CITY OF MOUNT VERNON

RESTORATION AND ENHANCEMENT OF WATERS/WETLANDS AND BUFFERS

Guidelines, Recommended Techniques and Details

OPERATIONAL DRAFT
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CHAPTER I INTRODUCTION

In March of 2007 the City of Mount Vernon adopted an updated Critical Areas Ordinance (CAO), Chapter 15.40, in accordance with the growth management requirement to review and include best available science in the crafting of regulations intended to protect and enhance environmentally sensitive areas.

The purpose of this document is to provide guidance on the process and implementation measures of Chapter 15.40. The City's CAO employs an innovative approach to critical areas regulation that considers the overall landscape with respect to mitigating project impacts. It also takes into consideration the existing built environment, by allowing the applicant, in many cases, to choose between two buffer alternatives. In large part, this manual has been prepared to assist applicants and City staff in understanding and implementing the buffer alternatives.

This manual only addresses the CAO provisions that involve waters and wetlands. In particular, sections 15.40.090, 15.40.110 and 15.40.120.

HOW TO USE THIS MANUAL

This manual is organized into seven chapters. Starting with Chapter II, each chapter is intended to provide the applicant with enough information to make informed decisions about how to proceed through the process, and with the subsequent design and implementation of their development project.

CHAPTER II: Describes the overall CAO review process. It contains four process charts and explanations of key steps and considerations. This chapter should be read first.

CHAPTER III: Contains a list of maps and other information resources an applicant will need to determine what specific CAO provisions will be applied to their project.

CHAPTER IV: Contains case study examples, depicting different site and project circumstances and how the provisions of the CAO would be interpreted and implemented.

CHAPTER V: Provides a basic discussion of restoration principals and practices. It is intended to orient and to give the applicant a basic understanding of what may be involved in the restoration and enhancement of waters/wetlands and buffers for their project.

CHAPTER VI: Provides extensive guidance on specific critical area enhancement and restoration activities. It is basically a "how to" chapter, with illustrations and discussions about each activity.

CHAPTER VII: Provides a brief description of what should be included in a monitoring program. Any restoration or enhancement of a critical area and/or its buffer will require monitoring over time to ensure success.

CHAPTER II CRITICAL AREAS ORDINANCE PROCESS – WATERS/WETLANDS

The following flow charts and accompanying boxed narratives are intended to provide basic guidance through the Critical Areas Ordinance review process. It is important to note that the process as shown in the flow charts is not strictly sequential and a number of tasks can be carried out concurrently with each other. For example, the various studies and plans can be developed together, and site visits by staff or the City Biologist and their evaluations occur concurrently with other required review and/or permitting activities.

There are four process charts within this chapter. Each chart has lettered, blue colored boxes that correspond with a boxed explanation on the pages immediately following the chart. The orange boxes direct the reader to another chart. In many cases, the specific section of the CAO is also referenced. The four flow charts are as follows:

CHART #1 - BASIC STEPS IN CAO REVIEW PROCESS

CHART #2 – DEFAULT BUFFER PROGRAM

CHART #3 – ECOSYSTEM BUFFER ALTERNATIVE

CHART #4 – REQUIRED STUDIES AND PLANS

Chart #1 Basic Steps in Critical Areas Ordinance Review Process for Waters/Wetlands

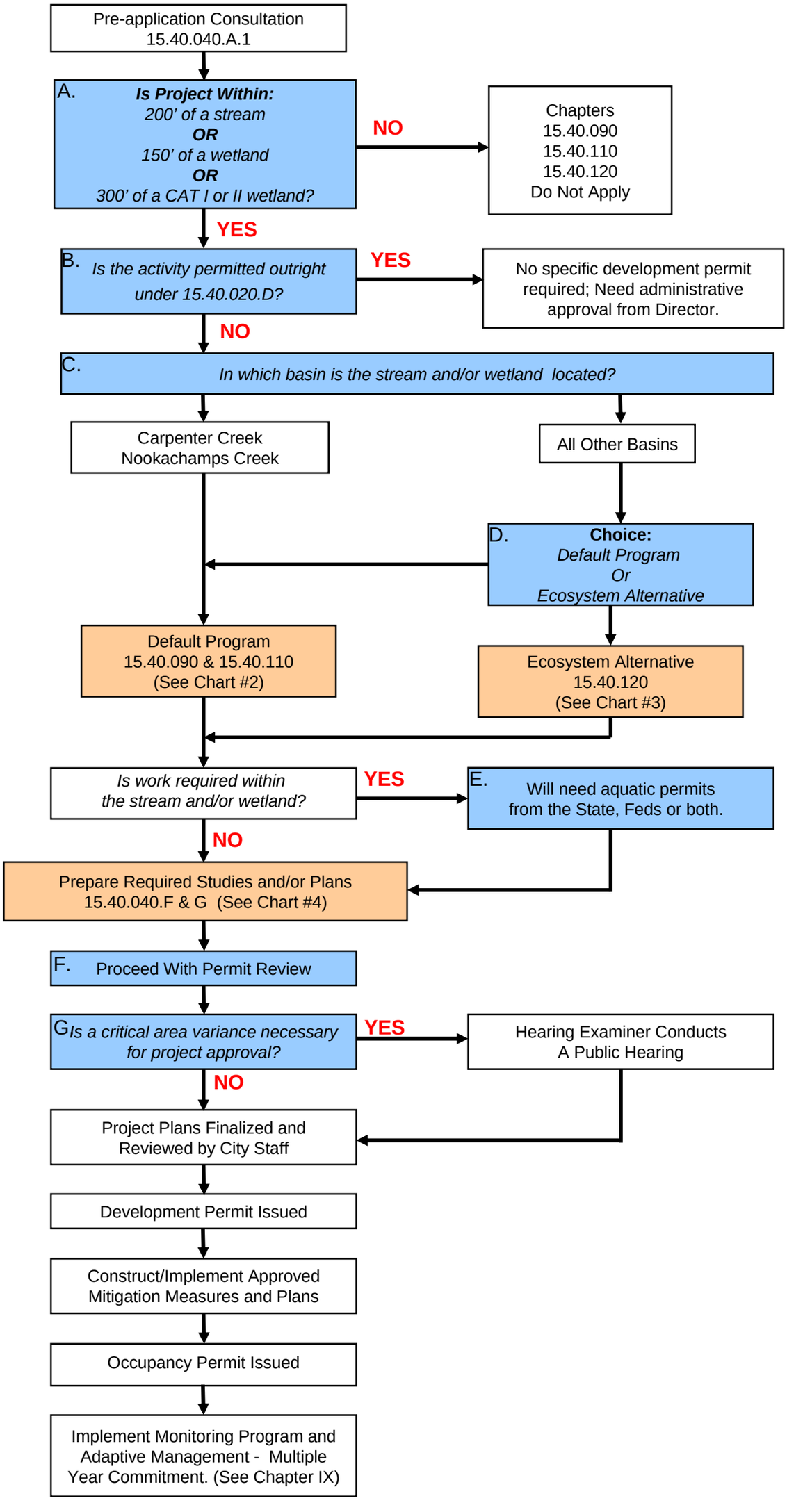


CHART #1 BASIC STEPS IN THE CRITICAL AREAS ORDINANCE REVIEW PROCESS FOR WATERS/WETLANDS

START: DEVELOPMENT PERMIT APPLICATION

The provisions of Chapter 15.40 apply to any project requiring a development permit that has a critical area on-site or is within a regulated distance of the project boundaries. Building construction, grading and drainage, and subdivisions are a few examples of development permits that may be required for any given project. The critical area regulations in Chapter 15.40 are implemented as a part of the underlying project permit approval process. There is no separate critical area permit.

In preparation of making a development permit application it is recommended that the applicant locate the project site on the City's ***Drainage Basins and Critical Areas*** map to see if the site might contain or be in close proximity to a stream or wetland. The map may be found in City Hall at the front counter of the Community and Economic Development Department, and staff can assist in reviewing the map. The map may also be found on the City's website at www.ci.mount-vernon.wa.us

1.A PRE-APPLICATION CONSULTATION - 15.40.040.A.1

Any applicant with property known or suspected to have a critical area, or that may be within a regulated distance of a critical area, is required to have a pre-application consultation with City staff. The purpose of the consultation is to help applicants identify regulatory requirements and assure that critical area planning is integrated into overall project designs.

To determine whether there is a critical area on-site may require a site visit by staff or the City Biologist. This is often true of wetlands in particular, since many of the wetland areas shown on City maps are approximations based on aerial photography and soils maps. As wetlands are located and delineated as part of project approvals City maps are updated and corrected.

To determine whether there is a critical area within a regulated distance of the project site may also require a site visit by staff or the City Biologist and/or may first require completion of a survey. A survey is required for every development permit application, regardless of permit type. Surveys show precise site boundaries, located exisiting structures, topography and other site features, and should locate off-site critical areas if they are within the vicinity of the project.

1.B PERMITTED ACTIVITIES - 15.40.020.D.1.a. through n.

Some activities are permitted within critical areas and/or their buffers, unless limited to buffers only, without the need of a development permit. Most of these activities are permitted outright only if certain conditions are met. These activities only require administrative approval from the Director and include the following:

a. Natural Resource/Habitat Conservation or Preservation	*(no conditions required)*
b. Minor Site Investigative Work	
c. Existing/Ongoing Agricultural Activities	
d. Harvesting Wild Foods	
e. Removing Dead or Diseased Trees	
f. Operation, Maintenance, or Repair	
g. Modification to Existing Structures	
h. Activities within an Improved Right-of-Way	
i. Storm Water Management Facilities – Wetlands	*(only in outer 25% of buffer)*
j. Chemical Applications	
k. Emergency Activities	
l. Navigational Aids and Boundary Markers	*(no conditions required)*
m. Trails and Walkways	
n. Existing structures, surfaces and activities	*(no conditions required)*

1.C IDENTIFY PROJECT SUB-BASIN

For the purpose of these regulations the City has been divided into eight stream sub-basins. The CAO provisions have been developed based on a review of the general conditions of each of the sub-basins, so an applicant must first determine which sub-basin regulations apply to their project. On the ***Drainage Basins and Critical Areas*** map identify in which of the City's eight sub-basins the project is located.

