within wetlands, wetland buffers and riparian corridor buffers is prohibited unless the Director has given prior approval to a restoration plan pursuant to buffer restoration, reduction, exemption, or exception provisions contained in this chapter.

B. Removal, clearing or any action detrimental to trees (including, but not limited to, tree-topping) or vegetation within land-slide-



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prone, steep-slope, and fish and wildlife habitat areas shall require a permit from the Director when any of the following thresholds are exceeded:

- 1. Any tree of six (6) inch caliper or greater, measured three (3) feet above the ground; or*
- 2. Any combination of trees over one and one-half (1.5) inch caliper, measured three (3) feet above the ground, which total a cross-section area greater than twenty-eight (28) square inches or equivalent to a tree cross-section of six (6) inches; or*
- 3. Any other combination of trees and other vegetation covering an area of seven hundred and fifty (750) square feet or more.*

D. A vegetation and tree removal permit shall not be required when the Director determines there is an emergency that threatens the public health, safety and welfare.

A. Environmentally Critical Areas (SMC 25.05.908)

- Landslide-prone areas, including, but not limited to, known landslide areas, potential landslide areas, and steep slopes of forty (40) percent average slope or greater;

Certain activities are not allowable on steep slopes. Others can be performed but with additional safety techniques or precautions applied. Timing is very important to performing work on steep slopes., No soil disrupting work is allowed during the wet season (November 1 – April 30).

- Riparian Corridors

The following buffer widths have been established by the City of Seattle (SMC 25.09.140)

Class A Riparian Corridor Buffers; Fifty Feet (50')

Class B Riparian Corridor Buffers; Twenty-five feet (25').

The retention of the buffer's existing vegetation is required if vegetation within the buffer is generally in a natural state that prevents erosion, protects water quality, and provides a diverse habitat,.

- Wetlands

Regulated wetlands have a fifty feet (50') buffer to a permanent structure, such as a service road. The same principles apply to wetland buffers as apply to riparian corridor buffers.

- Fish and wildlife habitat conservation areas.

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These are areas designated as critical to the life cycle of Species of Local Importance such as Bald Eagle, Blue Heron, and certain species of Salmon. The major theme in such areas is to *preserve integrity* and *minimize intrusion* (SMC 25.09.200).

B. Erosion Control

Every effort and precaution is required to reduce erosion during construction and maintenance activities

Major maintenance, repair, strengthening, or other operations that require substantial disturbance require notification of or permitting from DPD. Permits in stream corridors may also require a Hydraulic Permit Approval (HPA) from the Washington State Department of Fish and Wildlife.

Activities in these areas will conform to the following (update as in Policies):

- DPD's current Environmentally Critical Areas Regulations (SMC 25.09).
- DPD's Best Management Practices for Construction Erosion and Sedimentation Control Plans (1993)
- Environmentally Critical Areas Interdepartmental Standard Operating Procedure (1994).

5.7 Integrated Pest Management (IPM)

Natural areas are dynamic ecosystems that respond to natural processes of disturbance and succession, including fluctuating insect and fungal organism populations. As such, these natural processes will typically be allowed to occur with minimal intervention. Specific strategies to suppress or remove the threat of invasive and noxious vegetation invasion, or pest issues of public health and safety will be part of routine maintenance.

An overriding principle of Integrated Pest Management (IPM) is the promotion and maintenance of healthy plant communities. In natural areas, cultural or manual controls are preferred over pesticide application. Natural area IPM will include the highest tolerance for pests, expecting that ecosystem dynamics will in most cases control these organisms without specific intervention.

The City of Seattle requires that pesticide use be reduced in all landscapes. In natural areas as in all parks, integrated pest management (IPM) strategies will be practiced only when pest suppression or control is necessary. Please refer to Chapter 3, Integrated Pest Management , pages 3-1 through 3-18, for more information.

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5.7.1 Pest Tolerance Thresholds

Specific Pest Tolerance Thresholds

PEST	THRESHOLD
Noxious weeds	Will not be tolerated and will be controlled when found.
Invasive plants	Are generally not tolerated, as they represent a threat to biodiversity. Invasive plants will be controlled in conjunction with ecosystem restoration efforts in these environments.
Weeds	Weeds will be considered habitat and as such will be tolerated, EXCEPT in demonstration gardens and where weed presence presents a threat to a particularly valuable landscape asset such as a Heritage tree.
Insects	Native insect habitat will be encouraged. Insects that pose a risk to landscape asset health (such as tent caterpillars), may be tolerated or controlled based on the specific asset. Insects that pose a risk to public health and safety (such as hornets) may be controlled or suppressed ONLY in certain circumstances, where they are located in close proximity to human activity. Mosquito management will be performed according to the City's West Nile Virus response and IPM plan. http://www.cityofseattle.net/environment/WestNile.htm .
Diseases	Will generally be tolerated. Specific control or suppression may be necessary to ensure the health of particularly valuable landscape assets.

5.7.2 Pest Management Strategies

1. Weed Control

In certain circumstances, invasive, noxious, or other weedy plants will need suppression or control to preserve assets or establish native restoration sites.

Obnoxious weeds are a continuing challenge in natural areas. Parks staff will contain the spread of these plant species and reduce the size and spread of current populations. Obnoxious weeds include the following:

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PLANT NAME	SCIENTIFIC NAME	MAJOR ISSUE	CONTROL METHODS
Himalayan Blackberry	<i>Rubus discolor</i>	Wide-spread Disrupts native systems	Manual removal Mechanical removal Mulching Herbicide
Cut-leaf Blackberry (<i>evergreen</i>) (<i>lace-leaf</i>)	<i>Rubus laciniatus</i>	Wide-spread Disrupts native systems	Manual removal Mechanical removal Mulching Herbicide
English Ivy	<i>Hedera Helix vars.</i>	Regenerates in shade Disrupts native systems	Manual Removal Mechanical Removal Mulching
English Laurel	<i>Prunus laurocerasus</i>	Regenerates in shade Disrupts native systems	Manual Removal Herbicide
English Holly	<i>Ilex aquilifolium</i>	Regenerates in shade Disrupts native systems	Manual Removal Herbicide
Black Locust	<i>Robinia pseudoacacia</i>	Nitrogen-fixer Alleopathic	Manual Removal Herbicide
Norway Maple	<i>Acer platanoides</i>	Generates in shade	Manual Removal Herbicide
Walnut	<i>Juglans nigra</i>	Alleopathic	Manual Removal Herbicide
Horsechestnut	<i>Aesculus spp.</i>	Readily naturalizes Regenerates in shade	Manual Removal Herbicide

The following are preferred strategies for IPM of weedy plants:

- **Manual removal** by cutting, digging or pulling
- **Shading out** by increasing the number of plants or planting over the weedy species. This is most useful for restoration.
- **Timed mowing.** Carefully timed mowing before seed set can effectively reduce weed seed sources. Frequent mowing can eliminate blackberry and other woody species.
- **Mulching.** Mulching around the base of plantings is widely accepted as a horticultural practice for water conservation, soil temperature moderation, soil fertility, and weed control. In most instances, composted wood chips, organic composts, or onsite recycle leaf litter are adequate materials. Replace mulch every 2 years or as needed.

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- ❖ Mulches should be inspected at delivery. Mulches should be free of weed materials. Avoid wood chips from diseased trees.
- ❖ Mulch should be between 2 to 4 inches deep for best results. Mulch should not touch tree trunks or plant stems.
- ❖ Biodegradable materials such as cardboard can be installed over restoration areas or plants either alone or in conjunction with mulching. Non-biodegradable materials such as black cloth or synthetic fiber landscape cloth can also be used, but shall be removed before planting.
- **Limited herbicide applications** may be allowed ONLY for noxious weeds, invasive plants, or restoration sites (See “**Herbicide Use**”, page 5-21, for more detail).

2. Woody Brush Control

The control of woody brush like blackberries, Scot’s broom, and poison oak is very important in certain park locations. If not controlled, woody brush can overtake forest and grassland environments, eliminating vital habitat opportunities. Suppression and control measures for woody brush include the following:

- **Manual or mechanical removal** using hand tools or gas-powered equipment.
- **Limited herbicide applications** with Tier 2 products such as glyphosate products (Roundup Pro®) or triclopyr products (Garlon 4®) can be employed when hand removal, mulching, or other measures have failed or are not possible. Spot applications are preferred whenever possible although area applications may be employed, especially for poison oak where handling by humans is dangerous. Any area applications will be limited to the exact area of infestation to eliminate or minimize off-target effects.



3. Stump Re-Sprouting Control

When desired for restoration, the following methods for controlling re-sprouting of stumps are allowed:

- **Mechanical removed or grinding** can be used if the location is not within an environmentally critical area or is otherwise inaccessible.
- **Limited herbicide applications:** The re-sprouting of stumps can be controlled by painting newly cut stump surfaces or sucker growth with the herbicides Roundup Pro® (for some species) or Garlon 4®. The application of the selected herbicide is limited to the stump surface only.

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- ❖ **Herbicide application strategies:** Cut down the tree and apply the herbicide to the cut stump with a brush or wick applicator. An alternative method is drilling a hole into the stump of the cut down tree and pouring the herbicide into the hole, taking care not to apply to adjacent vegetation or on soils.
- **Monitoring:** The cut trees should be monitored for at least one year after control measures have been taken. Occasionally, the stump will resprout and the suckers will need to be cut again and the herbicide applied to the cut suckers. If in contact with soil, low branches of shrubs such as holly or laurel will take root and produce another tree. When removing holly, pull up on the lower branches to make sure they are not in contact with soil. Laurel branches and stumps will sprout again if left in contact with the soil.
- **Disposal:** All cut material can be left on site with the exception of laurel.
- **Conservation:** If there are a great many of these trees in an area, don't remove them all at one time. Do it over a period of time as you are replacing them with other native trees and shrubs. This way, the wildlife that has come to use the trees for shelter and nesting is not displaced. And also, do not remove the trees when birds are nesting (from mid-March to the end of August.)

4. Invasive Plant Control



Non-native plants have invaded many of the City's natural areas and landscapes, altering plant communities and reducing native habitat. Attaining long-term control of invasive plants is essential to recovery and preservation of the City's natural ecosystems.

Timing of invasive plant removal is most critical in natural areas as it affects the habitat and life cycles of birds, amphibians, fish, and other animals. Be sure to understand and limit habitat impacts as part of any chosen strategy before beginning control or suppression measures.

Reestablishing a native plant community as quickly as possible following the removal of invasive plants is critical to successful forest restoration. Native plants shall be planted densely and mulched to suppress weedy plants and promote establishment.



