Critical Areas Restoration and Enhancement

Purpose

This document provides guidance for developing, implementing, and monitoring restoration and enhancement plans for critical areas and buffers within unincorporated King County, consistent with King County Code (KCC) Chapter 21A.24. It is intended to help property owners and project managers understand the steps, standards, and documentation required to restore or enhance critical areas such as wetlands, streams, riparian areas, steep slopes, and wildlife habitat conservation areas.

SECTION I: UNDERSTANDING THE PROCESS

These guidelines apply primarily to small-scale or minor projects typically associated with single-family residential projects. Larger or more complex projects—such as those involving hydrologic alteration, grading over 2,500 square feet, wetland creation, stream channel modification, or significant habitat modification—should follow the King County Critical Areas Mitigation Guidelines and will require coordination with the Department of Local Services, Permitting Division (Permitting) and the Department of Natural Resources and Parks (DNRP).

When a Restoration or Enhancement Plan is Required

"**Restoration**" typically refers to activities that return an area to its prior natural conditions following a temporary impact or unpermitted alteration. It may also be referred to as "revegetation," as it generally requires replanting, but it may also include reestablishment of natural soils or topography.

"**Enhancement**" typically refers to compensatory mitigation activities that improve the ecological functions of an area, and most commonly involves removing invasive plant species and planting additional native species to increase the diversity and complexity of habitats but may include other ecologically beneficial actions.

A restoration or enhancement plan is required when any activity affects or proposes modification to critical areas or buffers regulated under KCC 21A.24, including:

- Buffer averaging, buffer reduction, or riparian area averaging requests under KCC 21A.24.325 or 21A.24.358;
- Alteration exceptions, variances, or other land use permit applications involving critical area or buffer impacts;
- Development permit applications with unavoidable buffer or critical area impacts (e.g., driveway or utility crossings);
- Development proposals directly adjacent to unvegetated or sparsely vegetated buffers that require revegetation under KCC 21A.24.325.C;
- Code enforcement actions for unpermitted clearing, grading, or filling;
- Voluntary restoration to enhance degraded habitat or correct prior disturbances, if not exempt under KCC 16.82.051.

All projects must demonstrate no net loss of ecological function and compliance with county, state, and federal environmental protection standards.

Qualified Ecological Professional Requirement

All restoration and enhancement plans must be prepared or directly overseen by a qualified ecological professional, which is defined in KCC 21A.06 as:

> A person having a degree in ecology, wildlife biology, wetland biology, fisheries, botany, soil science, environmental science, natural resource management, or a closely related field, with a minimum of five years of professional experience related to the subject ecological field. Professional certification in a relevant ecological field can be substituted for two years of professional experience.

Retaining an ecological professional is strongly recommended to ensure that plans meet the technical and ecological performance standards required for County approval and long-term ecological success.

Required Process Steps

A. Preparation of Restoration or Enhancement Plan
An ecological professional must prepare or oversee the plan to ensure scientific accuracy and compliance with regulatory standards. The plan must include all elements described in Section II, including site assessment, planting plan, and performance standards.

B. Financial Guarantee (Bond) Estimate
Complete a Bond Quantity Worksheet to determine the financial guarantee amount. This ensures the county can complete the project if the applicant fails to meet permit obligations.

C. Submittal and County Review
Submit the completed plan and bond worksheet for review by the county Ecologist assigned to your application. The county will assess compliance with KCC 21A.24 and provide comments or required revisions.

D. Approval and Financial Guarantee Posting
Upon plan approval, post a financial guarantee (performance bond) per KCC 27A.32.090.

E. Recording of Critical Areas Notice on Title
Record a Notice on Title provided by your county Ecologist identifying the critical areas and associated restrictions (KCC 21A.24.170).

F. Installation and Inspection
Install the approved mitigation according to the approved plan. Notify your county Ecologist for a post-installation inspection.

G. Monitoring and Reporting
Conduct annual monitoring for 5 years (unless a different time period is directed in the permit conditions). Submit annual reports to King County documenting progress toward performance standards. Supervision of monitoring by an ecological professional is recommended.