If the project site is located within either the Carpenter Creek or Nookachamps Creek sub-basin, then use of the Default Buffer Program regulations in 15.40.090 and/or 15.40.110 is required. (see Chart #2)

1.D CHOICE OF BUFFER REGULATIONS

If the project is located in one of the other six sub-basins, then the applicant has the option of using the Ecosystem Buffer Alternative regulations in 15.40.120. The sub-basins are:

Kulshan Creek
Trumpeter Creek
Maddox Creek
Bright Slough
West Mount Vernon
Skagit River

Standard buffer widths under 15.40.120 are on average narrower than those allowed under the Default Buffer Program and can be further reduced or modified. However, use of the Ecosystem Buffer Alternative requires meeting several conditions including restoration and/or enhancement of degraded stream, wetland and buffer areas, upgrading stormwater facilities, monetary contributions to the City's CAO Management Fund and a commitment to long term monitoring and maintenance. (see Chart #3)

1.E WORK WITHIN STREAMS AND WETLANDS

If the project and/or restoration activities require work within a stream and/or wetland, then a permit and/or approval will be required from the State Department of Fish & Wildlife (WDFW) and possibly the Army Corps of Engineers (Corps). The WDFW permit is called a Hydraulics Project Approval (HPA). There are two types of HPA permits: an Individual HPA and a Pamphlet HPA.

An Individual HPA is necessary for any in-water work that can not be performed under a Pamphlet HPA (see below), and requires a review process by WDFW prior to being issued. This applies to any work that uses, diverts, obstructs, or changes the natural flow or bed. This includes bed reconfiguration, all construction or other work waterward, under and over the ordinary high water line, including dry channels, and may include projects landward of the ordinary high water line (e.g., activities outside the ordinary high water line that will directly impact fish life and habitat, falling trees in to streams or lakes, dike construction, etc.). Examples include, but are not limited to the following:

Stream bank protection;
Construction of bridges, piers, and docks;
Pile driving;
Channel change or realignment;
Conduit (pipeline) crossing;
Culvert installation;
Dredging;
Gravel removal;
Pond construction;
Placement of outfall structures;
Log, log jam, or debris removal;
Installation or maintenance (with equipment) of water diversions.

If the in-water activities involve only the removal of trash and invasive or noxious weeds, and they can be performed by hand, with hand tools or with limited equipment, then a Pamphlet HPA is all that is required. It is called a "pamphlet" HPA because there is no review process by WDFW prior to receiving the permit. The applicant is only required to have a copy of the WDFW pamphlet ***"Aquatic Plants and Fish"*** on-site *while the work is being performed*. The pamphlet is issued by WDFW upon a written request and work may not proceed until the pamphlet has been received. Note that while you can view and down-load the pamphlet from the WDFW website, a downloaded copy of the pamphlet is NOT a valid permit: you must request the pamphlet in writing and have it sent to you.

Some weed control and other restoration activities are allowed under a Pamphlet HPA only with prior approval from WDFW. Examples would include the use of bottom barriers and diver dredges. Prior to preparing a mitigation plan (see chart #4), contact the regional office of the WDFW to determine whether a specific activity or activities can be performed under a Pamphlet HPA and whether prior WDFW approval is necessary.

Appendix A contains WDFW contact information, useful links and a WDFW HPA process chart to help in determining what type of HPA, if any, is required for your project.

1.F PROCEED WITH DEVELOPMENT PERMIT REVIEW

At this point in the process, studies and plans required under Chapter 15.40 have been prepared and are submitted to the City for the continued processing of the underlying development permit application. In addition, any monetary contributions to the CAO Management Fund (under 15.40.120), mitigation bonds and other required fees are often paid during this part of the process. Staff review of submitted studies and plans may result in the Director requesting additional information to clarify or mitigate specific critical area issues before issuance of the underlying permit.

Several types of City permits require a public hearing such as a PUD, subdivisions and conditional use permits. The Hearing Examiner will conduct the hearing and either issue a final decision or a recommendation to City Council, depending on the permit type. The Examiner can approve the permit as submitted, approve with conditions on the project, or deny the permit. If conditions of approval involve a critical area, then submitted studies and/or plans may need to be revised to reflect those conditions.

1.G VARIANCES - 15.40.130.D

An applicant may request a variance in circumstances where existing site conditions necessitate developing a project in a manner not otherwise allowed by the critical area regulations. This will most often occur in situations where existing structures or infrastructure was originally constructed in locations that are now regulated buffers or critical areas. In some cases even though a structure is not within a regulated buffer or critical area, other site constraints may leave no other option but to modify the buffer or critical area to accommodate the project. Even on undeveloped parcels the combination of lot size and configuration, topography, and critical area may necessitate a variance request.

A variance may be granted with the submission and approval of a critical area report (see Chart #4) and a mitigation plan (if necessary) that demonstrates the project meets all of the criteria in 15.40.130.D.3. These criteria include the following:

1. The proposal is the minimum necessary.
2. There is no other reasonable alternative to avoid impacting the critical area.
3. The project will not cause significant degradation of the critical area.
4. The project includes measures to minimize critical area impacts, including limiting the magnitude or implementation of the project, using appropriate and best available technology, taking steps to avoid or reduce impacts.

5. There will be no damage to nearby public or private property and no threat to the health or safety of people on or off the property.
6. The project mitigations are based on consideration of the best available science.

There may be situations where use of the Default Buffer Program necessitates a variance, but using the Ecosystem Buffer Alternative will not. In such cases the applicant is required to utilize the Ecosystem Alternative regardless of which basin the project is located.

A variance is another type of permit that requires a public hearing. A Hearing Examiner conducts the public hearing and renders a final decision. If the project has other permits that require a public hearing, then a single hearing is conducted that combines the variance with the others.

Chart #2 Default Buffer Program

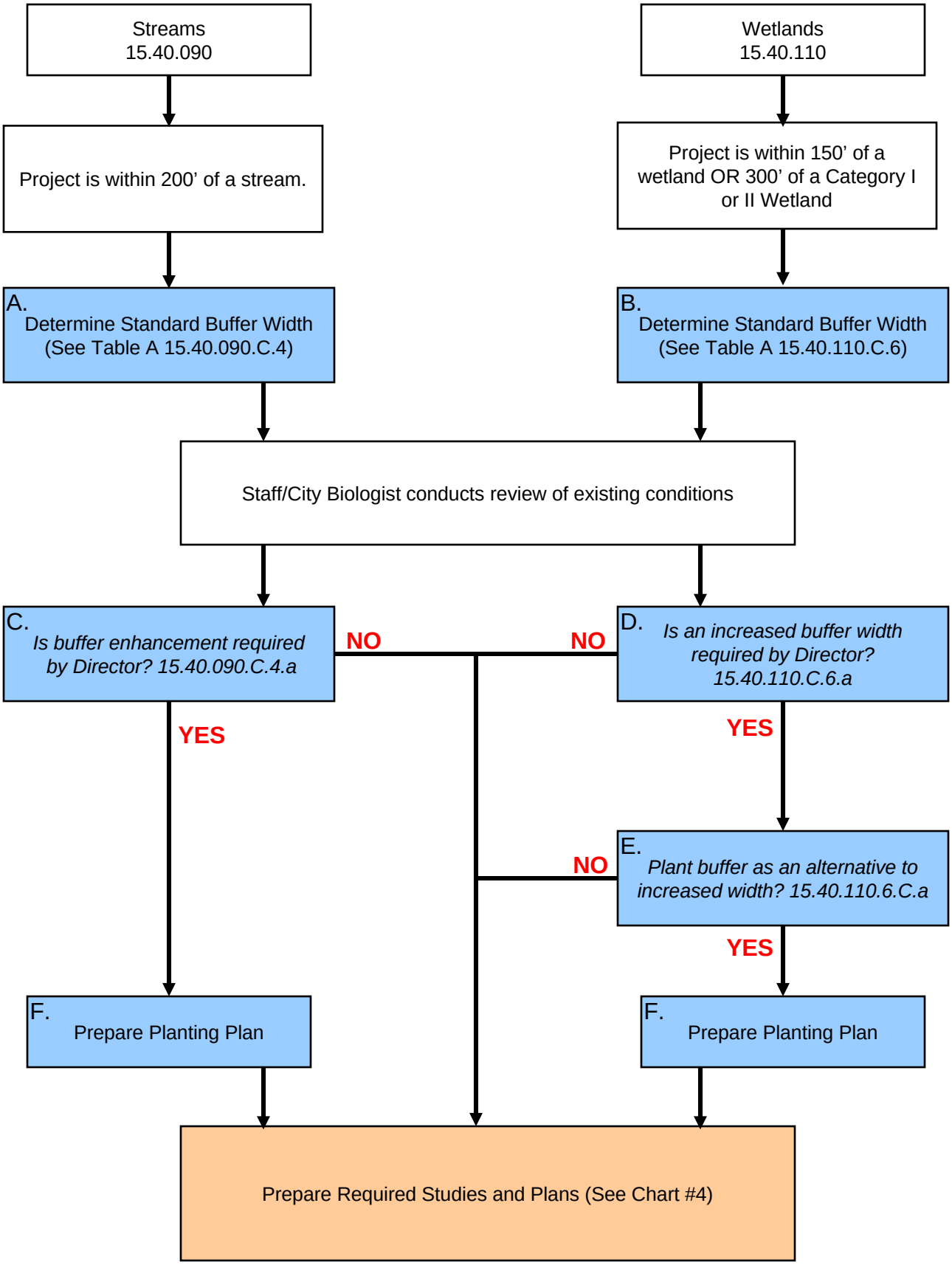


CHART #2 DEFAULT BUFFER PROGRAM

2.A DETERMINE STANDARD STREAM BUFFER

Streams are categorized into four types: S, F, NP and NS. Determine the stream type on the City's ***Drainage Basins and Critical Areas*** map. This may have already been done during the pre-application consultation.

Standard buffer widths by stream type are found on Table A of Chapter 15.40.090.C.4., which is provided below. The standard buffer width may be modified by the applicant through buffer averaging or a buffer reduction under certain conditions (see Chart #4, Box 4.A). Stream buffers are measured from the ordinary high water mark (OHWM).

15.40.090 Table A, Water Type Buffer Standards			
Water Types	Attributes	Minimum Building Setback	Buffer Width Standard
S Freshwater	Freshwater Shorelines of the State	15 feet beyond buffer	175 feet
F	Fish Habitat Waters	15 feet beyond buffer	150 feet
Np	Year-Round, Non-fish Habitat	15 feet beyond buffer	50 feet
Ns	Seasonal, Non-fish Habitat	15 feet beyond buffer	35 feet

2.B DETERMINE STANDARD WETLAND BUFFER

Wetlands are classified into four types: I, II, III, and IV; with I being the highest quality wetlands and IV being the lowest. Wetland classifications are defined in Chapter 15.40.110.B. While some wetlands have been classified during previous permit applications most have not. Determining the wetland category will likely require a site visit and evaluation by a qualified professional. If the wetland is on-site, then a delineation of the geographic extent of the wetland will also be a required part of the evaluation.

Standard buffer widths by wetland category are found on Table A of Chapter 15.40.110.C.6. which is provided below. The standard buffer width may be modified through buffer averaging under specified conditions (see Chart #4, Box 4.E). Wetland buffers are measured from the delineated wetland edge.