Invasive plants and noxious weed control shall follow the Best Management Practices for individual weed species established by the *King County Noxious Weed Program*. Except in the case of Class A weeds, the goal is suppression of

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weed populations to below threshold – generally defined as 5% or greater aerial coverage or as determined collaboratively by Horticulture and Operations staff. Eradication of widespread weeds such as blackberry or ivy is a challenge but control is possible. Removal of such plant populations in certain priority locations is one of SPR goals.

Control or suppression strategies may include any or all of the following:

- Mowing in large areas that are totally infested. Areas that are interspersed with invasive plants require more selective procedures such as manual removal.
- Heavy equipment or manual removal can be used on firm soils, but on either steep slopes or saturated areas, use techniques that will minimize site and slope disturbance.
- Consider biological controls
- Where cultural, mechanical, or manual removal is neither possible nor practical but control is essential, careful and selective use of an approved herbicide is permitted. The list of approved herbicides is limited to Roundup Pro®, Aquamaster, Rodeo®, Surflan or Garlon 4®. For more detail see “**Herbicide Use**”, below.

5. Herbicide Use

The use of herbicides in any natural environment must be carefully considered. Herbicides will be used for weed control in natural areas ONLY when the need is indicated by criteria in this manual AND when other control measures have been tried and have failed OR when past practice strongly indicates that control of the weed pest can ONLY be achieved through the use of an herbicide. The following are acceptable herbicide use practices:

- Cut and stem treatment (daubing or painting) is the preferred choice for natural area management as it limits the off-target impacts.
- Certain invasive plants are difficult to treat and control in their mature form. If possible, remove existing growth manually or mechanically. Wait for new growth to become established, and then treat with the appropriate and approved herbicide.
- Herbicides approved for use in natural areas are limited to products containing glyphosate (Roundup Pro®, Rodeo®, Aquamaster) or triclopyr (Garlon 4®). Oryzalin (Surflan) may be used in limited areas ONLY for garlic mustard seed germination control.

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- **Aquatic weeds may be treated ONLY by permit approval with the Washington State Department of Ecology. Any strategy or project to treat aquatic plants MUST be pre-approved by the Resource Conservation Coordinator.**



6. Insects

Management of insect pests will be limited to ecological management and habitat enhancement for the purposes of encouraging ecological conditions favoring healthy plant communities, populations of pest predators or other natural controls, except for cases involving public health and safety.

Insects like the European and Asian gypsy moth and the Citrus and Asian long-horned beetles can potentially devastate Seattle's urban forest. City of Seattle departments will cooperate with state and federal agencies in their monitoring and control programs to prevent further introduction or spread of these pests.

Examples of insect pests that may be suppressed under certain public health and safety conditions are:

- Mosquitoes ONLY for West Nile virus suppression
- Hornet and wasp nests ONLY when nest presence is next to a trail or in a highly visited area, such as a playground.

7. Wildlife



Urban wildlife such as mountain beavers, beavers, opossums, raccoons, waterfowl, and other species are highly desirable and enjoyable part of the natural area recreational experience. SPR encourages the enhancement of native wildlife habitat in all parks and maintenance activities in natural parks shall include activities to sustain these habitats for native birds, mammals, amphibians, and reptiles. Parks staff will generally tolerate most animal or bird activity in natural areas. If control of wildlife is needed, SPR will work with the most appropriated City (Animal Control) or State (Department of Wildlife) agency to assess and develop strategies for maintaining a sustainable non-damaging population level.

8. Plant Diseases

Even native forests can have serious disease problems. Root rots are the most serious, often killing significant trees, but other problems can occur. Staff should be aware of symptoms of diseases most likely to infect native plants, and determine a strategy for suppression or control as needed, following all IPM procedures.

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Important plant diseases are *Phytophthora* diseases and *Armillaria* root rots that commonly affect forest plants. Staff directly responsible for maintenance should routinely monitor for symptoms of these diseases.

5.8 Critical Natural Area Asset Management

Certain assets require specific BMPs that address detailed management strategies for these resources. Such areas include natural forests, wetlands, drainage systems, meadows, grasslands, beaches, shorelines and trails.

5.8.1 Forests

The following BMPs address management practices with regard to forest cover, canopy regrowth, erosion control, steep slopes, organic debris, and fire prevention.

Long-term sustainability is the primary goal of reforestation activities. Good planning develops strategies that are both realistic and feasible. To foster community stewardship, active community groups should be notified and involved in planning, installation and maintenance of project sites. Sustainable reforestation requires periodic maintenance and monitoring.

The following principles of stewardship provide general guidance for lands management. Actual implementation of these principles will vary from park to park based on environmental, ecological or neighborhood characteristics.

PRINCIPLES OF GOOD LAND STEWARDSHIP

- Be realistic; don't take on more projects than can be completed.
- Foster involvement through constituencies, partnerships and leveraged opportunities.
- Assure success by involving community and special interest groups.
- Ensure success by establishing dedicated community-based long-term care.
- Do not remove all vegetation from an area at once – remove it in blocks over time, unless the area can be revegetated within 12 months.
- Mulch all restoration sites immediately after invasive removal.
- Maintain new plantings in a manner and frequency that assures survival, including mulching, water rings, frequent watering, and periodic weeding.

1. Design

There are four primary guidelines governing design in forested natural areas:

- 1. Maximize upper canopy cover**
- 2. Maintain and increase plant species diversity**

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3. Protect and enhance wildlife habitat

4. Support recreational and community activities

Additionally, the following 3 guidelines address plant selection, placement and replacement:

- Plant installations shall consider and incorporate adjacent plant community composition when and wherever possible.
- Trees and large woody shrubs shall be planted so that they do not impact trails and access paths. Large trees and shrubs should be planted at least 10 feet from trail edges or access path edges, except for Interpretive Program Areas. For all required planting setbacks, see trails section page#.
- All trees greater than 6 inches that are removed shall be replaced at a 3:1 ratio based on diameter at breast height (DBH). Contact the Senior Urban Forester for guidance.

2. Construction and Restoration in Forests

Vegetative Cover

Healthy vegetation cover is important for erosion control, habitat, and invasive weed control.

- Except in features that cannot function with vegetative cover (e.g. trails, cliff habitats), vegetation will be preserved and enhanced to maximize its functional value.
- Wherever possible, enhance the conditions that are favorable to desirable vegetation and inhibit undesirable vegetation.
- Limit disturbance and changes to site conditions to prevent loss of plant biomass

Invasive Plant Management

Invasive removal is just one step in the multi-stepped, multi-year process of restoration - refer to 9.6.2 - Construction and Restoration in Forests. Invasive plants should be removed and replaced with appropriate native vegetation where feasible. The scale and scope of an invasive removal strategy or project should always consider funding and labor resources available. These following guidelines apply:

- Remove vegetation systematically to limit habitat impacts, especially for nesting birds or aquatic organisms.

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- Leave no bare ground where weeds and invasives can reinfest. Plan restoration of the site as part of the IPM strategy.
- Do not remove invasives from an area unless the site can be restored within 3 months. In the case where restoration within that time is not feasible and the invasives must be removed, the site should be mulched with cardboard, landscape cloth or other material, and wood chips to a depth of 4 inches and/or wood chips alone.

Canopy Regeneration

Except for grassland/meadow habitats, tree canopy is an integral part of the natural ecosystem. Use the following BMPs to encourage canopy growth:

- Where canopy is fragmented or absent, new plantings should anticipate natural succession in native conditions. In general, Pacific Northwest forests proceed from a pioneer deciduous forest to a predominantly conifer forest.
- While management practices should emulate natural succession, for practical reasons, successional stages may be accelerated, retarded, or staggered. For example, you might create canopy gaps to stimulate tree growth in the under story at a particular site.

Reforestation Projects

Typically projects are accomplished through partnership with community groups active in the park. Reforestation as a process takes at least 4 years and is divided into four major phases. These phases are further elaborated on in the Greenbelts and Natural Areas Vegetative Management Plan (due to be released in 2005). In general all restoration projects contain the following four phases:

PHASES:

- **[1] Planning,**
- **[2] Site Prep/ Installation,**
- **[3] Intensive Maintenance,**
- **[4] Long-term Maintenance.**

The following chart presents the general parameters, tasks, and workload involved in a typical restoration project.

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General Restoration Task List and Work Schedule

ACTION: REFORESTATION	MONTH											
PARAMETERS	J	F	M	A	M	J	J	A	S	O	N	D
Community Enthusiasm	minimal			lots			lots				some	
Birds Nesting/ Rearing	No			yes			yes				no	
Most Common Weather	wet / cold			wet / warm			dry / warm				wet/ cool	
STAGES	J	F	M	A	M	J	J	A	S	O	N	D
PHASE 1 - <i>Planning</i> ¹												
PHASE 2 - <i>Site Prep</i>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<i>Installation</i>												
PHASE 3 - <i>Intensive Maintenance</i> (Year 1)												
(Year 2)												
(Year 3)												
PHASE 4 - <i>Long-term Care</i>												

~ Adapted from the 'Three Year Establishment Care Calendar' first developed for Magnuson Park, found in: Sandpoint Magnuson Vegetative Management Plan (2000)

KEY

	Develop work plans (at least 4 months in advance of project dates)
	Advertise, build constituencies
<input checked="" type="checkbox"/>	Follow standard procedures
	Planting
	Watering
	Repeat as necessary

Parks with current VMPs have gone through a large part of the planning process. However, there may be a need to define the scope of the project, required materials, workforce, leverage/ partnering opportunities, project duration, specific intensive maintenance protocols and long-term care strategies. When doing this, the specific VMP developed for that area will be used as the primary resource and guide.

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Maintenance

The following activity chart projects generalized maintenance tasks based on time of the year. Initiating new removal projects is discouraged between the months of April and August to avoid disturbance to bird nesting and forage habitat.