H. Contingency and Adaptive Management
If monitoring reveals the project does not meet performance standards, the ecological professional must develop a Contingency Plan under KCC 21A.24.034C, detailing corrective measures and extended monitoring, as needed.

SECTION II: TECHNICAL GUIDANCE FOR DEVELOPING AND IMPLEMENTING A PLAN

A complete plan includes a technical report and a scaled planting plan.

Step 1: Technical Report Components

A. General Project Information

Provide parcel number, address, and project description, and relevant permit numbers.

B. Existing Site Conditions

Summarize current physical, hydrologic, and ecological conditions, including vegetation composition, topography, hydrology, soils, and any observed impacts. Summarize prior conditions as accurately as possible if unauthorized alterations have occurred. Reference prior delineations or critical area reports, as well as aerial photos when necessary.

C. Impact Analysis

Quantify the total and functional impact area (square feet) by critical area and habitat type (*e.g.,* emergent or forested). Include tables summarizing these impacts, including temporary and permanent impacts. Where applicable, differentiate between short- and long-term temporary impacts and direct and indirect permanent impacts. Refer to *Wetland Mitigation in Washington State – Part 1* (WA Dept. of Ecology, 2021) for guidance. Apply the ratios specified in KCC 21A.24 to determine the required mitigation area.

D. Mitigation Concept

Summarize the proposed restoration or enhancement activities (*e.g.*, "Replant 1,200 sq. ft. of degraded wetland buffer with native trees and shrubs to replace lost vegetation functions"). Indicate if there are areas where proposed enhancement activities will not fully offset functional losses at a 1:1 ratio (*e.g.,* a forest where only one stratum will be enhanced) and if additional enhancement area is proposed as a result.

E. Goals and Objectives

Identify measurable goals focused on improving ecological function, such as increased native vegetation cover, improved hydrologic stability, or enhanced habitat connectivity.

F. Performance Standards

Establish measurable success criteria. The following two performance standards are required as part of every enhancement project:

#	Performance Standard
1	Following year 1 of monitoring, there will be 100% survival of all planted species. Following year 3, there will be 80% survival rate of all planted species or equivalent replacement by a combination of planted and recolonization of native species. During year 5, there will be 75% survival rate or equivalent replacement.
2	After installation and following every monitoring event for a period of five years, exotic and invasive plant species will be maintained at levels below 10% total cover in the planting area.

Other examples of performance standards are provided below. Standards should be tailored as needed to reflect expected natural conditions of the target plant community.

#	Performance Standard
1	Percent of bare ground will not exceed 15% at any time after completion of planting during the five-year period.
2	At least 3 native species will be present in each vegetative stratum, with no single species representing more than 50% of the relative cover during any point in the monitoring period.
3	For wetland sites, at least 50% of the plant cover will be consist of OBL, FACW, or FAC species according to the most current version of the National Wetland Plant List: Western Mountains, Valleys, and Coast Region
4	Following year 1, tree and shrub cover will be at least 10%. Following year 3, tree and shrub cover will be at least 20%. By the end of year 5, tree and shrub cover will be at least 35%.

G. Planting Plan (described in more detail in step 2)

Include a scaled map showing plant locations, species, spacing, and quantities. Also show any supplemental habitat enhancement measures (e.g., large wood, snags, nest boxes). Use locally native plant species that are appropriate to site conditions and sourced from regional nurseries. If climate adaptive species are proposed, explain why locally native species are not expected to survive long-term site projected conditions.

H. Implementation and Maintenance Approach

Describe methods for invasive species removal, site preparation (*e.g.,* soil decompaction and amendments), planting (including mulch placement), and short-term irrigation or protection (*e.g.*, deer fencing). For invasive species removal, hand-held tools should generally be used, although more intensive methods prescribed by the King County Noxious Weed Control Board may be proposed for large infestations, and must be approved by the assigned county Ecologist.

I. Monitoring Plan (see Appendix B for guidance)

Provide the methodology (*e.g.*, transects, photopoints, percent cover surveys, water level monitoring wells) and schedule for monitoring compliance with performance standards. Under a 5 year monitoring period, monitoring is required at minimum during years 1, 3, and 5. If problems are identified during any monitoring year, monitoring should be done during the subsequent year.