Standard buffer widths by wetland category

Wetland Category	Standard Buffer
I	200 ft.
II	100 ft.
III	75 ft.
IV	50 ft.

2.C REQUIRED STREAM BUFFER ENHANCEMENT - 15.40.090.C.4.a

Where existing buffer areas provide minimal vegetative cover and cannot meet the City's water quality standards or habitat functions, buffer enhancement will be required by the Director. Buffer area vegetation is considered inndequate under the following conditions:

1. Nonnative or invasive plant species provide the dominant cover.
2. Vegetation is lacking due to disturbance and aquatic, stream, or habitat resources may be adversely affected.
3. Enhancement plantings in the buffer could significantly improve buffer functioning.

If buffer enhancement is required, then the applicant will need to prepare a Planting Plan (see Box 2.E below).

2.D REQUIRED WETLAND BUFFER INCREASE - 15.40.110.C.6.a

The Director may require increased buffer widths on a case-by-case basis when a larger buffer is necessary to protect wetland functions based on site-specific characteristics. This determination shall be based on one or more of the following criteria:

1. A larger buffer is needed to protect other critical areas.
2. The buffer or adjacent uplands has a slope greater than 15% or is susceptible to erosion and standard erosion-control measures will not prevent adverse impacts to the wetland.
3. The buffer area has minimal vegetative cover.

The determination to require increased wetland buffer widths is done in accordance with the recommendations of an experienced, certified professional wetland scientist, and the best available science.

2.E PLANTING IN LIEU OF WETLAND BUFFER INCREASE - 15.40.110.C.6.a.iii

In lieu of increasing the buffer width where existing buffer vegetation is inadequate, implementation of a buffer Planting Plan may substitute (see Box 2.E below). Buffer vegetation is considered "inadequate" and will need to be enhanced through additional native plantings and (if appropriate) removal of nonnative plants under the following conditions:

(1) Nonnative or invasive plant species provide the dominant cover.
(2) Vegetation is lacking due to disturbance and wetland resources could be adversely affected.
(3) Enhancement plantings in the buffer could significantly improve buffer functioning.

2.F PLANTING PLANS

Where a buffer Planting Plan is proposed it shall include planting densities that are not less than 3 feet on center for shrubs and 8 feet on center for trees. Monitoring and maintenance of plants shall be required in accordance with 15.40.090.F, Monitoring and Contingency Plan.

A monitoring program shall be included as a part of the approved planting plan. To ensure that the performance standards of the approved planting plan have been met, buffer planting and enhancement shall be monitored for a minimum of five years. A longer monitoring period may be required by the City based on either the initial planting and a monitoring plan or on a review of subsequent monitoring reports.

Chart #3 Ecosystem Buffer Alternative

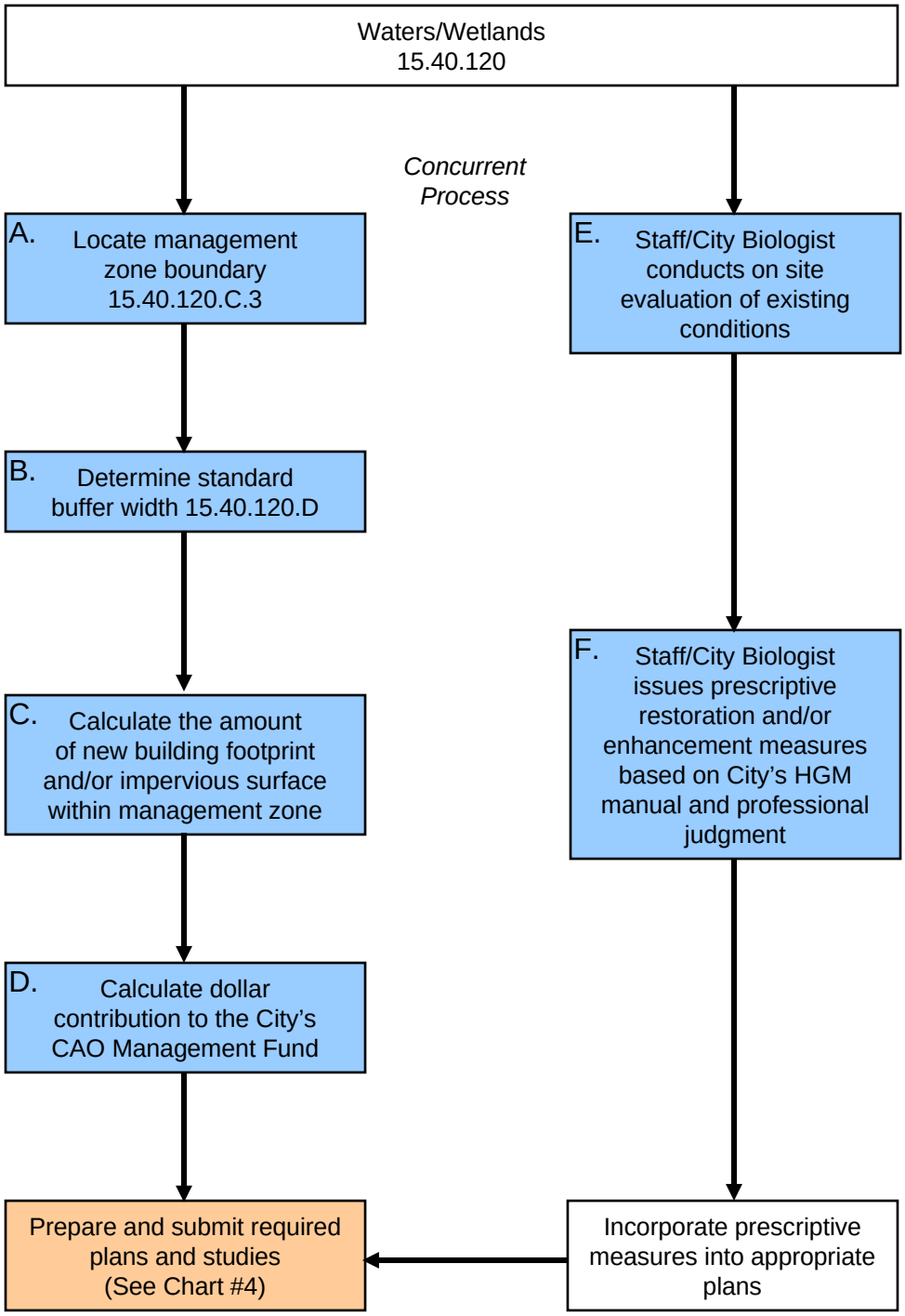
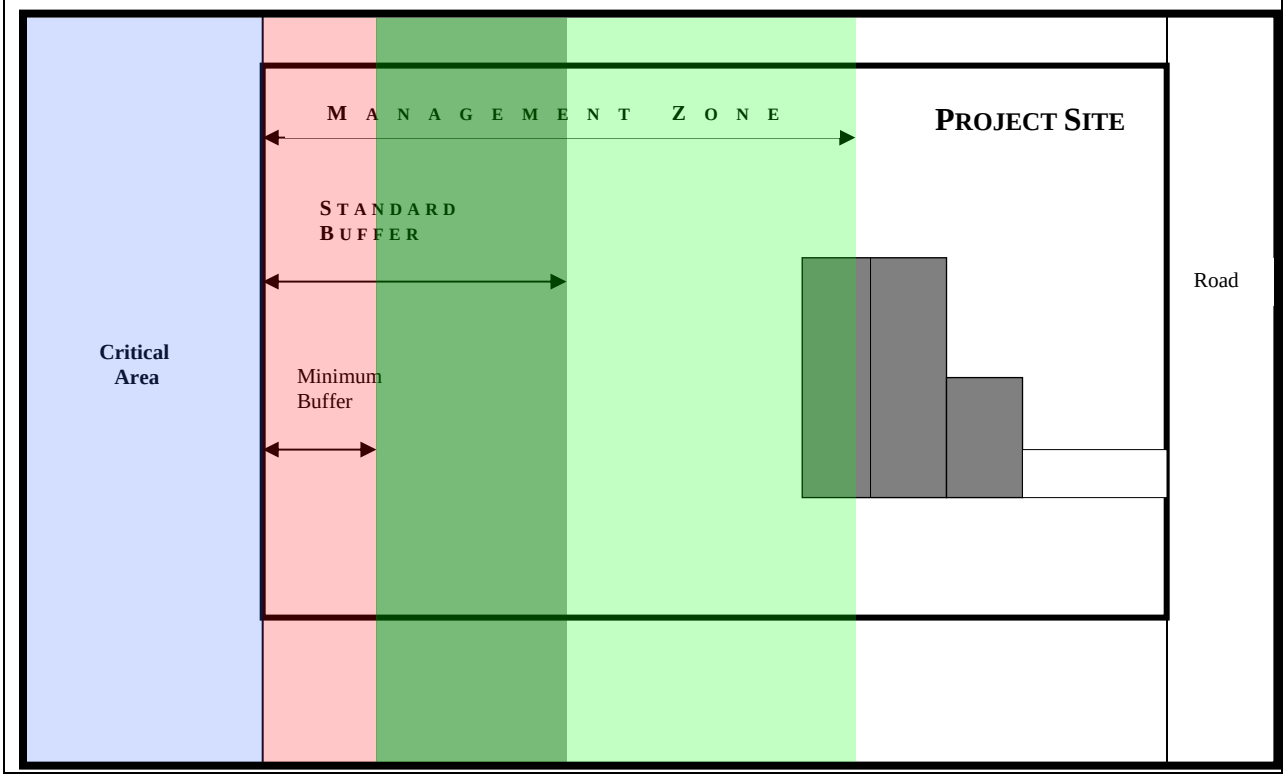


CHART #3 ECOSYSTEM BUFFER ALTERNATIVE

3.A LOCATE MANAGEMENT ZONE BOUNDARY - 15.40.120.C.3

The "Management Zone" is measured from the critical area edge to the nearest paved public street or 200 feet, whichever is less. Where the paved street simply bisects a critical area, the management zone is 200 feet.

The "Management Zone" includes both the standard buffer and the minimum buffer width areas. The illustration below shows the management zone on a project site. The outer edge of the light green area is the boundary of the 200 foot "Management Zone". The outer edge of the dark green area is the limit of the Standard Buffer. The red area represents the Minimum Buffer width, which is intended to be the minimum reduction allowed in most circumstances.



3.B DETERMINE STANDARD BUFFER WIDTH - 15.40.120.D

Determining standard buffer widths under 15.40.120.D requires referencing one or more City critical areas maps and may involve a site visit by City staff or Biologist. The standard buffer width is a function of three pieces of information:

1) *Stream Type or Wetland Category*. Stream types and wetland categories under the Ecosystem Buffer Alternative are the same as those used in the Default Buffer Program (see Chart #2, Boxes 2.A & 2.B).