	MONTH											
	J	F	M	A	M	J	J	A	S	O	N	D
community enthusiasm	minimal			lots			lots			some		
Birds nesting/ rearing	no			yes			yes			no		
most common weather	wet / cold			wet / warm			dry / warm			wet/ cool		
INITIAL INVASIVE REMOVAL	☺💧			⊘			☹			☺💧		
FOLLOW UP REMOVAL & WEEDING	☺💧			☺			☺			☺💧		
PLANTING	☺💧			☹			☠			☺💧		
MULCHING	☺💧			☺			☺			☺💧		
WATERING				!			!!!					
MONITORING				!!!						!		
MAINTAINANCE	↔			↔			↔			↔		

GENERAL MAINTENANCE SCHEDULE:

KEY

↔	Repeat as necessary	☺	Best time to perform task
☺💧	Ok to do under wet conditions	!!!	Essential activity
⊘	Avoid at this time	!	Consider performing this activity
☹	Task is discouraged during this time	☠	Under no circumstances even consider it

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3. Erosion Control

Vegetation Management Controls Erosion

- **Bare parkland**, should be carefully evaluated and the appropriate vegetation established.
- If **bare earth** is evident, it should, at a minimum, have a layer of organic mulch applied to buffer the soil until the appropriate vegetation can be established.
- **Management decisions** should reflect the principles of plant succession leading to a multi-layered canopy, which provides the ultimate buffer to erosion.
- **Natural accumulations of leaf litter** and other organic materials should be left undisturbed whenever possible.
- All streams should be buffered from **excessive runoff** and erosion by a comprehensive watershed study followed by appropriate corrective measures and maintenance.
- **Biofiltration of storm water runoff** from hard surfaces (trails, etc.) should be attempted whenever possible. Managing for healthy plant communities is a big element in the prevention of erosion. The grass in a forest can provide adequate erosion buffering provided it is healthy and vital.

Steep Slopes

- ❖ Slide areas, or areas suspected of being slide-prone, will be evaluated by the Parks Engineer before restoration is initiated.
- ❖ Work in identified Steep Slopes areas should be done in accordance with recommended standard operating procedures (SOPs). Strategies can be developed to help maintain or even improve slope stability.
- ❖ Stability of the slope shall be maintained during all phases of installation and prior to completion of all projects. Stability is defined by the city as ‘to possess permanent characteristics, either naturally or by manmade improvements, which can be shown to have sufficient resistance to forces normally expected to occur, and those forces which may occur as a result of a one (1) in one-hundred (100) year event (*Environmental Critical Area (ECA) Code Definitions (SMC 25.09.420)*)’.

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- ❖ Removing vegetation from the ground layer should be minimized, and plantings should be stabilized with appropriate bioengineering techniques (e.g. netting, wattling, hydro mulching, etc.)
- ❖ Storm water runoff must be prevented from saturating or loading steep slopes. The appropriate drainage system should be in place and adequately maintained to intercept runoff flows before reaching the slope. See "Stormwater Management" above under Section X5, Slide Areas

4. Organic Debris

It is important to maintain available nutrients and minerals onsite in natural areas. Plants and trees depend on rotting vegetative material because the soils in this area tend to be nutrient poor. For this reason, organic debris from maintenance practices will remain onsite, as long as it does not interfere with other landscape functions. Types of interference include blocking trails, forming unstable cornices, diverting drainages, smothering desirable vegetation, or having a high tendency to re-root or sprout from debris piles. Wherever possible, use the following BMPs:

- All trees down in woods are left where they fall except when across trails and roads. Trees across trails are cut and put into the woods.
- Leave uncut branches and logs in place to restrict traffic into natural areas.
- Stabilize logs to prevent sliding or rolling.
- Remove invasive species from the site.

5. Pruning and Hazard Trees

Pruning shall be limited to hazard mitigation such as dead limbs overhanging trails. Dead trees that do not pose a threat of falling and causing damage to persons or structures shall be left in place intact to provide habitat and large woody debris within the forest.

Pruning debris from other areas within the park can also be used to enhance habitat by placing within the forest.

Trees in natural areas that are identified as hazards should be evaluated for habitat potential and converted to snag, log, or other habitat feature if site conditions warrant.

Fire Prevention

A healthy, diverse plant community is fire resistant, but woody plant debris must be managed in any urban landscape. The following BMPs encourage fire prevention in natural areas:

- Large piles of dead, woody plant debris should not be accumulated near parks structures.

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- Maintain transitions to developed landscapes to provide interruptions to the normal path that fires usually travel. This practice creates a more defensible landscape.²
- Hydrants should be located along the edge of natural areas to provide immediate access for firefighting.
- Service roads into large woodland tracts should be maintained to allow access for Fire Department tanker trucks.
- Large woodland tracts with high fire potential should be studied for possible development of service roads.

5.8.2 Wetland & Drainage Systems

For years, park maintenance has focused on conserving trees and plants. Today we recognize that water environments are an equally important resource. Seattle parks contain more than 1000 acres of wetlands, including lakes, streams, riparian corridors, shorelines, rivers and other aquatic habitat. This section describes the BMPs for managing water environments in Seattle Parks.

Wetland of Exceptional Value	<p>This refers to wetlands with the following values:</p> <ol style="list-style-type: none"> 1. Rare or unique species listed by the federal or state government as endangered or threatened and needing special protection; 2. Presence of plants or group of plants that occur infrequently in the Seattle or Puget Sound region 3. Habitat diversity 4. Sensitivity to disturbance 5. Difficulty in replacement of ecological functions unique to Seattle. <p style="text-align: right;"><i>- Environmental Critical Area (ECA) Code Definitions (SMC 25.09.420)</i></p>
Degraded Wetland	<p>"Degraded wetland" means and refers to those wetlands that have been altered or damaged by past human activities and/or biologically diminished by invasive, non-native plants so that the natural biofiltration and habitat values have been rendered inefficient or nonfunctional.</p> <p style="text-align: right;"><i>- Environmental Critical Area (ECA) Code Definitions (SMC 25.09.420)</i></p>

¹ DNR publication on Fire Defensible Landscaping

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1. Design

All wetland projects will be designed and developed by qualified professionals. All renovation/construction work and some maintenance tasks in wetlands are subject to special permit requirements.

2. Structures

Structures are constructed features—check dams, water bars, sediment pool, boardwalks, bridges, or stairs—built to mitigate urban impact on sensitive areas.

- Structure materials should be either wood treated with AQC or plastic. Alternative materials shall be approved during design review.
- Structures should neither interfere with nor dominate natural processes.
- Structures are intended to endure extreme exposures, including unstable ground and constant wetness. Staff should monitor structures as necessary for degradation or hazardous conditions. .

3. Construction and Renovation in Wetlands

In order to avoid alteration of ecosystem function, wetland construction should not be undertaken by maintenance staff. Capital projects will be the only method of renovation within wetland areas. Special consideration to protection of critical habitat shall be mandatory in construction on shorelines, beaches, and nearshore aquatic habitat (See Construction Site Management for more details, page #.).

Wetlands will be carefully monitored and managed during construction to prevent loss of the facility and/or adverse environmental impacts. SPR Planning and Development Staff will be responsible for renovation or other large-scale projects in wetlands. Strategies include the following:

- Erosion control
- Materials replenishment
- Large woody debris retention
- Monitoring and inspection
- Routine cleaning

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4. Maintenance

All maintenance in wetlands should be done by employing the least environmental impacts.

Invasive Plant Management

Invasive plants should be removed and replaced with appropriate native vegetation where feasible. The scale and scope of an invasive removal strategy or project should always consider funding and labor resources available. These guidelines apply:

- Remove vegetation systematically to limit habitat impacts, especially for nesting birds or aquatic organisms.
- Leave no bare ground where weeds and invasives can reinfest. Plan restoration of the site as part of the IPM strategy.
- Do not remove invasives from an area unless the site can be restored within three months. In the case where restoration within that time is not feasible and the invasives must be removed, the site should be mulched with cardboard, landscape cloth or other material, and wood chips to a depth of 4 inches and/or wood chips alone.

Inter-Agency Water Quality Monitoring

Agencies that manage City-owned open spaces cooperate with many jurisdictions to preserve and improve water quality. See the chart below for more information.



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How to Coordinate with Other Agencies	
Agency	Type of Coordination
Department of Planning and Development (DPD)	<ul style="list-style-type: none"> • Advise them through standard operating procedures of projects that may substantially impact environmentally critical areas. • DPD must participate in any review process for projects in watersheds that drain through City property
Seattle Public Utilities (SPU)	Monitor water quality and streambed conditions to document the effects of management practices and development on water quality.
Washington State Department of Fish and Wildlife (DFW).	Obtain a Hydraulic Project Approval permit for any project that might impact a fish-supporting watercourse.
Seattle-King County Department of Health (Eileen Hennessy)	Water Quality monitoring for human health
King County Freshwater Assessment Group BEACH Program (Jonathon Frodge)	Beach Water quality program

Buffers

Tri County Pesticide Use Guidelines, which the City of Seattle follows, impose a 25-foot buffer from all water bodies and wetlands within which the use of pesticides is strongly discouraged. If there is a need for use within this buffer zone, extra precautions and care are required to absolutely keep pesticides out of the water.

Salmon protection ruling by the U.S. District Court for the Western District of Washington imposed a 20 yard or 60 foot buffer zones restricting use of more than 30 pesticide active ingredients along streams supporting threatened and endangered salmon. Special conditions are in place for certain other pest control issues.

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5.8.3 Meadows and Grasslands

The following BMPs guide best practice for grassland vegetative cover, meadow preservation, meadow restoration, habitat preservation, and fire prevention.

1. Design, Construction & Renovation of Meadows & Grasslands

Design or restoration of a meadow should consider the following:

- **Hydrologic Study of the Site.** Available moisture is the determining factor in appropriate plant selection.
- **Soil Study.** Many native plants require specific soil requirements to succeed.
- **Existing Vegetation.** The site should be assessed for desirable species as well as undesirable species. A small test plot can also help determine the potential weed seed bank in the soil profile. A thorough inventory of existing species can provide valuable information for selection of appropriate species.
- **Natural Succession.** Whenever possible, attempt to emulate the natural succession process by initially introducing primarily pioneering plant species and gradually expanding into later successional species as cultural conditions allow.

2. Maintenance

Mowing or brush removal should be done to suppress brush, which can invade grasslands and change the plant community, altering habitat quality. Scheduling and timing should minimize impacts with wildlife nesting and habitation, typically after August 1st.

One mowing every 2 to 3 years may be sufficient for woody brush control. Firebreak areas may require frequent mowing to maintain. Mowing heights should be approximately 4 to 5 inches or as determined by species composition. Preserve native herbaceous plants such as wildflowers or bulbs.

3. Grassland Vegetative Cover

Healthy vegetative cover is important for erosion control, habitat, and noxious weed control.

- **Grasses.** Most urban meadow sites are previously disturbed sites resulting in growth of primarily exotic grasses. Once established, these exotic species should be accepted as the primary component of the vegetative cover.

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- **Native Meadow Plants.** Preservation of native plants should be attempted whenever possible.
- **Wet Meadows.** Many meadow areas in this region remain in a saturated condition for six months or more. Avoiding significant maintenance activities during this period is recommended. Preservation and introduction of appropriate native plants into these sites will help ensure a healthy vegetative cover.

4. Preservation

To preserve grassland, wet meadow, or perennial meadow in the Pacific Northwest requires an ongoing maintenance program.