J. Contingency Plan

Identify potential risks and adaptive measures, such as supplemental planting, soil amendments, or revised maintenance practices.

Step 2: Design

Planting design should mimic natural patterns and maximize habitat value.

Minimum recommended densities:

Vegetation Stratum	Density	Approximate Spacing
Trees	0.012 per sq. ft.	9 ft.
Shrubs	0.028 per sq. ft.	6 ft.
Groundcover	0.25 per sq. ft.	2 ft.

If the enhancement area has existing vegetation, it may be appropriate to modify the planting densities to accommodate the existing plants. It may also be appropriate in some cases, depending on natural site conditions, to propose 2 strata instead of 3, or use native grass seed in place of groundcover species. In most cases, at least 3 different species should be used for each applicable stratum, but this may vary for especially small or large sites, or sites with highly selective ecological conditions.

Step 3: Installation

Plant during fall through early spring (October–March) for best establishment. It is important to install the mitigation as it is shown on the plans. All substitutions or species changes from approved plans **must** be approved by a King County Ecologist **before** installation. If any issues are encountered during project construction that might lead to a need to shift any project components, including the mitigation areas, contact the assigned King County Reviewer **immediately**, before changing any part of the approved plans.

Step 4: Inspection

After installation, the applicant or consultant must contact the assigned King County Ecologist to schedule a site inspection. Provide an as-built plan of the mitigation that indicates where any species substitutions or adjustments of spacings or arrangements have occurred.

Step 5: Maintenance

Maintenance activities typically include:

- Invasive species control;
- Irrigation during first two growing seasons;
- Mulching and soil stabilization;
- Temporary fencing or other deterrents to protect young plants from wildlife, if necessary.

Step 6: Monitoring and Reporting

Monitoring reports should include:

1. Site map showing monitoring points;
2. Monitoring year and period;
3. Quantitative data (e.g., vegetation cover, species survival, invasive species percentage);
4. Photo documentation;
4. Evaluation of performance standard achievement;
5. Recommended contingency actions if needed.

Step 7: Final Inspection

At the end of the monitoring period, if the restoration or enhancement area meets all performance standards, provide the final monitoring report and contact the assigned county Ecologist. In the event of personnel changes, email permitquestions@kingcounty.gov for assistance. If performance standards are not met, the monitoring period may require an extension, along with contingency actions. Once mitigation receives final approval, the financial bond will be released, and formal monitoring is no longer required, but the area must still be protected from disturbance in perpetuity.

References

King County

- Department of Local Services, Permitting
- On-line Permit Status, Invoice Payment and Inspection Scheduling IVR
- Guidance on Choosing an Ecological Consultant
- King County Noxious Weed Control
- Native Plant Nursery List
- Native Plant Guide

Washington State Department of Ecology

- Wetland Mitigation in Washington State Part 1: Agency Policies and Guidance

US Army Corps of Engineers

- Wetlands Delineation Manual. January 1987
- Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region. May 2010

APPENDIX A

Habitat Worksheet

Project Name:

Project Number:

Location:

Contact Name:

LIGHT NEEDS*

SI=Shade Intolerant ST=Shade Tolerant

SD=Shade Dependent HA=Highly Adaptable

SITE PLACEMENT**

DB=Drier Buffer WB=Wetter Buffer SW=Shallow Water

WE=Water's Edge SS=Saturated Soils

Habitat requirements derived from: *Flora of the PNW* (Hitchcock & Cronquist); *Plants of the PNW Coast* (Pojar & MacKinnon); Wetland Plants of Western WA (Cooke); Guidelines for Bank Stabilization Projects and Surface Water Design Manual (King County); Proceedings of the Puget Sound Wetlands and Stormwater Management Research Study (9/26/96); and Permitting field observations.