2) *Gradient (15.40.120.C.8. a - c).* This is simply a measurement of the slope on which the critical area occurs. There are three gradients used in the regulations: Low (less than 1% slope), Medium (1% to 2%) and High (greater than 2%). For streams the gradient can be looked up on the City's ***Streams by Gradient*** map or measured in the field. For wetlands the gradient will likely need to be determined in the field by a qualified professional, though a detailed topography map may be sufficient in some cases (e.g. nearly level terrain).

3) *Open, Managed or Closed System (15.40.120.8.d - f).* This information is an indicator of the prevailing condition of the critical area and its associated buffer. An Open System (or open ecosystem) is one that has an existing natural vegetated buffer of 50 or more feet. A Closed System is specific to streams and is one that is piped or in a completely confined structure. A Managed System is one that is neither of the other two, and is typically a situation where the buffer area has been altered from its natural state and is maintained (such as lawn mowing) in some fashion.

Sections 15.40.120.D.1 through 8 correspond to each of the eight sub-basins that occur within the City. Each set of management regulations, including buffer widths, is tailored to the specific sub-basin and are found in these sections. Sections 1 through 4 have a table where the applicant can apply the three factors above and identify the standard buffer. In the other four sections the buffer widths are listed, since the City has already applied these three factors in developing these sections of the code. In these latter four, the applicant needs only the type of stream category of wetland to determine the standard buffer.

3.C CALCULATE SQUARE FEET OF NEW BUILDING FOOTPRINT AND/OR IMPERVIOUS SURFACE

This is a straight forward calculation. All of the new square footage of building footprint and other impervious surfaces that occur within the management zone are totaled. The one consideration here is to keep track of where in the management zone the new structure and/or impervious surfaces are located. The reason for this is explained below in Box 3.D.

"Impervious surface" is defined in 15.40.170.A. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, lawns, and oiled, macadam or other surfaces which impede the natural infiltration and movement of water.

3.D CALCULATE DOLLAR CONTRIBUTION TO THE CAO MANAGEMENT FUND

Construction of new building footprint and new impervious surface anywhere within the Management Zone (see illustration in Box 3.A above) requires a monetary contribution to the City's Critical Area Management Fund. The amount of the contribution is based on the total square feet of new building footprint and/or impervious surface multiplied by the dollar amounts specified in Sections 15.40.120.D.1 through 8. The dollar amounts are modified depending on where within the Management Zone the construction is located, and whether or not tree canopy is being removed as part of the project.

As an example, lets assume a project occurs within the Trumpeter Creek sub-basin. The dollar amounts are specified within Section 15.40.120.D.2.f. Subsections i.(a) and i.(b) specify the dollar amounts per square foot for construction that occurs in the outer portion of the Management Zone; the light green area in the illustration in Box 3.A above. The base dollar amount is $1.50 per square foot. If a portion of the new square footage involves removal of tree canopy, then the dollar amount increases to $4.00 per square foot just for the area of tree canopy removal.

Subsection ii.(a) specifies the dollar contribution for construction that occurs within the Standard Buffer area; the dark green area on the figure above. In this case the amount is $4.00 per square foot of new structure and/or impervious surface. Note that the dollar amounts are always higher for construction that occurs within the Standard Buffer area.

3.E ON-SITE EVALUATION OF EXISTING CONDITIONS BY CITY STAFF OR BIOLOGIST

Under the Ecosystem Buffer Alternative the applicant will need to have City staff or Biologist perform an evaluation of existing critical area and buffer conditions. Chapter VI of this manual (Restoration Principles) provides an overview of the types of features, characteristics or processes considered in this evaluation. Review of existing conditions will provide a "functional assessment" of the critical area and associated buffers, which means how well the critical area functions are operating on the subject site. City staff or Biologist will be using the companion document to this manual during their evaluation. The document is titled ***Guidebook to Assessment of Riverine, Slope and Depressional Waters/Wetland Functions*** and has been developed specifically for the critical area conditions found in Mount Vernon.

3.F CITY PROVIDES PRESCRIPTIVE RESTORATION AND ENHANCEMENT MEASURES TO APPLICANT

After conducting a functional assessment the City will prescribe a set of actions necessary to restore and/or enhance existing critical area/buffer conditions. These prescriptive measures are based on site conditions, the type of project proposal, the City's HGM Manual and the Biologist's best professional judgment. Chapter VI of this manual provides examples of what these measures may entail based on four generic sets of conditions. These prescriptive measures are then incorporated into the plans required under this Chapter (see Chart #4).

Chart #4 Required Studies and Plans

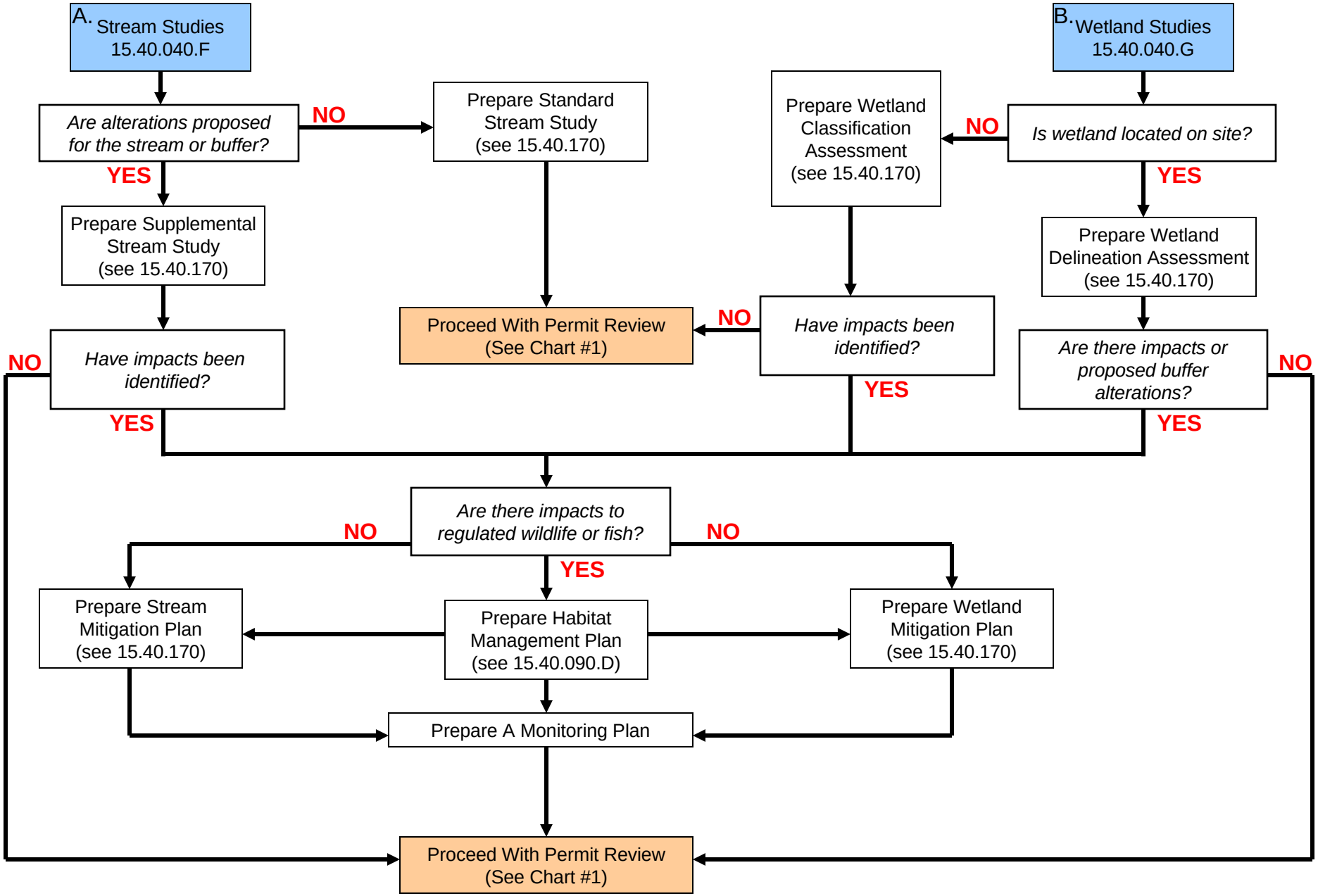


CHART #4 REQUIRED STUDIES AND PLANS

4.A STREAM STUDIES AND PLANS - 15.40.040.F

In earlier steps of the process it has been determined that the project site is within 200 feet of, or has a stream located on-site.

Standard Stream Study: A Standard Stream Study is required in two instances: 1) when the project site is located within 200' of a stream; or 2) when there is a stream on-site and no alterations are proposed for the stream or its buffer. Standard Stream Study requirements are outlined in 15.40.170.C. The study may be waived by the Director under the following circumstances:

1) A public road, building or other long-term barrier exists between the stream and the proposed development activity, or;

2) The stream or riparian management zone does not intrude on the applicant's lot, and based on evidence submitted, the proposal will not result in significant adverse impacts to nearby streams, or;

3) Applicable data and analysis appropriate to the project proposed exists and an additional study is not necessary.

Supplemental Stream Study: A Supplemental Stream Study is required when a site contains a stream or management zone and alterations of the stream and/or management zone are proposed, either administratively or via a variance request. Supplemental Stream Study requirements are outlined in 15.40.170.C. The study may be waived by the Director when applicable data and analysis appropriate to the project proposal already exists and additional study is not necessary.

Stream Mitigation Plan: A Stream Mitigation Plan is required when impacts have been identified within the Supplemental Stream Study. Stream Mitigation Plan requirements are outlined in 15.40.170.C. The mitigation plan may be waived by the Director when applicable data and analysis appropriate to the project proposal already exists and additional mitigation is not necessary.

Note that stream studies and mitigation plans must be prepared by a certified professional with appropriate expertise.

4.B WETLAND STUDIES AND PLANS - 15.40.040.G

In earlier steps of the process it has been determined that the project site is within 150' feet of a wetland, or is within 300' of a suspected category I or II wetland, or has a wetland located on-site.

Wetland Assessment Identifying Classification: An applicant is required to conduct a study to determine the classification of the wetland if the subject property or project area is within 150 feet of a wetland even if the wetland is not located on the subject property. Similalry, if there is a potential Category I or II wetland within 300 feet of a proposal, the City may require an applicant to conduct a study even if the wetland is not located on the subject property, but it is determined that alterations of the subject property are likely to impact the wetland in question or its buffer.

Wetland Assessment Identifying Delineation : A wetland delineation is required for any portion of a wetland located on the subject property. The exact location of the wetland edge is determined by a wetlands specialist through the performance of a field investigation using the procedures identified in 15.40.110.A.