- **Disturbance.** Avoid creating holes in the vegetative cover because it will provide opportunities for noxious weeds to invade.
- **Meadow Succession.** The natural evolutionary process of forest/meadow succession will eventually colonize meadow areas with shrubs and trees. The management of this process will have a major impact on the character and longevity of the meadow. The desired character of a meadow area should be defined. The meadow should be managed to prevent establishment of exotic trees and shrubs. Depending on the desired character of the meadow, all, some, or none of the native plants attempting to colonize the site can be retained.
- **Weed and Brush Control.** Scotch broom and other noxious weeds colonize many meadow areas, especially if the vegetative cover is weak or not intact. If invasive brush is a minor problem, hand grubbing or spot spraying with a broadleaf herbicide are both options. When invasive brush is a major problem, it may be necessary to mow the meadow on an annual basis. Mowing should be timed to avoid disturbing wildlife. Spring should be avoided to allow protection for ground nesting birds. The site should be monitored for other wildlife activity before mowing occurs. Mowing should also be done before seed set of the targeted species. Mowing heights should be a minimum of 6 inches high to prevent excessive grass clippings and to minimize exposing bare ground.

5. Wildlife Habitat

The management practices of meadow areas should reflect the goal of preserving and enhancing desirable wildlife species.

- **Maintenance Activities.** Maintenance activities should be evaluated as to their impact on wildlife.

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- **Enhancements.** Many desirable wildlife species can be attracted by enhancements such as nesting boxes, brush piles, rock piles, stumps, snags, and specific plant types.

6. Fire Prevention

Wildfire prevention is an important aspect of meadow management. The following items should be considered when managing or creating grassland.

- **Fuel Loading.** How much fuel does the site contain and what is the potential for an uncontrolled burn?
- **Site Geography.** Does the grassland connect to woodlands, structures, or other valued assets?
- **Fire Breaks.** Grassland areas should have established firebreaks. These breaks divide grassland and woodland areas from homes, park structures, or any other potentially flammable area. The firebreaks should be at least 25 feet wide and should be mowed frequently enough to prevent any buildup of dead grass. Closely mowed swaths and service roads can function as firebreaks. Plan firebreaks to limit a grass fire to just the grasslands.
- **Irrigation.** If a site has an irrigation system, it may be necessary to occasionally activate the system to dampen the potential fuel.
- **Mowing.** Site conditions should be monitored for the above items. Summer or fall mowing could be recommended if conditions indicate.

5.8.4 Beaches and Shorelines

Beaches and shorelines are considered Environmentally Critical Areas (ECA) and as such need special considerations to protect both terrestrial, fresh water and marine habitats, with a special emphasis on protecting salmon habitat. SPR manages 24 miles of shorelines on Lake Washington, Lake Union, Lake Washington Ship Canal, Green Lake, Bitter Lake, and along the Puget Sound, including nine swimming beaches.

1. Marine Reserves

SPR has several beaches that include designated Marine Reserves on nine miles of Puget Sound shorelines. A marine reserve is any stretch of beach or water that is protected. No collection of organisms, rocks or other features is allowed. These designated areas help prevent over harvesting of shellfish and damage to local marine habitat. Protecting even limited areas of beach and water gives marine life the chance to reproduce safely and creates nurseries for marine life.

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Marine reserves are established within portions of the following beach areas:

Carkeek Park
Discovery Park
Golden Gardens Park
Lincoln Park
Mee-Kwa-Mooks Park
Schmitz Viewpoint
South Alki/Richey Viewpoint

2. Design

The unstable nature of shorelines requires that beaches be carefully engineered to prevent loss of the facility or adverse environmental impacts such as those from park users. Beach engineering includes importing sand and cobble, armoring, and installing geotextiles to reduce erosion. Jetties, seawalls, and other retention structures are ineffective shoreline management.

3. Shoreline and Bank Stability

Armoring a shoreline should consider the least impact necessary to achieve reasonable stability.

- Traditional use of riprap should be limited to severe exposed sites. Softer treatments, such as log placement and plantings, are preferred where feasible.
- Shoreline improvements and interpretive features should be used to direct usage and interpret non-traditional treatments. Seasonal variations in water (lake or stream) level require additional engineering.

4. Construction and Renovation of Beaches and Shorelines

Beach construction should not be undertaken by maintenance staff. Capital projects are the only method for renovation on beaches. Special consideration to protection of critical habitat shall be mandatory for construction on shorelines and beaches, especially in marine reserves (See Construction Site Management for more details, page #.).

Beaches will be carefully monitored and managed during construction to prevent loss of the facility and/or adverse environmental impacts. SPR Planning and Development Staff will be responsible for renovation or other large-scale maintenance of beaches. Strategies include the following:

- Sand and cobble replenishment
- Driftwood retention
- Periodic inspection by divers
- Routine sand raking and cleaning

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5. Maintenance

Routine maintenance procedures shall include protection of critical land and water habitat during work tasks. Litter and debris shall be promptly removed from beaches on a daily basis. Do not remove vegetation, animals, rocks or other features from beaches or otherwise disturb beach features. If such features must be disturbed during maintenance, return them back to the place where they were found. Stay out of water areas if possible. Fill any holes that are dug.

Preserve native vegetation and native habitats. Control invasive vegetation and noxious weeds (see IPM, page #). If vegetation management requires plant removal, stage and remove carefully to avoid unnecessary impacts to beaches.

Monitor for wildlife damage or impacts.

Certain projects or maintenance tasks may require permits to execute. Call PPD staff to assess the need for permits.

5.8.5 Trails

It is the vision of Seattle Parks and Recreation to manage a trail system that provides inviting and safe year round access to parks and natural areas for people of all abilities that is aesthetically and functionally integrated into the surrounding landscape, that promotes the protection of our natural resources and is linked to other Departmental and Citywide environmental stewardship opportunities. SPR has over 65 miles of established trails, with several more miles existing in green belts and natural areas. In general the trails described in this section are permeable or soft surface trails. These trails are not to be confused with the larger asphalt trails (such as the Burke Gilman Trail). Although many of the trails that exist are maintained by a variety of entities and volunteers, it is important that there is a consistent standard in the maintenance of these areas. The BMPs described in this section are meant as a guide for all trail stewards.

1. Design

User Access/Control

Access path guideline: This document clearly defines access paths and usage, and is contained in Vegetation Management Plans, the trails hierarchy or other documents. A study of predominant use patterns should determine the best way to define access from trails, shorelines, and service roads. These routes should then be developed and maintained using the BMP for trails.

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Trail Classification Hierarchy City of Seattle Department of Parks and Recreation October 30, 2000

Below are eight classifications describing the hierarchy of trails within the jurisdiction of the City of Seattle Department of Parks and Recreation.

Class	Description	Min.-Max. width	Example
I.	On-Street Trail, or spur section, of which a considerable portion is within Parks and Recreation jurisdiction. Typically a cross-jurisdictional bicycle or walking route. Route is published and/or signed.	5'-0 min., may vary	Central Park Trail
II.	Paved multi-use trail. Surfacing either concrete or asphalt. Uses including walking, jogging, skating, bicycling. Cross-jurisdictional, urban, includes street crossings although vehicular access is limited to service vehicles.	8'-0 min.	Burke Gilman, Green Lake, Alki Blvd.
III.	Paved multi-use trail. Surfacing either concrete or asphalt. Uses including walking, jogging, skating, bicycling and service access. Contained within a Park, vehicular access limited to service vehicles.	8'-0 min.	Seward Park loop.
IV.	Paved Pedestrian-only walking path contained within a Park.	5'-0 min., may vary	Almost any developed Park.
V.	Soft Surface Multi-purpose trail. Crushed rock paving. Primarily walking, service access, limited bicycle use. Contained within a Park, vehicular access limited to service vehicles.	8'-0 min., 12'-0 max.	Carkeek Park.
VI.	Arterial Walking Trail. Crushed rock paving. Pedestrian only, no vehicle access. Contained within a Park.	4'-0 min., 8'-0 max.	Most fully-developed primary trails within "undeveloped" or natural parklands.
VII.	Secondary Walking Trail. Improved mineral soil or crushed rock paving. Pedestrian only, usually associated with a Class VI arterial trail. Should reconnect back to arterial, developed area, or terminate at a destination of some significance. Lowest legitimate level of development within the Park system.	2'-0 min., 4'-0 max.	Far loop at Dead Horse Canyon - Lakeridge Park.
VIII.	Dirt Track. Illegitimate path or underdeveloped class VI or VII trail awaiting improvement. Illegitimate paths may include private points of access or those in very wet or steep areas typically deemed inappropriate for continued maintenance or future development.	as narrow as 1'-0	Many short-cuts throughout the Parks trail system.

2. Construction and Renovation of Trails

PART 1 - GENERAL

1.01 Description

The work of this section is limited to the restoration of disturbance resulting from all activities related to the restoration or new construction of trails in Seattle Parks. This work includes, but may not be limited to:

- Clearing and Removal of Existing Invasive Vegetation
- Stockpiling of salvaged Native Plants
- Stockpiling of Native Organic Material
- Grading of Disturbed Areas
- Construction of Trails and Related Appurtenances
- Drainage
- Soil Reconditioning
- Planting
- Mulching
- Warranty

1.02 Related Sections

Coordinate the work of this Section with that of all other Sections of the Contract.

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1.03 Definitions

The following definitions may apply to this Specification Section only:

“Disturbance” refers to any negative impact to the project site caused by the execution of the Contract, including, but not necessarily limited to, access, excavation, exploration, hauling, staging, stockpiling, or survey.

“Mechanical Damage” refers to damage caused by unnatural physical forces, including vandalism, inappropriate handling, or damage occurring over time as a result of poor materials or workmanship.

“Plant Schedule” refers to the Native Plant Associations: Plant Palettes for Trail Restoration Work, a list of plants associated with the restoration work of this Contract. Schedules are provided for planting in 4 differing cultural conditions.

“Trail Stationing Plan” refers to the spreadsheet formatted stationing plan associated with the restoration work of the Contract identifying specific improvements or restoration measures by type and location.

1.04 Quality Assurance

A. Reference Standards

The following standards are considered part of these specifications.

American Association of Nurserymen

“American Standard for Nursery Stock, ANSI Z 60.1”, latest edition.

B. Inspections

1. On-Going inspection and observation by the City of Seattle Department of Parks and Recreation (DPR) of the work in progress will be coordinated through the Project Manager.

2. Plant Material

Upon approval of purchase order and Vendor, paragraph 1.03.C below, ship plants to project site staging area for inspection and approval by DPR. Remove from the site any plant material not accepted by the inspector immediately. Alternatively, arrange for inspection at the Vendors location, if within 20 miles of the Seattle City limits, within 24 hours of anticipated shipping.