TREES						
Scientific Name	Common Name	Indicator Status	Max Ht.	Light Needs*	Site** Placement	Comments
*Abies grandis**	grand fir	FACU-	125	SI-ST	DB	Best conifer for soil binding roots
Acer macrophyllum	big leaf maple	FACU+ [FAC]	100	SI-ST	WB,DB	Seral/sprouter - shallow rooter
Alnus rubra	Red alder	FAC	80	SI-ST	WB,DB	Seral, sprouter & spreader
Arbutus menziesii	Pacific madrone	UPL	80	SI	DB	Likes drier, coastal: slow-grower
Betula papyrifera	paper birch	FACW	80	SI	WE, SS	Saturated soils
Fraxinus latifolia	Oregon ash	FACW	80	SI-ST	WE,SS	Requires flat, damp soils
*Picea sitchensis**	Sitka spruce	FAC	230	SI	WE,SS	Wettest conifer
*Pinus contorta**	Shore pine	FAC	60	HA	WE,WB,DB	Tolerates poor soil
*Pinus monticola**	Western white pine	FACU- [FACW]	120	SI	WB,DB	NOT within 900' of *Ribes* spp.!
Populus tremuloides	quaking aspen	FAC+	75	SI	DB	Seral in montane
Populus trichocarpa	black cottonwood	FAC	200	HA	WE,SS,WB	Seral; sprouter
Prunus emarginata	bitter cherry	FACU	50	SI	DB	Tree form has heavily pubescent leaves.
*Pseudotsuga menziesii**	Douglas fir	FACU	300	SI	WB,DB	Driest conifer-seral, fast grower
*Taxus brevifolia**	Pacific yew	NI [FAC-]	80	ST-SD	WB	Very slow growing
*Thuja plicata**	western red cedar	FAC	230	SD	SS,WE,WB	Basic to PNW & wetlands
*Tsuga heterophylla**	western hemlock	FACU-	200	SD	DB	Dry conifer
All plant prices from Fourth Corner Nurseries, Sound Native Plants, Storm Lake Growers, and Wabash Natives (containers); and Abundant Life and Frosty Hollow (seeds).						

SHRUBS		Indicator	Max	Light	Site	Comments
Scientific Name	Common Name	Status	Ht.	Needs*	Placement	
Acer circinatum	vine maple	FAC-	25	SD	WB,DB	Needs canopy shade or lots of moisture.
Amelanchier alnifolia	serviceberry	FACU	20	SI	DB	Edge-loving
Berberis aquifolium	tall Oregon grape	UPL	7	SD	DB	Dry sites
Berberis nervosa	short Oregon grape	UPL	4	ST-SD	DB	Drier sites
Cornus stolonifera	red-osier dogwood	FACW+	20	ST	WE,SS,WB	Takes sun if has lots of moisture
Corylus cornuta	hazelnut	FACU	15	ST	DB	Good wildlife habitat
Crataegus douglasii	black hawthorn	FAC	20	SI	WB,DB	Typically on meadow hummocks
Gaultheria shallon	salal	FACU	7	ST-SD	DB	Basic forest groundcover
Holodiscus discolor	ocean spray	NI	10	SI-ST	DB	Drought-tolerant, edge-loving
Lonicera involucrata	black twinberry	FAC+	10	SI-ST	WE,SS,WB	Takes sun if has lots of moisture
Myrica gale	sweetgale	OBL	6	SI	WE,SS	Common in scrub-shrub wetlands
Oemleria cerasiformis	Indian plum	FACU	15	SD	WB,DB	Sub-canopy
Oplopanax horridus	Devil's club	FAC+	7	ST	WE,WB	Needs good drainage, forms thickets
Philadelphus lewisii	mock orange	NI	10	SI-ST	WB,DB	Likes streams, good drainage
Physocarpus capitatus	Pacific ninebark	FACW-	20	SI-ST	WB,DB	Needs good drainage
Prunus virginiana	choke cherry	FACU	20		DB	Native to the whole US
Pyrus fusca	western crabapple	FACW	35	SI-ST	WE,WB	Edges - most of value in streamside control
Rhamnus purshiana	cascara	FAC-	30	ST-SD	WB,DB	Found in most wetlands
Ribes bracteosum	stink currant	FAC	10	ST	WB,DB	Transition
Ribes lacustre	prickly currant	FAC+	7	ST	WB,DB	Can take drought
Ribes sanguineum	red-flowering currant	NI	7	SI	WB,DB	Doesn't form thickets!
Rosa gymnocarpa	Wood rose	FACU	7	ST	DB	Tough, hardy
Rosa nutkana	Nootka rose	FAC [OBL]	10	ST	SS,WB	Rapid volunteer on damp soil
Rosa pisocarpa	clustered rose	FAC [FACW]	7	ST	WE,SS,WB	Will hybridize with nootka rose
Rubus leucodermis	black raspberry	NI	10	ST	DB	Good buffer planting
Rubus parviflorus	thimbleberry	FAC-	10	SI	DB	Seral groundcover in clear-cuts, drought tolerant
Rubus spectabilis	salmonberry	FAC+	15	HA	WE,WB,DB	Takes sun if has lots of moisture
Salix geyeriana	Geyer willow	FACW+	15	SI	SW,WE	Likes inundation, sluggish water, wet meadows
Salix hookeriana	Hooker's willow	FACW-	20	SI	SW,WE,SS	Only found <5 mi. from coast
Salix lasiandra	Pacific willow	FACW+	50	HA	WE,SS,WB	Common, tolerant, prefers riparian
Salix scouleriana	Scouler willow	FAC	35	ST	SS,WB,DB	Upland & wetland
Salix sitchensis	Sitka willow	FACW	25	HA	WE,SS,WB	Common, tolerant
Sambucus racemosa	red elderberry	FACU	20	HA	WB,DB	Rapid grower, tolerates sun, seral on clear-cuts
Sorbus sitchensis	Cascade mountain	FACU	15	SI-ST	WB,DB	Montane, not to be mistaken for *S. aucuparia*
Symphoricarpos albus	snowberry	FACU	7	SI	WB,DB	Common, tolerant
Vaccinium ovatum	evergreen	UPL	5	SD	DB	Prefers mature shade
Vaccinium parvifolium	red huckleberry	NI [FACU]	13	SD	DB	Requires lots of organic matter