Wetland Clssification and Delineation studies may be waived by the Director under the following circumstances:

1) A public road, building or other physical barrier exists between the wetland and the proposed activity; or,

2) The wetland or buffer does not intrude on the applicant's lot, and based on evidence submitted, the proposal will not result in significant adverse impacts to nearby wetlands regulated under this section; or,

3) Applicable data and analysis appropriate to the project proposed exists and an additional study is not necessary, consistent with current rating system and mitigation standards.

Wetland Mitigation Plan: An applicant is required to prepare a Wetland Mitigation Plan per 15.40.170 if impacts are identified within a Wetland Classification or Delineation Study or if a wetland buffer alteration is proposed.

A wetland mitigation plan may be waived by the Director when applicable data and analysis appropriate to the project proposal exists and an additional report is not necessary, consistent with current rating system and mitigation standards.

Note that wetland studies and mitigation plans must be prepared by a certified wetland biologist.

CHAPTER III KEY MAPS

Below is a list of maps containing information that the applicant will need to determine what specific provisions of the CAO will apply to their project. They can be found on the City's website and are available for viewing at the front counter of the Department of Community and Economic Development. All of these maps show approximate locations of property boundaries.

A. DRAINAGE BASINS AND CRITICAL AREAS MAP

This map shows the eight stream sub-basins used to implement the CAO, the location of creeks and streams, and the approximate location of known or suspected wetlands. This map should be used to make an initial determination whether a subject property contains and/or is in close proximity to a regulated stream or wetland.

B. INDIVIDUAL DRAINAGE BASIN MAPS

This set of maps provides a more detailed presentation of the information presented in the Drainage Basin and Critical Areas map above.

C. SUB-BASINS WITH STREAMS BY GRADIENT MAP

This map shows the City's creeks and streams by gradient, or percent slope. Three gradients depicted: less than 1%, between 1% and 2%, and greater than 2%. This map is necessary to help determine the Standard and Minimum Buffer widths contained in 15.40.120. Note that wetland gradients will likely need to be determined in the field.

D. FISH DISTRIBUTIONS MAP

This map depicts the general distribution of various fish species found in the City's streams and creeks. This map is useful in determining stream type. Fish bearing streams are typed 'F' and are given a larger buffer than non-fish bearing streams.

E. FISH BLOCKAGES MAP

This map shows where there are impediments to the movement of fish along the City's streams. This map is useful in cases where removal of the blockage can be incorporated into the mitigation of an adjacent project's impacts.

F. PRIORITY HABITATS MAP

This map is developed by the Department of Fish and Wildlife and shows the general location of known or suspected State and Federal listed endangered, threatened and species of concern. Note that this map is typically not given out to the general public. City staff can reference this map to determine if an applicant's project site possibly contains or is in proximity to a regulated species.

G. ZONING MAP

This map shows the location of the City's zoning districts.

CHAPTER IV CASE STUDIES: EXAMPLES OF IMPLEMENTATION

The following case studies illustrate how the Critical Areas Ordinance review process might be applied to the various project proposals City staff will encounter. The cases range in complexity from a straightforward scenario to one where existing conditions prevent project development from conforming to critical area regulations. Each case study describes the site location, project circumstances and description, impacts, applicable code, and resolution. An illustration accompanies each scenario. The case studies are:

CASE STUDY #1	MR. JONES' ADDITION – EXAMPLE A
CASE STUDY #2	MR. JONES' ADDITION – EXAMPLE B
CASE STUDY #3	COMMERCIAL BUILDING CHANGE OF USE
CASE STUDY #4	GREEN ACRES SUBDIVISION
CASE STUDY #5	VARIANCE

CASE STUDY #1 MR. JONES' ADDITION - EXAMPLE A

CIRCUMSTANCES: Mr. Jones' owns an existing residence on a conforming lot that has frontage on Maddox Creek. There is a depressional wetland located on the adjacent property and a portion of the wetland buffer is located on Mr. Jones' property. The house is rectangular and located wholly within the Management Zone. The creek is an open system with a low gradient and is fish bearing. The stream buffer is partially degraded.

PROJECT: Mr. Jones has applied for a building permit to add a modest addition to the river side of his house. The proposed addition is located within the Default Stream buffer, but is located outside of the Ecosystem Alternative standard stream buffer. He has chosen to opt for the Ecosystem Buffer Alternative in Chapter 15.40.120.

IMPACTS: The project will add 300 square feet of new building footprint within the Management Zone, but will not require the removal of any trees.

APPLICABLE CODE PROVISIONS:

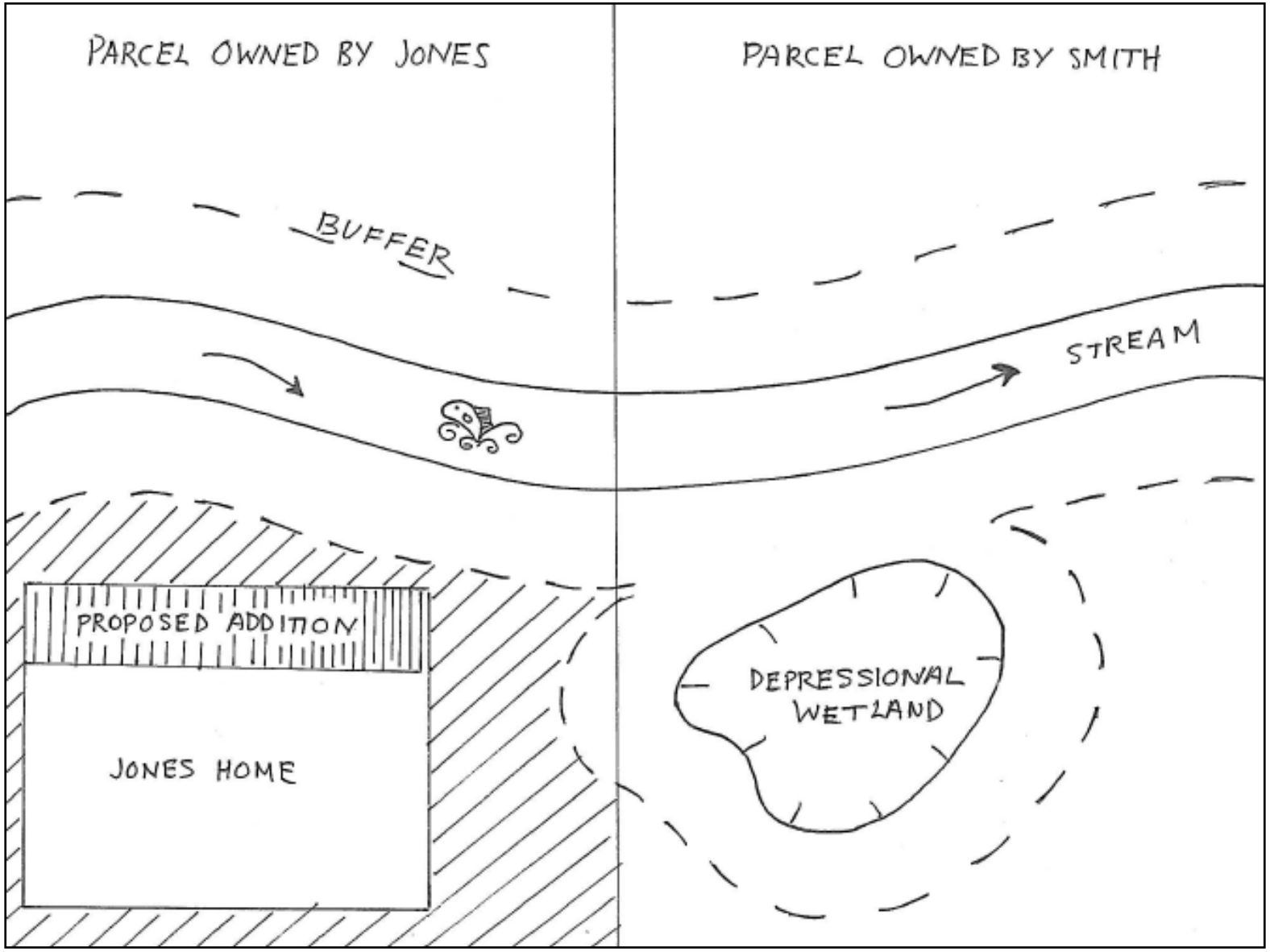
15.40.120.D.3 Maddox Creek

15.40.120.D.3 Table C open system
low gradient
Type F stream

15.40.120.D.f.i.(a) contribution to CAO fund

RESOLUTION: Mr. Jones will be required to make a payment to the CAO Management Fund in the amount of $450 (300 square x $1.50). He will also be required to enhance the degraded portions of the stream buffer based on prescriptive measures provided by the City Biologist. In addition, he will also be required to upgrade on-site drainage to current City standards.

Case Study #1: Mr. Jones' Addition - Example A



CASE STUDY #2 MR. JONES' ADDITION - EXAMPLE B

CIRCUMSTANCES: Mr. Jones' owns an existing residence on a conforming lot that has frontage on Maddox Creek. There is a depressional wetland located on the adjacent property and a portion of the wetland buffer is located on Mr. Jones' property. The house is rectangular and located wholly within the Management Zone. The creek is an open system with a low gradient and is fish bearing. The stream buffer is partially degraded.

PROJECT: Mr. Jones just won the lottery. Mr. Jones has applied for a building permit to completely remodel his home, which includes 1,200 square foot addition to his house. Since the proposed addition would intrude into the stream buffer, he must use the Ecosystem Buffer Alternative in Chapter 15.40.120.

IMPACTS: The project will add 1,200 square feet of new building footprint within the Management Zone. 400 square feet is located within the Standard Buffer.