3. Refer to paragraph 3.09 for Inspections required by Warranty.

4. Comply with the requirements of other inspections that may be identified elsewhere in these specifications.

C. Submittals

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Provide for DPR approval a copy of all purchase orders for plant material, including the name, address, and telephone number of the Vendor. Do not ship plant material until approved. Approval of purchase order and vendor does not constitute acceptance of plant material.

D. Field Changes

Field Changes may be instituted by DPR, to the extent that the over-all value of the work is not substantially changed. In the event of a substantial change to the scope of work, as determined by agreement between the Contractor and the Owner, a Change Order will be negotiated.

E. Work Force

Work Force to be utilized for Planting, paragraph 3.07, shall be experienced in the planting of native species and be approved by DPR prior to mobilization.

PART 2 - PRODUCTS

2.01 Native Organic Material

Native Organic Material refers to that material encountered within the limits of disturbance, including haul and access routes that consists of naturally occurring decomposed vegetation. This material does not include waste from clearing, logs, branches over 2" in diameter or over 5 feet in length. Native Organic Material, for the purposes of this Section, includes topsoil and composted leaves, sticks, and twigs, which when stockpiled may result in a mixture of those elements.

2.02 Native Mineral Soil

Where described in this Section, Native Mineral Soil refers to that soil encountered during clearing and excavation that contains little or no Native Organic Material. Native Mineral Soil, for the purposes of this Section, includes clay, silt, sand, gravel, and rock in such a combination as to provide adequate drainage with a minimum of visible voids.

2.03 Native Plants

As described in **Appendix A**, Native Plants refer to those species growing native in western Washington state.

2.04 Imported Trail Construction Materials

A. Trail Surfacing

Trail Surfacing shall be 5/8" Minus Crushed Rock, crushed ledge rock or talus with no naturally occurring faces. Particle gradation as follows:

<u>Sieve</u>	<u>% Passing</u>
5/8"	90-100

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1/4"	55-75
#40	8-24
#200	5-15

B. Lumber

Materials specified in this Section are for Footbridges under 20' in length, Water bars, Turnpike sections, and Step construction only. Refer to City of Seattle Department of Design, Construction and Land Use Standards and Details for lumber associated with all other wood construction associated with this Contract.

All lumber for work of this section shall be Pressure Treated ACQ Lumber, #2 Structural.

C. Fasteners

1. All plate-type and stamped fasteners shall be 16 gauge hot dipped galvanized steel or as approved by DPR prior to installation.
2. All other fasteners and connectors, i.e., nails, screws, and bolt assemblies, shall be galvanized steel, sized per details or as appropriate for the task.
3. Reinforcing Bars used as anchor pins for wood-on-grade construction shall be #4 deformed.

2.05 Drainage

- A. Culvert Pipe shall be 12" I.D. corrugated PVC, double-wall re-core, smooth interior wall, or approved equivalent.
- B. Rock for Rock Spillway and Rock Lined Sump shall be granite, largest face generally flat, weathered or shot, and minimum size 1/2 cubic foot.

2.06 Soil Conditioning and Planting Backfill

- A. Native Organic Material as described in this Section, paragraphs 2.01, above.
- B. Moisture Retention Agent shall be a Hydrophilic Acrylic Copolymer, "Soil Moist" by JRM Chemical, Cleveland, Ohio, or equal.
- C. Planting Backfill shall be a thoroughly blended mixture of existing soil, Moisture Retention Agent at the manufacturers recommended rate, and Native Organic Material.

2.07 Plant Material

- A. Provide only those plant species identified on the Schedules and listed in **Appendix A**, Native Plant Associations: Plant Palettes for Trail Restoration Work. Where specific cultivars or varieties are not identified, provide only the species as indicated. Do not provide cultivars or varieties.
- B. Size

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1. Meet or exceed the standards for plant size per container as described in “American Standard for Nursery Stock, ANSI Z 60.1”.
 2. Provide trees and shrubs at the sizes indicated on the schedules. In the event of unavailability, provide one size smaller at a documented credit to the Owner, or alternatively, one size larger at no additional cost to the Owner.
 3. Provide groundcovers at the size indicated on the schedules. In the event of unavailability, provide one size smaller at a documented credit to the Owner.
- C. Quality
1. Meet or exceed the standards for plant quality as described in “American Standard for Nursery Stock, ANSI Z 60.1”.
 2. Plant Material shall be healthy, vigorous, and sound upon inspection and acceptance. There shall be no evidence of insect infestation including eggs, insects, or feeding damage. There shall be evidence of mechanical damage such as broken branches, root balls, or bruising of foliage.
 3. Plant material shall have been grown and held in conditions similar to those expected for the species.

2.08 Mulch

Mulch shall be DPR wood chips or Erosion Control Blanket, unbound Wood Excelsior, supplied in bales.

PART 3 - EXECUTION

3.01 Clearing

- A. In general, clear only that vegetation that is immediately threatened by activity associated with the work of this Contract.
- B. Remove no deciduous trees over 3” in trunk diameter measured 4 feet above ground level and no coniferous trees measuring over 5’ above ground level without prior approval of DPR. Obtain approval by flagging trees proposed for removal prior to coordinating a review by DPR. Anticipate the alignment far enough ahead to allow for alternate routing in the event proposals for tree removal are rejected by DPR.
- C. Where overhead clearance requirements necessitate the pruning or limbing of tree branches over 3” in diameter at that point where the cut is to be made, obtain approval through the same procedure identified above in paragraph 3.01.B.
- D. Refer to the construction details associated with the trail work for additional clearing requirements.

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E. Remove thoroughly from the Project Site all material cleared. Alternatively, chip all material mechanically and disperse equally to both sides of the Project alignment.

F. Leave Downed Woody Debris (DWD) to decompose in natural areas.

3.02 Stockpiling of Native Organic Material and Salvaged Native Plants

A. Refer to the above paragraph 2.01, for a description of Native Organic Material.

B. Excavate by scraping the upper soil profiles to collect the material. Work in such a manner as to accumulate a minimum of Native Mineral Soil.

C. Stockpile Native Organic Material (Organic Material) in a linear “berm” along both outer edges of disturbance. In the event that excavated Native Mineral Soil (Mineral Soil) requires such room as to make stockpiling the Organic Material on both sides of the disturbed area impractical, stockpile the Mineral Soil on the up-slope side of the disturbed area. Areas receiving stockpiles will be considered disturbed areas.

D. Stockpile Organic Material loosely. Do not compress or compact stockpiles beyond the natural compression of the material to achieve a steeper angle of repose.

E. Carefully dig up root ball of native plants identified by Urban Forester and place in 1-gallon containers for future replanting. Store pots in wood chip mulch and insure adequate irrigation for duration of trail construction.

3.03 Grading

A. General

1. Grading of disturbed areas within the limits of DPR jurisdiction falls within two categories. Grading taking place beneath areas to receive trails on grade and their associated appurtenances, referred to as “Traffic Areas”, grading taking place beneath areas to receive elevated trail structures such as footbridges and bridges, and grading taking place along areas to receive Plantings, referred to as “Non-Traffic Areas”.

2. On average, the rough grade of all areas within the limits of disturbance shall transition smoothly into the adjacent existing undisturbed grades. Exceptions are those areas on the up-slope side, which are scheduled to receive parallel ditches.

B. Traffic Areas

1. All Traffic Areas shall be rough graded with clean Native Mineral Soil containing a minimum of contaminating organic material.

2. Areas scheduled to receive a Standard Trail Section;

a. Shall be graded with a side slope draining either inward to a parallel drainage ditch or outward down-slope at between 2 and 5 percent.

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- b. Shall be compacted to the greatest density supportable by the surrounding soils and slopes.
- 3. Areas scheduled to receive Turnpike and/or Water-bars;
 - a. Shall be graded flat, or no more than 2% across in any direction.
 - b. Shall be compacted to the greatest density supportable by the surrounding soils and slopes.
- 4. Areas scheduled to receive Drainage improvements;
 - a. Shall occur only as excavations into undisturbed soil.
 - b. Shall be graded in lateral section per the drawings and in profile such that they result in a positive designed out-fall.
- C. Non-Traffic Areas
 - 1. All Non-Traffic Areas shall be rough graded with either Native Mineral Soil or a combination of Native Mineral Soil and Native Organic Material (Organic Material). Minimize use of stockpiled Organic Material and do not use Organic Material occurring outside the limits of disturbance.
 - 2. Areas scheduled to receive Elevated Trail Structures;
 - a. Shall be graded;
 - i. To smoothly transition into adjacent existing grades.
 - ii. To drain along pre-existing flow lines. Where directed, reconstructed flow-lines shall be reinforced with imported rock, as associated with drainage work, and as defined in paragraph 2.04.B, above.
 - b. Shall be compacted to the greatest density supportable by the surrounding soils and slopes.
 - 3. Areas scheduled to receive Plantings;
 - a. Shall be graded to smoothly transition into adjacent existing grades.
 - b. Shall be compacted to such an extent as to prevent excessive erosion but not to such an extent as to inhibit infiltration or percolation of surface water into the soil. Generally, 70% of maximum density at 15% moisture by weight.

3.04 Trail Construction

- A. General

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1. Work of this Section consists of all services, labor, equipment, and materials necessary to construct the trail system described in the Trail Stationing Plan. This includes construction of Standard Trail Section, Water Bars, Turnpike Section, Steps, and Footbridges under 20' in length.
 2. The Trail Stationing Plan has been developed to meet the existing topography, soil conditions, and apparent hydrology of the Project Site. If, in the course of construction, substantial changes are made to any of these existing characteristics, it will become necessary to alter, in the field, the Trail Stationing Plan. The current schedule of construction details associated with this work and described below will be used to adapt the plan to actual conditions. Refer to paragraph 1.03.D.
 3. Prior to performing the work of this section, verify the condition of the rough grade as being in conformance with the above paragraphs 3.03.A.2 and 3.03.B. Obtain Urban Forester approval of conditions as adequate to proceed.
 4. Provide clean, uncontaminated surfaces.
- B. Standard Trail Section
1. Generally, Standard Trail Section consists of a 48" (standard) or 72" (wide section) wide trail tread on grade.
 2. Import and place Trail Surfacing in a single lift to the dimensions specified in the details. Provide sufficient material to insure a full 3" depth following compaction.
 3. Compaction
 - a. Perform compaction only under suitable conditions. Do not compact excessively wet or dry material or when the sub-grade soils are excessively wet or dry. Allow materials to dry or add clean water as necessary to achieve optimum moisture.
 - b. Mechanically compact the Trail Surfacing to the maximum density supportable by the underlying soils.
- C. Turnpike
1. Generally, Turnpike shall consist of a 48" (standard) or 72" (wide section) wide trail tread on grade, retained by 8"x 8" Pressure Treated ACQ timbers pinned to the sub-grade with 24" of #4 deformed reinforcing bar, 3 bars per timber.
 2. Layout and set bottom of retaining timbers flush to, or up to 1/2" below, compacted sub-grade, end to end with no gaps between timbers. Stagger joints on opposing sides of tread where practical. Miter ends of timbers equally where trail alignment turns.