Sedges and Rushes						
Scientific Name	Common Name	Indicator	Max	Light	Site	Comments
		Status	Ht.	Needs*	Placement	
Carex comosa	Bristly sedge	OBL	2'	SI	SW,WE,SS	Rare in King County
Carex lenticularis	Shore sedge	FACW+	3'	SI	WE,SS	From shore to high mountains
Carex lyngbyei	Lyngby sedge	OBL	3'	SI	SW,WE,SS	Coastal only
Carex obnupta	Slough sedge	OBL	4.5'	ST	SW,WE,SS	Extremely common, coast to Cascade crest
Carex rostrata (utriculata)	Beaked sedge	OBL		SI-ST	SW,WE,SS	Common
Carex stipata	Sawbeak sedge	OBL	3'	SI-ST	SW,WE,SS	Lowland to mid-montane
Eleocharis acicularis	Spikerush	OBL	0.5'	SI	SW,WE	Rhizomatous, lowland to mid-montane
Eleocharis palustris	Common Spikerush	OBL	0.5'	SI	SW,WE	Rhizomatous, coastal to mid-montane
Juncus acuminatus	Tapered rush	OBL	2'	SI	SW,WE	Tolerant
Juncus articulatus	Jointed rush	OBL	2'	SI	SW,WE	Tolerant
Juncus effusus(var. *pacificus,*	Soft rush	FACW	3'	SI-ST	SW,WE,SS	Weedy, common, hardy - often invasive
Juncus ensifolius	Dagger leaf rush	FACW	2'	SI	SW,WE,SS	Lowland to mid-montane, lovely flowers & foliage
Juncus oxymeris	Pointed rush	FACW+	3'	SI	SW,WE,SS	Lowland
Scirpus acutus	Hardstem bulrush	OBL	6'	SI	SW,WE	Tolerates up to 3' of water; common, hardy
Scirpus maritimus	Saltmarsh bulrush	OBL	4.5'	SI	SW,WE	Coastal only
Scirpus microcarpus	Small-fruited bulrush	OBL	4.5'	SI-ST	SW,WE,SS	Lowland to mid-montane, very common
Grasses						
Scientific Name	Common Name	Indicator	Max	Light	Site	Comments
		Status	Ht.	Needs*	Placement	
Alopecurus aequalis	Short-awn foxtail	OBL		SI-ST	SW,WE,SS	Often submerged
Alopecurus geniculatus	Water foxtail	OBL	1.5'	SI-ST	SW,WE,SS	Often submerged, tolerant
Beckmannia syzigachne	American	OBL	2'	SI	WE,SS	Good wildlife forage, lowland to mid-montane
Calamagrostis canadensis	Bluejoint reedgrass	FACW+			WE,SS,WB	Rhizomatous, coastal to mid-montane
Cinna latifolia	Wood reed	FACW	6'	ST	WE,SS,WB	Coastal to sub-alpine
Deschampsia caespitosa	Tufted hairgrass	FACW	2'	SI	WE,SS,WB	Common, keystone species in wet meadows
Elymus glaucus	Blue wildrye	FACU	2'	SI	DB	Very drought-tolerant, good wildlife forage
Festuca idahoensis	Idaho fescue	FACU*	2.5'	SI	DB	Drought-tolerant
Festuca rubra var. rubra	Red fescue	FAC+	2.5'	SI	SS,WB	Common, tolerant
Glyceria borealis (occidentalis)	Northern mannagrass	OBL	4'	ST	WE,SS	Tolerates up to 3' of water
Glyceria elata	Tall mannagrass	FACW+	4.5'	SD	WE,SS,WB	Prefers streamside
Panicum occidentale	Western panic-grass	FACW		SI	WE,SS,WB	Coastal to sub-alpine