APPLICABLE CODE PROVISIONS:

15.40.120.D.3 Maddox Creek

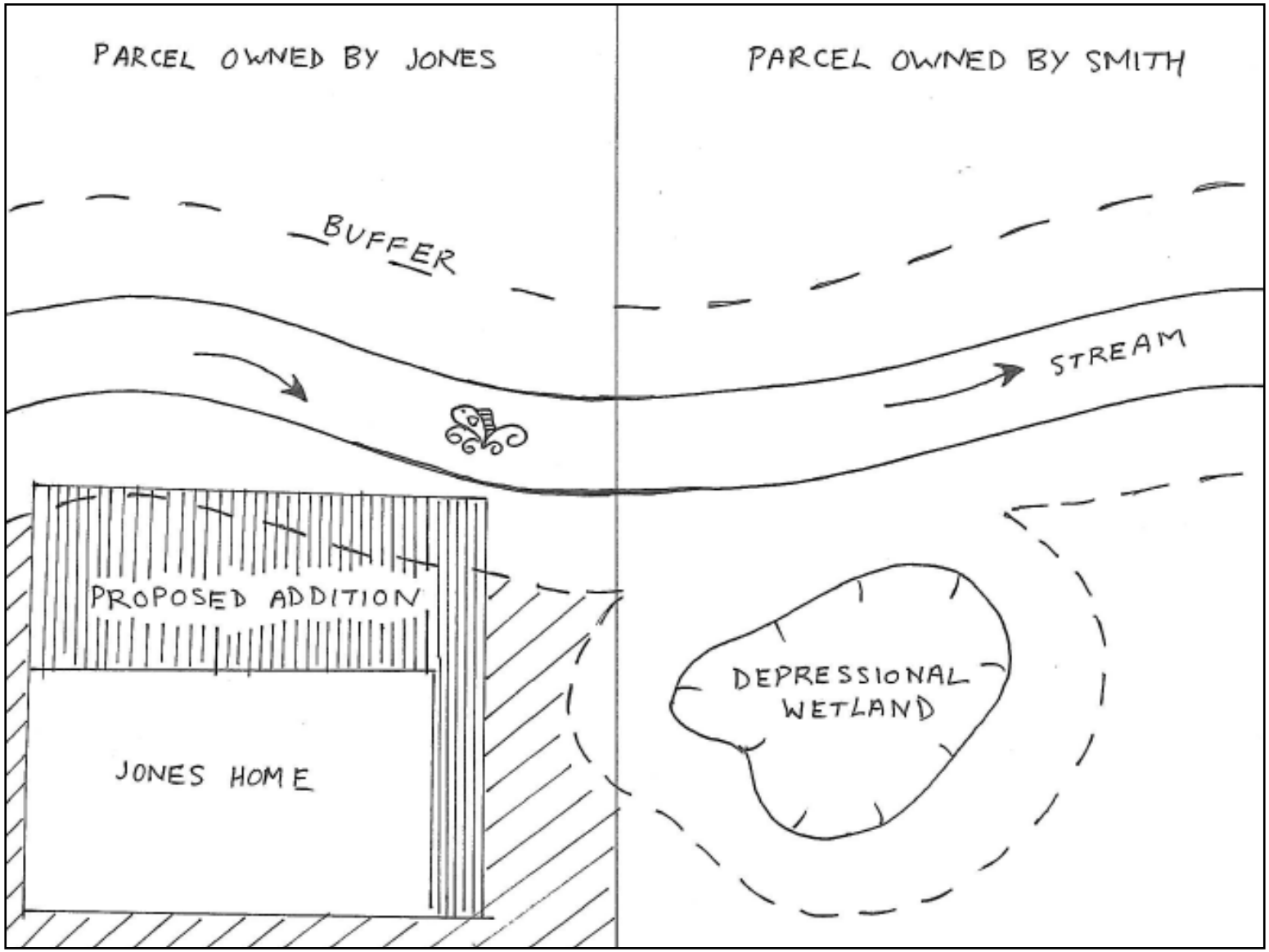
15.40.120.D.3 Table C open system
low gradient
Type F stream

15.40.120.D.3.f.i.(a) contribution to CAO fund

RESOLUTION: Mr. Jones will be required to make the following payment to the CAO Management Fund:
800 square feet x $1.50 = $1,200 (Management Zone)
400 square feet x $4.00 = $1,600 (inside Standard buffer)
Total = $2,800

He will also be required to enhance the degraded portions of the stream buffer based on prescriptive measures provided by the City Biologist. In addition, he will also be required to upgrade on-site drainage to current City standards.

Case Study #2: Mr. Jones' Addition - Example B



CASE STUDY #3 COMMERCIAL BUILDING CHANGE OF USE

LOCATION: Kulshun Creek sub-basin

CIRCUMSTANCES: There is an existing commercial building that has been a bait and tackle shop for as long as anyone can remember. The building is on a lot that has frontage on a public street, but that has access via a paved driveway, which divides the lot in two. On the north side of the property there is a portion of a category III wetland.

PROJECT: The building has been sold and the new owner has made a Conditional use application to change the use to Lee's Burger Hut. Since the change in use requires providing additional parking, Mr. Lee has submitted plans that show the new parking area located on either side of the paved driveway. The parking area on the north side of the driveway is proposed within the wetland and its buffer.

IMPACTS: The project will add 3,500 square feet of new impervious surface within the Management Zone and, as proposed, would require filling 400 square feet of wetland and would have 700 square feet of pavement within the minimum buffer area.

APPLICABLE CODE PROVISIONS:

15.40.120.D.1 Kulshun Creek	
15.40.120.D.1 Table A	open system medium gradient Category III wetland
15.40.120.D.1.f.i. & ii	contribution to CAO fund

RESOLUTION: Mr. Lee will not be allowed to fill the wetland or locate the parking within the minimum buffer area, since his use is not water dependent and there are other options to address the parking issue (e.g. on street). Additionally, the Management Zone extends across the paved driveway since it is not a public street. Mr. Lee will be allowed to develop approximately half of the area north of the driveway, the half adjacent to the public street; which will result in new impervious area of approximately 2,200 square feet. 400 square feet will be located within the area between the Standard and Minimum buffer.

Mr. Lee will be required to make a contribution to the CAO Management Fund as follows:

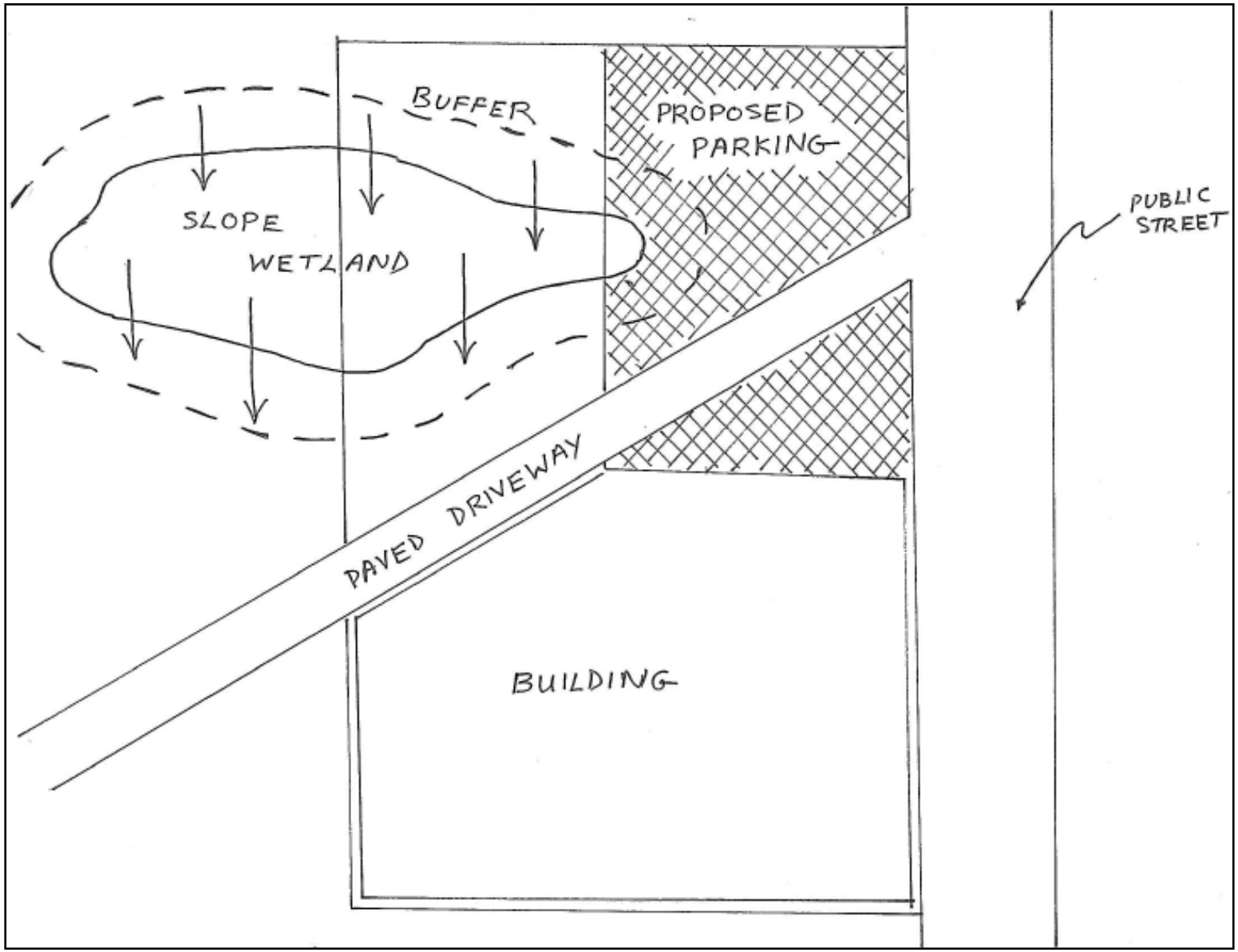
1,800 square feet x $1.00 = $1,800 (Management Zone)

400 square feet x $4.00 = $1,600 (inside Standard Buffer)

Total = $3,400

Mr. Lee also be required to enhance the degraded portions of the wetland buffer based on prescriptive measures provided by the City Biologist. In addition, he will also be required to upgrade on-site drainage to current City standards.

Case Study #3: Commercial Building Change Of Use



CASE #4 GREEN ACRES SUBDIVISION

CIRCUMSTANCES: In this case there is an undeveloped 40 acre parcel that contains three depressional wetlands. There is a sloped wetland immediately off-site and that is connected to an intermittent drainage way, which carries water tree months out of the year. The drainage continues off-site through a culvert and terminates in Trumpeter Creek. While the site is undeveloped, it is not pristine. There are degraded wetland buffers, missing tree canopy and some invasive plant species have become established.

PROJECT: The owner of the property is proposing to develop 160 new single-family residences. He intends to fill the wetlands, remove all vegetation during site preparation, put the drainage way in pipes and develop the property in a grid. The developer contends that the drainage way is a ditch, not a stream.