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3. Pre-drill timbers 3/8", to accept reinforcing bar pins, at 12" from each end and at center. Set 24" - #4 reinforcing bar pins into stable soil to a depth of 3/4" below the top of retaining timber.
4. Import and place, in one lift, sufficient Trail Surfacing to provide an average depth of 4" following compaction, with a crown of 1" above top of retaining timbers.
5. Compaction per 3.04.B.3, above.

D. Water Bars

1. Generally, Water Bars are intended to both divert surface water off the trail and stabilize Trail Surfacing. Construct Water Bars of 6"x6" Pressure Treated ACQ timbers pinned to the sub-grade with 24" - #4 deformed reinforcing bar, 2 bars per timber. Install Trail Surfacing, as for Standard Trail Section, paragraph 3.04.B above.
2. Locate timbers flush to the prepared sub-grade, spaced per the Trail Stationing Plan. Where formal drainage ditching is scheduled, set timbers to divert surface run-off into these ditches. Where no formal drainage work is associated with the Water Bars, set the timbers to divert surface run-off generally down-slope.
3. Pre-drill timbers perpendicular to the prevailing slope 3/8", to accept 24" - #4 reinforcing bar pins, at 6" from each end. Set reinforcing bar pins into stable soil to a depth of 1" below top of timber.

E. Timber Steps

1. Generally, Steps are constructed of 6"x6" LP-22 timbers arranged in a "crib-work" fashion, each riser consisting of 2 sides and a leading edge, stacked and staggered to fit the slope to the tolerances indicated in the drawings. Individual timbers are fastened with 30" - #4 deformed reinforcing bars as indicated below.
2. Begin all Step construction at the bottom of the slope by excavating a stable, flat bench slightly larger than the design dimensions of the Step. Mechanically compact this bench to the maximum density supportable by the soils present, assuming optimum moisture content per paragraph 3.04.B.3 above.
3. Arrange the timbers per the drawing, with the leading edge timber spanning the full width of the Steps. Length of the sides of the crib-work will vary depending on the slope. Provide sufficient length for the next Steps sides to overlap a minimum of 12".
4. Pre-drill timbers plumb 3/8", to accept 30" - #4 reinforcing bar pins, as follows;
 - a. For leading edge timbers, at 2 places, 4" from each end.
 - b. For side timbers, at 4" from exposed ends.

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- i. If tread will be longer than 24", one place centered between exposed end and leading edge of the next riser.
- ii. If last riser at top of steps, 3 places, 12" on center beginning 4" from each end.

Set pins into stable earth to a depth of 3/4" below top of each timber.

5. Backfill each Step as it is constructed by importing sufficient Trail Surfacing in a single lift, to completely fill the crib-work upon compaction per 3.04.B.3, above.
6. Begin construction of successive risers directly atop the preceding riser, using the drilling and pinning procedure, paragraph 3.04.E.4 above, to secure the overlapped portions of the riser below.
7. Backfill the sides of the completed Steps with Native Mineral Soil to a point 2" below the bottom of the leading edge timber of each step.

F. Puncheons and Railings

1. Generally, Puncheons are wooden structures constructed with either post-and-beam construction for sections over 14" above grade or mud-sill construction for sections under 14" above grade. Sections more than 30" above grade require a handrail. All timbers lumber, and fasteners are per paragraphs 2.03.B and 2.03.C above, sized per the details or as appropriate for the task.
2. Refer to other Specifications of this project for details regarding installation of Sewer Interceptor supported by Puncheons or Boardwalks.
3. At the Contractors option, all construction of Puncheons under 20' in total length associated with this project may be of the post-and-beam construction technique described for Footbridges over 14" above grade, or per details provided for Boardwalks or Footbridges over 20' in overall length.
4. Construct all Puncheons components plumb and level, with the exception of extreme ends, which may transition at up to, but no more than, a 5% slope down to the successive or proceeding trail detail.

3.05 Drainage

A. General

1. Work of this Section consists of all services, labor, equipment, and materials necessary to construct the Drainage work associated with the trail system described in the Trail Stationing Plan. This includes construction of Drainage Dips, Drainage Ditches, Rock-Lined Sumps, Culverts, Leadoff Ditches, and associated Rock Spillways.
2. The Trail Stationing Plan has been developed to meet the existing topography, soil conditions, and apparent hydrology of the Project Site. If, in the course of construction, substantial changes are made to any of these existing characteristics, it

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will become necessary to alter, in the field, the Trail Stationing Plan. The current schedule of construction details associated with this work and described below will be used to adapt the plan to actual conditions. Refer to paragraph 1.03.D.

3. Verify that the condition of areas scheduled to receive drainage work is consistent with the requirements of paragraph 3.03.B.4 above. Obtain Engineer approval of conditions as adequate to proceed.

B. Drainage Dips

Where directed by the Trail Stationing Plan to install a Drainage Dip, refer to the detail and provide the necessary grading alteration to the specified trail construction detail, paragraph 3.04, above. Each Drainage Dip shall collect and divert surface run-off down-slope to an associated Rock Spillway, paragraph 3.05.G, below.

C. Drainage Ditches

1. Where indicated on the Trail Stationing Plan, Drainage Ditch refers to a surface run-off interceptor trench that runs parallel to and up-slope from the trail and perpendicular to the prevailing slope
2. Where directed by the Trail Stationing Plan, excavate Drainage Ditches to the dimensions indicated in the details. Provide ditch bottoms that slope positively to the associated outlet.
3. Where Drainage Ditches slope at greater than 1' vertically in 12' for more than 30', provide a 6"x6" timber check-dam across the bottom of the ditch, embedded 12" into each side, 10' spacing. Secure the timber check-dam as for Water Bars, paragraph 3.04.D.3 above, except 12" from each end.

D. Rock-Lined Sump

Where directed by the Trail Stationing Plan to install a Culvert associated with a Drainage Ditch, install on the up-slope side of the trail or trail structure a Rock-Lined Sump (Sump) as follows;

1. Identify the intersection point of the flow-line of the culvert and the flow-line of the associated ditch to be drained. At the point of intersection, excavate sufficient undisturbed Native Mineral Soil to allow the excavation to be tightly lined with Rock, per paragraph 2.04.B above, leaving a sump approximately 1 foot deep below bottom of ditch invert of Culvert with a capacity of 2 cubic feet. Dimensions for Sump should be approx. 1'-5 square or 1'-7 diameters.
2. Beginning with the bottom of the Sump and working up to the bottom of the associated Drainage Ditch, line the Sump with Rock. Rock should fit tightly, with no gaps over 2" in any dimension. Provide additional Rock across the bottom of the Drainage Ditch which over-hangs the Sump 1" to protect the Sump walls from out-wash.
3. Pack joints in the bottom of the Sump with 5/8" Minus Crushed Rock per paragraph 2.03.A.

E. Culvert

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1. Generally, Culverts occur either at the apparent low-point of a Drainage Ditch or as a surface water run-off outlet along flat, wet runs of trail. If for reasons defined in paragraph 3.04.A.2, the Trail Stationing Plan identifies a location as scheduled to receive a Culvert that does not appear to meet these criteria, notify the Project Manager and obtain specific direction before proceeding with the work.
 2. Culverts have, normally associated with them, the following additional elements;
 - a. Rock-Lined Sump, paragraph 3.05.D, above.
 - b. Leadoff Ditch, paragraph 3.05.F, below.
 - c. Rock spillway, paragraph 3.05.G, below.
 3. Install Culverts as follows;
 - a. Generally perpendicular to trail, sloping to drain down-slope.
 - b. Extend Culvert 12” beyond edge of trail up-slope or 4” into Sump
 - c. Extend Culvert 12” beyond edge of trail down-slope
 - d. Invert of pipe at inlet shall be either
 - i. Flush with finish grade at Culverts not associated with Drainage Ditches.
 - ii. At 6” below bottom of Drainage Ditch.
 - e. Minimum cover over Culvert shall be 6”.
 - f. Invert of Culvert out-fall shall be sufficiently lower than the inlet to provide adequate flow, generally 2-5%.
 - g. Where the existing slope permits, construct a Rock Spillway at the out-fall of the Culvert.
 - h. Where the existing slope would otherwise inhibit discharge of the out-fall, construct a Lead-off Ditch, paragraph 3.05.F
- F. Lead-off Ditch
1. Construct a Leadoff Ditch where directed by the Trail Stationing Plan or where the elevation of the out-fall of a Culvert would otherwise be below existing grade.
 2. Leadoff ditches shall have a flat bottom 8” in width shall be a minimum 12” in depth, depth increasing as necessary to provide a 2% slope to a point where

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natural grade allows for discharge. Leadoff Ditches shall be excavated into previously undisturbed earth.

3. At the out-fall point of all Leadoff Ditches, provide a Rock Spillway, paragraph 3.05.G.

G. Rock Spillway (no detail for this in drawings)

Install Rock Spillways (Spillway) at the out-fall point of all drainage structures as follows;

1. Use only imported rock, which complies with paragraph 2.04.B of this specification.
2. Extend the Spillway the width or diameter of the drainage structure discharge to each side of the discharge point and 3 times that dimension down-slope. Slope the Spillway to drain a minimum 2% or to conform to the existing slope. Embed the Rock so that only the top plane is exposed, butting all joints as tightly as possible. Pack all resulting joints with 5/8" Minus Crushed Rock complying with paragraph 2.03.A.

3.06 Soil Reconditioning

A. General

The intent of the work of this section is to provide a complex soil profile and finished grade for planting that is more conducive to the survival of native plant species scheduled for restorative planting. All areas of disturbance, generally those consisting of exposed mineral soils unless otherwise directed by the Urban Forester, shall receive Soil Reconditioning.

- B. Identify the limits of disturbance remaining following the work of paragraphs 3.03, 3.04 and 3.05. Verify that the condition of rough grades encountered is in compliance with paragraph 3.03.C, as appropriate for the specific location. Obtain Urban Forester approval of the conditions as adequate to proceed before commencing the work.
- C. Distribute equally all stockpiled Native Organic Material over the disturbed areas identified above. Incorporate this material into the top 2" of the sub-grade soil. Roll or otherwise lightly compact the resulting surfaces to form a consistent mat.