Ferns						
Scientific Name	Common Name	Indicator Status	Max Ht.	Light Needs*	Site Placement	Comments
Athyrium filix-femina	lady fern	FAC	3	ST	SS,WB	Very common, tolerant
Blechnum spicant	deer fern	FAC+	2	SD	WB	Needs shade, moisture
Dryopteris expansa	shield fern	FACW	2	SD	WE,SS,WB	Likes muddy soil
Polystichum munitum	western sword fern	FACU	5	ST	DB	PNW basic; needs shade or moisture
Pteridium aquilinium	bracken	FACU	4	SI	DB	Seral on disturbed areas
Herbs and Groundcovers						
Scientific Name	Common Name	Indicator Status	Max Ht.	Light Needs*	Site Placement	Comments
Achillea millefolium	Yarrow	NI	1'	SI	DB	Self-seeds, robust, tolerant
Anaphalis margaritacea	Pearly everlasting	NI	1'	SI	DB	Robust, tolerant
Arctostaphylos uva-ursi	Kinnikinnick	FACU-	1'	SI	DB	Slow grower - likes dry stony soil
Aruncus dioicus	Goat's beard	FACU+	2'	ST	WB,DB	Streamside
Caltha palustris	Marsh marigold	OBL	9"	ST	SW,WE	Coastal
Dicentra formosa	Bleeding heart	FACU*	18"	ST-SD	WB,DB	Very common, tolerant
Epilobium angustifolium	Fireweed	NI	4'	SI	DB	Seral on clear-cuts, common, tolerant
Fragaria chiloensis	Coast strawberry	NI	6"	SI	DB	Rapid spreader, evergreen
Geum macrophyllum	Big-leaf avens	FACW-	3'	ST	WE,SS,WB	Common
Heracleum lanatum	Cow parsnip	FAC+	6'	ST	WE,SS,WB	Likes riparian, self-seeds
Hydrophyllum tenuipes	Pacific waterleaf	NI [FAC]	12"	ST-SD	WB,DB	Wet forest groundcover
Linnaea borealis	Twinflower	FACU-	6"	ST	DB	Usually in forests, but seral on clear-cuts
Lupinus polyphyllus	Big-leaf lupine	FAC+	3'	SI	DB	Seral, common, tolerant
Lysichiton americanum	Skunk cabbage	OBL	10"	SD	SW,WE	Totemic plant, like cedar
Maianthemum dilatatum	Wild lily of the valley	FAC	14"	ST	WB,DB	Rapid spreader
Mimulus guttatus	Yellow monkey flower	OBL	3'	SI	WE,SS,WB	Forms sheets near seeps
Myosotis laxa	Small forget-me-not	OBL	15"	ST	WE,SS	Uncommon, pretty
Oenanthe sarmentosa	Water parsley	OBL	3'	ST	SW,WE,SS	Common, hardy, good amphibian habitat
Osmorhiza chiloensis	Sweet cicely	NI	6"	ST-SD	DB	Very common in PNW forest
Oxalis oregana	Wood-sorrel	NI	9"	ST	WB,DB	Very rapid spreader, robust, highly tolerant
Petasites frigidus	Coltsfoot	FACW-	20"	ST	WE,SS,WB	Rhizomatous, good spreader
Polygonum persicaria	Lady's thumb	FACW	3'	SI-ST	SW	Many species in this genus, good amphibian habitat
Potentilla fruticosa	Bush potentilla	FAC-	3'	SI	DB	Montane, pretty
Smilacina stellata	Solomon's Star	FAC-	18"	ST	WB	Forms drifts near streams
Stachys cooleyae	Great betony	FACW	4'	SI-ST	WB	Common
Tellima grandiflora	Fringecup	NI	2'	ST	DB	Common, tolerant
Tiarella trifoliata	Foamflower	FAC-	2'	ST	DB	Common, tolerant
Tolmiea menziesii	Piggy-back plant	FAC	30"	SD	WB	Forms drifts near streams
Viola glabella	Stream violet	FACW+	7"	SI-ST	WB	Common, rapid spreader