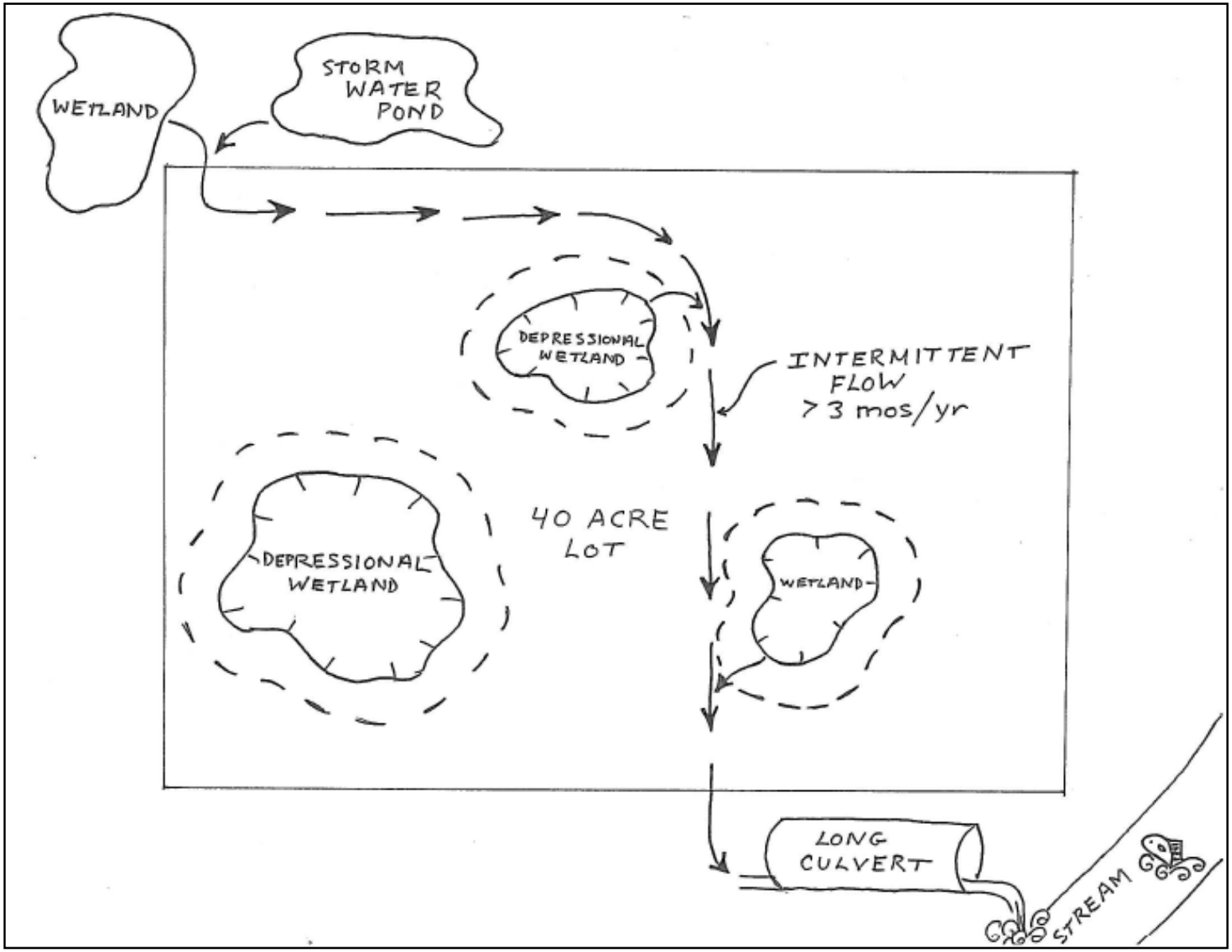
IMPACTS: The proposal would eliminate 8 acres of wetlands and associated habitat, and permanently change the site hydrology.

APPLICABLE CODE PROVISIONS:

15.40.120.D.2	Trumpeter Creek
15.40.120.D.2 Table A	open system low gradient Category III wetlands
15.40.120.D.2.f.i. & ii	contribution to CAO fund

RESOLUTION: The developer will not be allowed to fill the wetlands since his proposed use is not water dependent and there are clearly ways to design the project to meet programmatic objectives. In addition, he will also not be allowed to pipe the drainage way since it meets the definition of a stream. He has been instructed that he has a choice to use either the Default Buffer Alternative or the Ecosystem Alternative. He has chosen to use the Ecosystem Alternative since he believes the additional lots he will get from the reduced buffers will off-set the cost of paying into the CAO Management Fund.

Case Study #4: Green Acres Subdivision



CASE #5 VARIANCE

LOCATION: Trumpeter Creek sub-basin

CIRCUMSTANCES: In this case there is an old historic home constructed on an unusually small, non-conforming lot. The house is nonconforming due to an intrusion into the front yard setback, a side yard setback, a wetland buffer from an adjacent property and is within the minimum buffer area for trumpeter Creek.

PROJECT: The owner is proposing to add 200 square feet of addition to accommodate the expansion of an existing bedroom. The only area avialble for the addition is between the house and Trumpeter Creek.

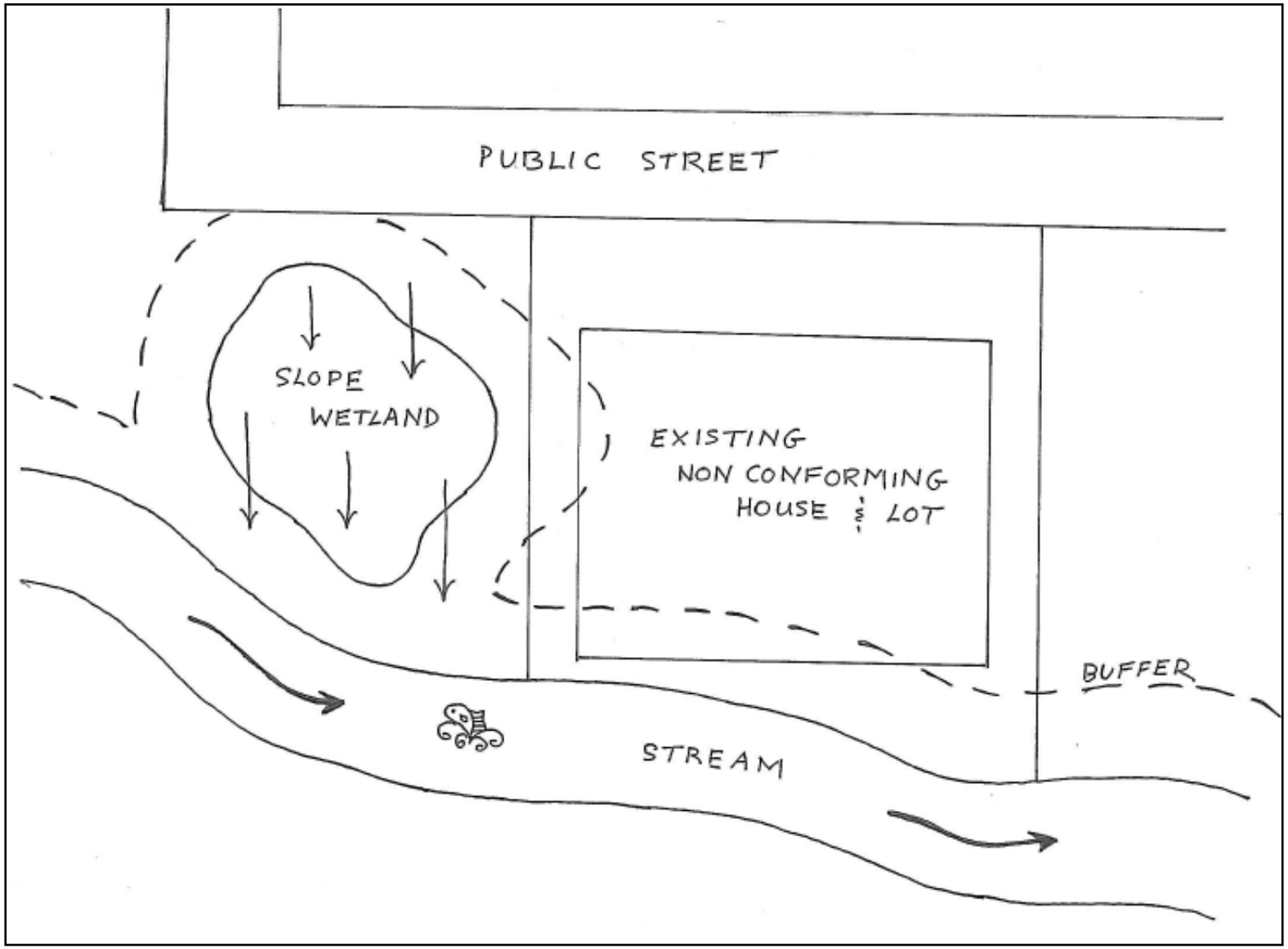
IMPACTS: The proposal would add another 200 square feet of building within the minimum buffer area.

APPLICABLE CODE PROVISIONS:

15.40.120.D.2 Trumpeter Creek	
15.40.120.D.2 Table A	open system low gradient Category III wetlands
15.40.120.D.2.f.i. & ii	contribution to CAO fund
15.40.160.D Variances	

RESOLUTION: A variance is required in this case since there is no other option for the proposed addition. In order for the project to be approved, the applicant must prepare a critical area study and develop a mitigation and monitoring plan. The decision will be made by the Hearing Examiner.