3.07 Planting

A. General

1. All areas of disturbance not occupied by drainage, trail on-grade, or related appurtenance, shall receive Planting, including areas beneath Bridges, Boardwalks, or Puncheons.
2. Refer to the Trail Stationing Plan for identification of areas to receive plant material from each of the four Plant Schedules. Calculate the total area associated with each Plant Schedule, and provide a copy of the purchase order to the Urban Forester for approval, per paragraph 1.03.C.

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3. Provide and maintain stationing stakes indicating limits of planting for each schedule.
4. Planting activity is to take place between October 1st and December 1st only, unless site conditions warrant otherwise or authorized by Urban Forester.
5. Prior to commencing planting activity, obtain approval of the plant material per paragraph 1.03.B.2.

B. Shipping and Handling

1. Plant material received on-site showing evidence of mishandling such as tightly bound or broken branches, crushed or misshapen containers or root-balls, or stripped, crushed, or severely bruised foliage will be rejected and must be removed from the project site immediately.
2. Plant material shall be transported to the planting location with extreme care and attention. Do not handle plant material by any means other than fully supporting the container or root-ball. Previously accepted plant material showing evidence of mishandling, such as broken branches or loose root-balls will be rejected and must be removed from the site immediately.

C. Tree Location

Stake for DPR approval the locations of individual trees. Locate in a natural, random pattern. Alternatively, provide DPR with stakes pre-marked by species and in the specified quantities for placement within 48 hours of receipt.

D. Preparation and Planting

1. Excavate planting pit approximately one and one half times as deep as the root mass provided with the plant and twice as wide.
2. Planting Backfill

To the excavated soil, thoroughly incorporate the manufacturers recommended rate for Moisture Retention Agent and the Native Organic Material found at the surface of the pit.

3. Gently disturb the root ball of the plant manually; loosen or cut tightly wound or matted roots.
 4. Set the plant plumb in the planting pit on a small mound of soil, spreading roots out, and add Planting Backfill. By hand, compact the backfill to eliminate air pockets.
-

5. Sufficient Planting Backfill should result in the plant root crown being flush or slightly above, the surrounding grade.
6. Where practical, water plants thoroughly.

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3.08 Mulching

Provide 4" wood chip mulch, or alternately, a uniform 2" layer of unbound Wood Excelsior Erosion Control Blanket over all disturbed areas not covered by trail on-grade or drainage appurtenances.

3.09 Warranty

- A. Prior to Project Closeout, coordinate a punch-list walk-through with the Urban Forester and DPR.
- B. Correct any punch list items to the standards established by the Trail Stationing Plan, Plant Schedules, details, and this Specification. Upon satisfying the requirements of the punch list, request DPR acceptance of the work as substantially complete.
- C. Warranty the materials and workmanship for a period of one year from date of DPR acceptance as substantially complete, as follows;
 - 1. At 6 months, coordinate an inspection of the condition of the work and correct, in a timely manner, any damage or failure as follows;
 - a. For plant material, replace 100% of trees and shrubs and 50% of groundcovers showing significant sign of decline as determined by DPR. Exclusion to this warranty is allowed for obvious mechanical damage due to vandalism or natural processes.
 - b. For Drainage work and Trails or Trail Appurtenances, repair and/or replace any defects which may have occurred other than obvious mechanical damage due to vandalism.
 - 2. At the one-year anniversary, coordinate an inspection of the condition of the work and correct, in a timely manner, any damage or failure as follows;
 - a. For plant material, replace 50% of trees and shrubs showing significant sign of decline as determined by DPR. Exclusion to this warranty is allowed for obvious mechanical damage due to vandalism or natural processes.
 - b. For Drainage work and Trails or Trail Appurtenances, repair and/or replace any defects which may have occurred other than obvious mechanical damage due to vandalism.
 - c. Upon satisfaction of the requirements of the inspections at 6 months and one year, obtain DPR approval of the work as physically complete.

END OF SECTION

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3. Vegetation adjacent to Trails

NATIVE PLANT ASSOCIATIONS: Plant Palettes for Trail Restoration Work

Adapted from “*Grow your Own Native Landscape*” by Michael Leigh, Native Plant Salvage Project; Cooperative Extension; WSU/Thurston County

The following plant lists are species recommended for trail-side planting. There are 4 different groups specified for varying conditions. Each group is further divided as follows:

Zone A - 3 feet adjacent to the trail - plant no species greater than 3' high x 2' spread

Zone B - 5 feet on each side of trail - plant no species with greater than 5' spread

Note: species in bold face are considered hardiest for trailside use.

1. DEEP SHADE/ MOIST SOILS

Ground Covers: (plant in Zone A – 3ft. on each side of trail)

lady fern (*Athyrium filix-feminina*)

salal (*Gaultheria shallon*)

sword fern (*Polystichum munitum*)

Bunchberry (*Cornus unalaschensis*), deer fern (*Blechnum spicant*), false Solomon's seal (*Maianthemum racemose ssp ampexicaulis*), foam flower (*Tiarella trifoliata*), Pacific bleeding heart (*Dicentra formosa*), Piggy back plant (*Tolmeia menziesii*), redwood oxalis (*Oxalis oregana*), snowberry (*Symphoricarpos albus*), wild strawberry (*Fragaria spp.*)

Tree & Shrub Understory: (plant in Zone B – 5 ft. on each side of trail)

low Oregon Grape (*Berberis/mahonia nervosa*)

red huckleberry - on stumps & logs (*Vaccinium parvifolium*)

red osier dogwood (*Cornus sericea ssp. occidentalis*)

red elderberry (*Sambucus racemose ssp. Pubens var. arborescens*)

evergreen huckleberry (*Vaccinium ovatum*), vine maple (*Acer circinatum*).

Canopy: (plant in Zone C - furthest from trail, or not at all)

Western Hemlock (*Tsuga heterophylla*), Western Redcedar (*Thuja plicata*), Cascara (*Rhamnus purshiana*), Douglas fir (*Pseudotsuga menziesii*)

2. PARTIAL SHADE/ WELL-DRAINED SOILS

Ground Covers: (plant in Zone A – 3' on each side of trail)

sword fern (*Polystichum munitum*)

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trailing yellow violet (*Viola sermpervirens*)

Twinflower (*Linnaea borealis* ssp. *Longiflora*), deerfoot vanilla-leaf (*Achlys triphylla* ssp. *Triphylla*), western trillium (*Trillium ovatum* ssp. *Ovatum*)

Tree & Shrub Understory: (plant in Zone B – 5' on each side of trail)

bald hip rose (*Rosa Gymnocarpa* var. *gymnocarpa*)

indian plum (*Oemleria cerasiformis*)

low Oregon Grape (*Berberis nervosa*)

oceanspray (*Holodiscus discolor*)

red huckleberry (*Vaccinium parvifolium*), on stumps and logs

salal (*Gaultheria shallon*)

beaked hazelnut (*Corylus cornuta* var. *californica*), evergreen huckleberry (*Vaccinium ovatum*), mock orange (*Philadelphus lewisii* var. *gordonianus*), western serviceberry (*Amelanchier alnifolia* var. *humptulipensis* or var. *semiintegrifolia*), red-flowering currant (*Ribes sanguineum* var. *sanguineum*), vine maple (*Acer circinatum*) (

Canopy: (plant in Zone C - furthest from trail or not at all)

Bitter cherry (*Prunus emarginata* var. *mollis*); Douglas fir (*Pseudotsuga menziesii*); Western Redcedar (*Thuja plicata*); Grand fir (*Abies grandis*); high bush cranberry (*Viburnum edule*)

3. SUN/MOIST SOILS

Ground Covers: (plant in Zone A– 3' on each side of trail)

lady fern (*Athyrium filix-femina*)

sword fern (*Polystichum munitum*)

false lily-of-the-valley (*Maianthemum dilatatum*), Pacific bleeding-heart (*Dicentra formosa* ssp. *formosa*), Sawbeak sedge (*Carex stipata*), small-fruited bulrush (*Scirpus microcarpus*), **violets** (*Viola* species)

Tree & Shrub Understory: (plant in Zone B – 5' on each side of trail)

pacific willow (*Salix lucida* ssp. *Lasiandra*)

red-osier dogwood (*Cornus sericea* ssp. *Occidentalis*)

Sitka willow (*Salix sitchensis*)

thimbleberry (*Rubus parviflorus* var. *Parviflorus*)

black twinberry (*Lonicera involucrata* var. *involucrata*), clustered wild rose (*Rosa pisocarpa*), Nootka rose (*Rosa nutkana* var. *muriculata* or var. *nutkana*), **Pacific ninebark** (*Physocarpus capitatus*), vine maple (*Acer circinatum*)

Canopy: (plant in Zone C - furthest from trail or not at all)

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Big leaf maple (*Acer macrophyllum*), bitter cherry (*Prunus emarginata* var. *mollis*), black cottonwood (*Populus basamifera* ssp. *Trichocarpa*), black hawthorn (*Crataegus suksdorfii*); common chokecherry (*Prunus virginiana* var. *demissa*), Pacific crabapple (*Malus fusca*), red alder (*Alnus rubra*)

4. SUN/ WELL-DRAINED SOILS

Ground Covers: (plant in Zone A – 3' on each side of trail)

sword fern (*Polystichum munitum*)

kinnikinnick (*Arctostaphylos uva-ursi*), coastal strawberry (*Fragaria chiloensis*), twinflower (*Linnaea borealis*), sedum (*Sedum*), lupine (*Lupinus polyphyllus*), Cardwell's penstemon (*Penstemon cardwellii*)

Tree & Shrub Understory: (plant in Zone B – 5' on each side of trail)

bald hip rose (*Rosa gymnocarpa*)

evergreen huckleberry (*Vaccinium ovatum* var. *ovatum*)

indian-plum (*emleria cerasiformis*)

oceanspray (*Holodiscus discolor*)

red-flowering currant (*Ribes sanguineum* var. *sanguineum*)

salal (*Gaultheria shallon*) snowbrush (*Ceanothus velutinus* var. *hookeri*)