APPENDIX B

Monitoring Instructions and Data Forms

INTRODUCTION

Monitoring is the mechanism by which the county is able to determine whether performance standards have been met. Most performance standards should be met by the final year of the monitoring period; however, some performance standards may need to be met within the first year. King County staff will visit the site at the end of the monitoring period to verify that conditions are as they have been reported, and that performance standards have been met so that your bond may be released. It is to your benefit to accurately report conditions during the monitoring events to ensure that your bond will be released at the end of the monitoring period. You may request that Permitting staff visit your site at any point during the monitoring period to discuss problems; however, you will be billed hourly for staff time.

To begin monitoring, select the methods that are recommended for your performance standards. See Tables 2 and 3 to determine what methods to use. Instructions for each of these methods are described in this appendix.

PHOTO POINTS

Purpose

Photo points provide a visual record of the mitigation site over time. General photographs provide a representative view of the entire area and are helpful to document large-scale changes over time. Every monitoring effort should include photo points.

Methods

1. Select one or more locations (depending on the size of the mitigation site) from which you can capture most of the site. Mark this spot in the field so that you can find the exact location from year to year. You may wish to drive a steel or wooden stake in the ground at this location.

2. Take a picture from each point that you have established. If your camera has the capability to imprint the date on the photograph, take advantage of this.

3. Identify the location of photo points and the direction in which the photo was taken on your site plan.

LINE INTERCEPT METHOD

Purpose

The line intercept method is used to estimate the percent cover of trees and shrubs. If one of your performance standards relates to tree and/or shrub cover, this approach should be used during your monitoring.

Method

1. Establish permanent 50-foot transect lines. Transects may be permanently established and used for the entire three- or five-year monitoring period or randomly located during each monitoring event. Refer to the table below to determine how many transects are required. To establish transects, stretch a 50-foot tape measure[1] between two points through an area planted with trees and shrubs. This same transect may be used to collect data for any of the methods.

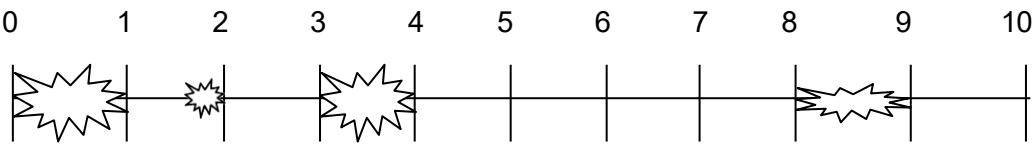
2. Show the location of the transect on your site plan.