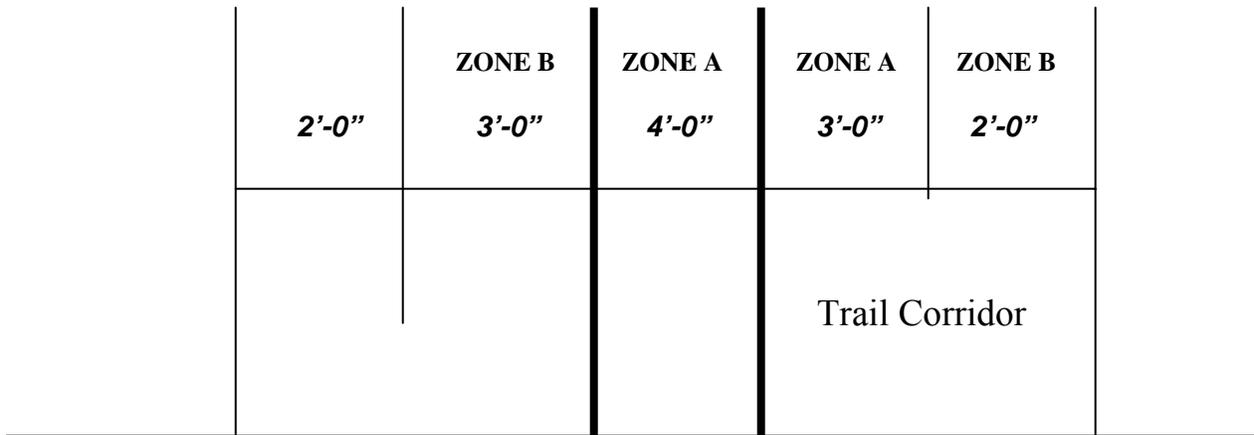
blue elderberry (*Sambucus cerulea* var. *cerulea*), hairy manzanita (*Arctostaphylos columbiana* ssp. *Columbiana*), mock orange (*Philadelphus lewisii* var. *gordonianus*), western serviceberry (*Amelanchier alnifolia* var. *humptulipensis* or var. *semiintegrifolia*), red huckleberry (*Vaccinium parvifolium*, on stumps and logs), vine maple (*Acer cincinatum*), (orange honeysuckle (*Lonicera ciliosa*))

Canopy: (plant in Zone C - furthest from trail or not at all)

bitter cherry (*Prunus emarginata* var. *mollis*), common chokecherry (*Prunus virginiana* var. *demissa*), Douglas fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), Pacific Shore pine (*Pinus contorta*); beaked hazel (*Corylus cornuta* var. *californica*)



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TYPICAL TRAIL PLAN

4. Trail Maintenance Standards

The maintenance of trails hinges on the construction and maintenance of proper drainage systems along trails. See "Drainage" above. Trail surfaces can be composed of bare mineral soil, wood chips, or crushed gravel. The existing surface can be maintained by adding the same material that is already there. Do not mix surface treatments. Restrict access or close any excessive and redundant social trails using barriers and plantings.

Maintaining the Trail Travel Corridor

In order to provide safe and enjoyable hiking experiences year round, all trails should be free of obstructions and brushed out to a height and width of 8 feet. To accomplish this, vegetation and other elements of the urban forests (e.g.: down trees, rocks, debris piles) should be removed from all trail areas if they encroach into the trail travel way.

- Trails should be brushed to 8 feet high and 6 feet wide. All material removed should be safely scattered off trail, down slope, and away from trail structures.
- Vegetation that is not growing over the trail tread *and* is less than 18 inches high does not need to be removed.
- On steep slopes, vegetation on the uphill side of a trail should be brushed back an additional foot while the vegetation on the downhill slope can remain flush to the trail tread. This encourages hikers to use the more stable uphill portion of the trail tread.

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- With a hand pruner, saw, lopper, or weed whip, cut out the vegetation (or other trail obstruction) within 3 feet of the center of the trail.
- Vegetation over 18" tall should always be cut flush with the ground (take out the whole plant) or at the point where a branch connects to its mother branch or trunk. Removing the whole plant, or at least an entire limb, is best because “stubs” (the exposed cuts on plant limbs) pose a danger to future trail users, and often sprout new “branchlets” out into the trail corridor. Pruning this way insures that the plants do not have to be recut year after year.

Maintaining the Trail Backslope

Trails, which are located on sloping terrain (as apposed to trails in relatively flat areas), should not have a backslope in excess of 45 degrees. Steep backslopes force hikers away from the more durable inside (uphill) edge of the trail, and force them to use the outer edge (or shoulder) of the trail where tread material erodes quickly.

- With a Hoe, Pulaski, or Pick Mattock, loosen all material needing to be excavated from the backslope and remove it with a shovel. In most cases, vegetation and other forest debris will have to be removed before excavation can begin.
- The backslope of all trails should be maintained at an angle less than 45 degrees.
- All material removed while maintaining the proper backslope should be safely scattered well off trail, down slope, and away from trail structures.

Maintaining the Trail Tread

Trail tread should always be 4 feet wide, smooth, hazard free, free of standing water and mud, properly graded for effective surface water runoff, and consist of hard packed mineral soil, gravel, or crushed rock.

- Trail tread should be uniformly smooth and slightly out-sloped (about 5 degrees), or crowned. Out-sloping the trail means grading the trail tread so it is lower nearest the outer (and down hill) edge of the trail and highest at the trail’s inner (or uphill) edge.
- A crowned trail means the trail's tread is highest in the trail’s center, and gently slopes downward towards the outer edges of the trail. Trail tread, which is crowned or out-sloped, encourages surface water to

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drain off trail (sideways) rather than down the trail. Water, which is allowed to run down the trail causes erosion and will increase the amount of maintenance a trail will need.

- All plant life growing on the trail tread (including moss, grass, flowers, weeds, etc) should be removed, and standing water or muddy areas should be eliminated.
- With a Pulaski, Pick Mattock, or Hoe, remove all roots, rocks, logs, or other tripping/stumbling hazard from the trail tread.
- Tread hazards should be chopped or dig out to a depth of 6 inches and the resulting hole filled with mineral soil, gravel, or crushed rock. Always tamp the worked area with a McLeod or tamper to compact the new material consistent with the overall tread.
- To create a trail tread that drains well (as described above), use a Pulaski, Pick Mattock, Hoe, or shovel to move material from one area of the tread to another to create a proper trail outslope or crown. Compact all material with a McLeod or tamper. Use a Smart level to ensure a slope of 2-5%.
- To eliminate mud puddles or areas of standing water, use a shovel or McLeod to remove all muddy soil and moisture from the trail tread. Once all moisture and mud is removed, fill in the resulting depression with mineral soil, gravel, or Crushed rock, and re-establish the trail's outslope or crown. Tamp down all tread material with a McLeod or Tamper.
- In areas where the trail has expanded so the tread is more than 3 feet wide, move nearby forest materials (such as plants, leaves, sticks, old logs, and large rocks) into the trail so the tread is brought back to the appropriate size.
- Any items put within reach of the trail must be firmly in place and resistant to rocking or tipping.) If the trail in question is on a slope, always cover the downhill portion of the tread so as to retain the upper 4 feet of tread.

Maintaining Timber Steps, Board Walks, Puncheon, Footbridges

- Use a shovel blade to scrape out any material from the wood. Stairs and wooden structures should be completely free of debris and plant life at all times.

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- The shovel blade can also be used to test the integrity of the wood and to check for rot. For puncheon and footbridges be sure to check the sills or supports for level and integrity.
- Using a small sledge drive any exposed re-bar back into the structure to avoid tripping hazards.

Maintaining Rockwalls

- By hand, check the rockwall for loose components and use smaller rock to fill in eroded areas.

Maintaining Drainage Structures

Water bars, drain ditches, and culverts should always be clean, clear, and properly sloped to eliminate tread erosion, on trail standing water, and the creation of mud puddles. Culverts, water bars, and drainage ditches should be maintained to allow maximum trail drainage and prevent water from flowing onto the trail. If materials are damaged, rotten, or easily kicked out of place, the structure should be replaced.

All drainage structures made of wood, plastic, or similar materials should be firmly in place, resistant to prying, and free of rot or other damage

1. Drain Ditches

- Use a Pulaski, Mattock, McLeod, Hoe, or shovel to maintain drainage ditches to a depth and width of one foot. Most importantly, eliminate ditch walls, which are greater than 50 degrees. The walls of all drain ditches should be angled less than 50 degrees to reduce and eliminate dirt or other forest debris from sloughing off the walls and into the ditch. Any nearby logs, rocks, or sticks should be moved well away from the ditch to allow the trail Maintenance Staff easy access, and any plant life growing in the ditch should be removed.

2. Water Bars

- Use Pulaski, Mattock, McLeod, Hoe, or shovel to remove all debris and excess dirt from the uphill edge of Water Bar. A slight depression should be maintained along the upper edge of the water bar to facilitate collection and diversion of surface water from the trail. Maintain the water bar's leadoff ditch at its downhill end consistent with a standard drain ditch (as described above). The trail tread on the downhill or "downtread" edge of the water bar should be flush with (or slightly higher than) the top of the water bar, while the upper edge, or

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“uptread” part of the water bar (the one nearest where the water flows) should be slightly lower and packed with gravel so as to prevent water from under cutting the water bar.

3. Culverts

- Use a shovel blade, shovel handle, or a post hole digger to scrape out any material from inside the culvert. Culverts should be completely free of debris and plant life at all times. Catch basins of culverts should be dug out to at least 4 inches lower than the bottom of the culvert. Deep catch basins allow sediments in the runoff to settle out and ensure that water traveling through the culvert is fast flowing and clear. Like drain ditches, catch basins should have sloped walls no greater than 50 degrees and should be free of plant life, debris, sticks, etc... The downslope opening of the culvert should also be free of obstructions and should be maintained as a drainage ditch. If possible, the downslope opening of the culvert should be two inches higher than the bottom of the drain ditch to prevent water from backing up into the culvert.

5.9 Training



Natural Areas BMP Overview

Storm Water management

Arboricultural technology and techniques

Integrated pest management in natural areas and invasive plant control techniques

Environmentally Critical Area protection and regulations

Trail building and maintenance

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5.10 Appendices Lists for Natural Areas

ONLINE REFERENCES

1. **Seattle Department of Parks and Recreation Tree Management, Maintenance, Pruning And/Or Removal Policy**, Number 060-P 5.6.1, June 1, 2001 <http://parksweb/refs/policy/index.htm>
2. **SPR Trail Standards**
<http://www.cityofseattle.net/parks/projects/standards/trails.asp>
3. **Viewpoint Policy (from Tree Policy) Number 060-P 5.6.1, 4.8:**
Views from designated public view parks and viewpoints will be preserved through maintenance and management of parks vegetation in front of or below the viewpoint.
<http://www.seattle.gov/parks/parkspaces/Viewpoints/VMP.htm>
4. Viewpoints List <http://www.seattle.gov/parks/parkspaces/Viewpts.htm>