Recommended Number of Transects

Size of Mitigation Area	Number of 50-Foot Transects Required
< 500 square feet	1
500-1,000	2
>1,000-2,500	3

3. Using **Data Form 1**, and beginning at the zero end of the tape, walk along the tape, noting and recording the length that each plant intercepts the transect line. See the following pictures as an example:

EXAMPLE



Plant 1 covers from 0-1 feet, Plant 2 covers approximately from 1.6 to 2 feet, Plant 3 covers from 3-4 feet, and Plant 4 covers from 8 to 9 feet. The total cover provided by these four plants is 3.4 feet out of 10 feet. This represents 34 percent cover. (3.4 feet of plants divided by 10 feet of the area evaluated). Note: Only measure the portion of the tree or shrub that intercepts the transect line. It is common for this percent cover calculation to be fairly low during Years 1 and 2, particularly if small plant material is used.

Data Sheet for Above Example

Species	Begin (Distance)	End (Distance)	Total Distance
Snowberry	0	1.0	1.0
Rose	1.6	2.0	0.4
Western Red Cedar	3.0	4.0	1.0
Big Leaf Maple	8.0	9.0	1.0
Total:			**3.4**

[1]If you do not own a 50-foot tape measure, you can use 50-foot length of plastic flagging, which is available in hardware stores. You may either use this in conjunction with a shorter tape measure, or you may mark off 1-foot increments on the plastic flagging using a permanent marker.

BELT TRANSECT

Purpose

This method may be used to determine plant density (e.g., number of plants per acre), or estimating survivorship and vigor of trees and shrubs within a sample area.

Method

1. Establish one or more transect lines. To do this, stretch a tape measure (100-foot tape is recommended) between two points through an area planted with trees and shrubs. The same transect may be used for other sampling elements. Using **Data Form 2**, and beginning at the zero end of the tape, walk along the tape, noting and recording any trees or shrubs that occur within 3 feet on either side of the tape. Observe the condition of each plant. This will assist you in detecting problems early. The type of observations you may make include:

- Browsed by deer
- Chlorotic (meaning leaves are yellow, which suggests stress)
- Vigorous
- Wilted
- Etc.

2. Use the following formula to calculate percent survivorship:

(Total number of living plants divided by total number of plants) X 100 = percent survivorship

Use the other observations to determine if some corrective action is necessary.

POINT INTERCEPT

Purpose

This method can be used to measure the percentage of bare ground.

Method

1. Establish one or more transect lines. To do this, stretch a tape measure (100-foot tape is recommended) between two points. The same transect may be used for other sampling elements, if desired. You may choose to establish permanent transects by marking each end so that you can measure the same area each year, or you may randomly select a transect during each monitoring period.

2. Use **Data Form 3**, and beginning at zero end of the tape, walks along the tape. At every 5 feet, stop and look directly below the tape at that point. Note whether bare ground or plants are present. Record this information.

3. Use the following formula to calculate the percent of bare ground:

   (Number of points with bare ground divided by total number of points evaluated) X 100 = percent of bare ground

DATA FORM 1: Line Intercept

Name: ______________________________ Transect Number: ______________________

Sampling Date: ________________________ Transect Location: ______________________

Project Number: ________________________ Transect Length: ______________________

Species	Begin (Distance)	End (Distance)	Total Distance

DATA FORM 2: Belt Transect

Name: _____ Transect Number: _____

Sampling Date: _____ Transect Location: _____

Project Number: _____ _____

Species	Alive	Dead	Observations
Totals:			

DATA FORM 3: Point Intercept

Name: _____ Transect Number: _____

Sampling Date: _____ Transect Location: _____

Project Number: _____ _____

Point	Vegetated	Bare Ground
0 feet		
5 feet		
10 feet		
15 feet		
20 feet		
25 feet		
30 feet		
35 feet		
40 feet		
45 feet		
50 feet		