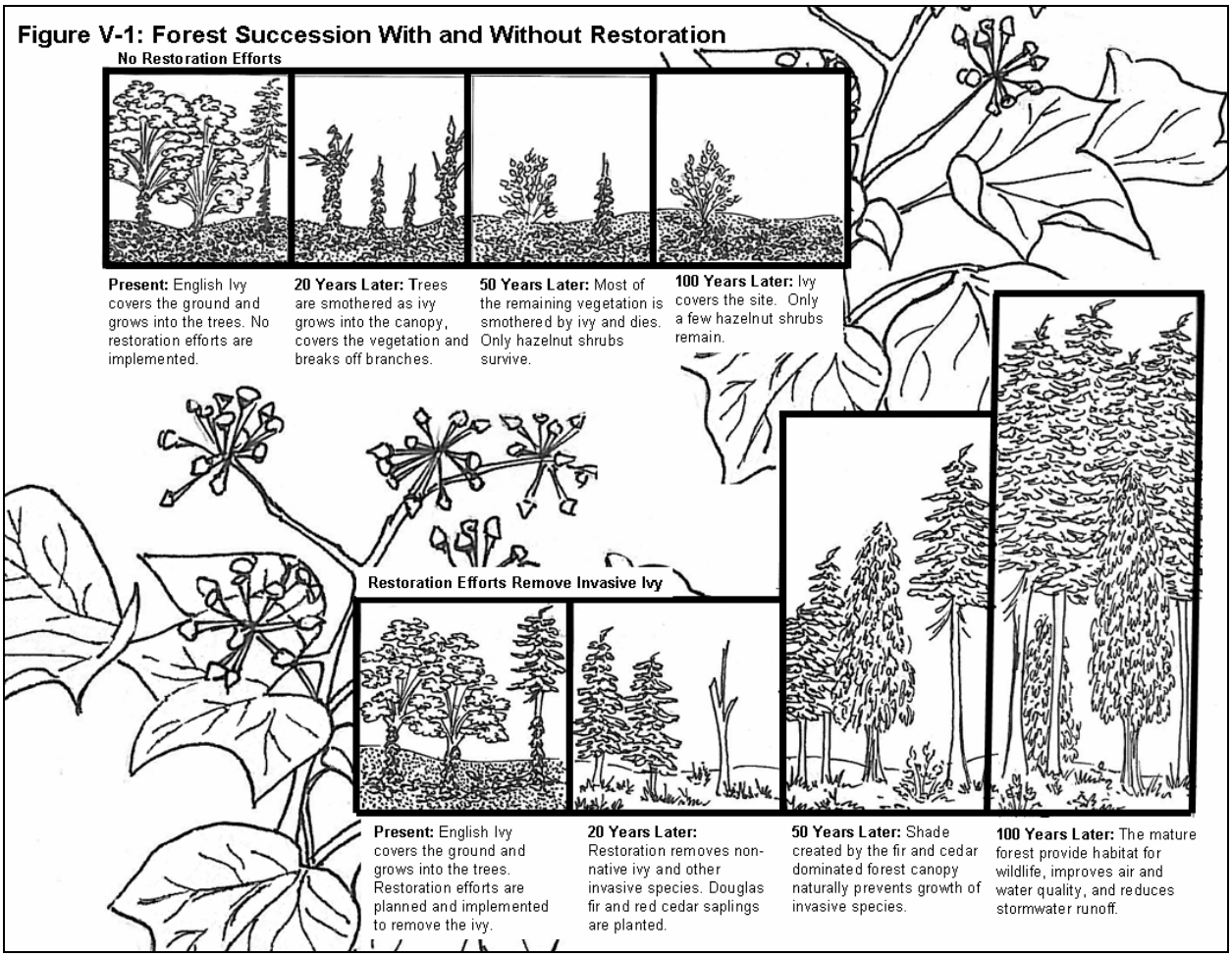
Case Study #5: Variance



CHAPTER V RESTORATION PRINCIPLES, GUIDELINES AND EXAMPLES

Restoration/Enhancement Practices According to Site Conditions

The following examples provide feasible restoration options that are intended to reestablish desirable ecological trajectories on degraded sites. Figure V-1 illustrates the ecological trajectory of a forest that has been invaded by English ivy under two scenarios: 1) when no restoration efforts are undertaken, and 2) when restoration projects are implemented that remove the ivy and plant conifers. The following examples are only generalities which suggest and describe the type of restoration that may be necessary on a site. They provide a starting point in the thought process of designing suitable restoration or enhancement plans for the Ecosystem Alternative Buffer Option. Note that the final required restoration efforts for your individual site may differ broadly from these examples. Section VI provides detailed specifications for implementing the suggested restoration and enhancement activities.



A. RELATIVELY INTACT SITES

The aquatic critical areas of relatively intact sites have been basically undisturbed during the past few decades. The critical area and its buffer are functioning well with respect to hydrology, biogeochemistry, plant community and faunal support (habitat). Woody debris in various stages of decay exists on the forest floor. Nearly 100% of the critical area and its buffer are covered with a dense vegetation canopy. Decomposing litter exists on forest floor. Channel and bank are stable. The channel longitudinal profile (channel gradient) is not interrupted by manmade barriers. Multiple layers (trees, shrubs, herbs) exist in the vegetation canopy. Few non-native plants are present. Significant restoration activities and enhancement efforts are usually not necessary. Any work to enhance the site typically can be performed by hand.

Figure V-2: Photographs of relatively intact waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES:

a. Remove any man-made garbage, trash or litter.
b. Remove any non-native weeds and carry out on-going weed management.

B. SEMI-INTACT SITES

In semi-intact sites, the aquatic critical area has been basically undisturbed during the past few decades; however, some non-native plants are evident. The critical area and its buffer are functioning with respect to basic hydrology and biogeochemistry, though plant community and faunal support may be compromised due to a recent disturbance. Often a sharp boundary exists between the buffer and surrounding upland areas. The critical area and its buffer are dominated by native plant species; however, sections of the buffer have been recently disturbed and are without tree canopy and/or significant under-story. These areas are often characterized by grasses and ornamental shrubs. Weeds/invasive plants may have become established at the site, but are not yet extensive. Multiple layers (trees, shrubs, herbs) exist in the vegetation canopy across most of the site. While significant restoration is not necessary, enhancement of the disturbed sections of the buffer will improve ecosystem functioning. A key element of restoration efforts is to ensure that invasive, non-native species do not become established within or along the edge of relatively intact, pristine buffers. In most cases enhancement or restoration activities (e.g., planting) can be performed by hand.

Figure V-3: Photographs of semi-intact waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES:

a. Remove any man-made garbage, trash or litter.
b. A high priority activity is to remove non-native/invasive plant species from the critical area and the upland buffer. This likely will involve on-going management to control and prevent new invasions.
c. Replant disturbed parts of the critical area and buffer with native trees, shrubs, and herbs species.
d. In some cases, woody debris piles and/or microdepressions can be installed to improve habitat structure.

C. MODERATELY DEGRADED SITES

In this case, the critical area and its buffer have had some recent and moderate to extreme disturbance. There is accumulation of trash throughout the site. Non-native/invasive plants have become established, but are not yet dominant. Most buffer functions (hydrology, biogeochemistry, plant community, faunal support/habitat) have been impacted to some degree; however, on-site water quality appears to be acceptable. Remnants of historic hydrological processes exist, but they have been partially interrupted. Stream channels may have been highly altered or channelized. The buffer plant community has been significantly altered with non-native and ornamental plant species, and much of the canopy has been removed, leaving grasses and in many cases bare, compacted earth. Slope stability may be an issue. Invasive plants dominate some patches. Human use of the area and trash are evident. Restoration and enhancement is necessary to re-establish ecosystem structure and functions. It is likely that some activities will require motorized equipment (e.g., small track hoes on dozers), though much of the work should still be accomplished manually.

Figure V-4: Photographs of moderately degraded waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES:

a. Remove any accumulated man-made litter and trash.
b. A first priority activity is to re-establish hydrological and biological processes where they have been interrupted. For example, stabilize slopes and soils and/or remove any barriers to fish or flow within the channel.
c. Remove weeds/invasive plants.
d. Plant native trees, shrubs and herbs within the critical area and its buffer and to increase native plant species while removing invasive plants. Increase conifers within forests that are dominated by deciduous trees such as alders. All planting efforts must be monitored and maintained at least annually over several years to ensure success of the new plants.
e. Introduce large wood to the channel. Increase habitat structure by installing woody debris piles, microdeprssions, snags, etc.

D. HIGHLY DEGRADED SITES

In highly degraded sites, the critical area has been disturbed and/or has been significantly impacted by adjacent development and human activities. Trash accumulation may be significant, including such things as car bodies and parts, metal barrels, etc. Water quality is or has been impacted by nearby land uses and poor stormwater control. Non-native/invasive plant species are well established and dominate much of the critical area. Grading for development in the immediate area may have resulted in topographic changes that have severely impacted hydrologic and biochemical processes.

In highly degraded sites, buffer functions are highly impacted and many functions are missing. There is essentially no intact plant community and most if not all of the canopy is missing. Non-native/invasive plant species are well established and in some cases are dominating upland habitat, smothering trees and completely covering available habitat area. Significant restoration activities are necessary to re-establish buffer functions and the health of the aquatic critical area.

Figure V-5: Photographs of highly degraded waters/wetlands.

Figure V-5 (continued): Photographs of highly degraded waters/wetlands.

EXAMPLES OF RESTORATION/ENHANCEMENT ACTIVITIES:

a. Remove accumulated trash, garbage, man-made refuse and any contaminants. This may require special handling and/or remediation if the site is contaminated by hazardous materials.
b. Conduct large scale removal of weeds, invasive and/or noxious plant species. Mechanical disturbance (i.e., grading) may be done to completely remove all weeds, before installing plants on the site. Topsoil may be replaced on highly disturbed sites. On-going monitoring and maintenance will be required to prevent reinvasion by non-native species.
c. Significant earth moving may be necessary to re-establish hydrologic connectivity between the critical area and its buffer and the surrounding upland area. Barriers within the channel may need to be removed or slopes may need to be graded and stabilized.
d. Re-establish a diverse native plant community by planting native trees, shrubs, and herbs. Increase conifers. Plantings will require regular monitoring to ensure success.
e. Introduce large wood to the channel. Increase habitat structure by installing woody debris piles, microdeprssions, snags, etc.

CHAPTER VI RECOMMENDED TECHNIQUES AND SPECIFICATIONS FOR BUFFER ENHANCEMENT AND RESTORATION

Restoration opportunities that will satisfy the Alternative Ecosystem Approach to buffer protection can be easily defined, simple to accomplish, and inexpensive. Using this guide, individuals can quickly begin to identify a restoration plan for their site. For small scale construction and development plans, individuals can usually identify a restoration plan which they can discuss with the city biologist or planning staff to determine an approved project plan. For more complex projects and situations with extensive buffer impacts, a private consultant and/or the city biologist likely will be needed to assist in developing a plan for buffer restoration and enhancement that is sufficient to mitigate the proposed buffer impacts.

The following sections provide a listing of the most common restoration and enhancement activities. The techniques and specifications for implementation the activities described below are already endorsed by the City of Mount Vernon, but additional techniques can always be added to this list. This document does not present all of the potential restoration and enhancement activities that are or will be acceptable for work in buffers. Please discuss any other restoration or enhancement ideas with the planning staff.

Generally, a combination of the procedures listed below will be required to reach restoration goals. The activities listed below flow roughly from simple and inexpensive activities. For example, removal of trash is a first step in buffer enhancement, while to slope stabilization through brush layering is a more comprehensive restoration project.

A. REFUSE REMOVAL

PURPOSE

At many sites, one of the most important first steps to restoration is to remove the garbage, remnant construction materials, large dirt piles, and/or other refuse piles. Refuse can release toxic chemicals, create an unsightly landscape, smother desirable vegetation, and lead to further degradation of a site.

Discarded battery found within a riparian buffer.

SPECIFICATIONS

Determine whether the debris can be dealt with by hand or whether mechanical equipment is necessary due to the bulk or mass of the refuse. Ensure that appropriate physical protection is worn while removing the garbage to prevent injury, because debris in urban/suburban settings often includes contaminants, sharps, *etc*. The waste must be disposed of properly. Be sure to separate any hazardous materials (chemicals, antifreeze, batteries, electronic equipment, *etc*.) from other debris. Hazardous materials should be handled with great care and sent to appropriate facilities such as the Skagit County Household Hazardous Waste Collection Center.

B. WEED MANAGEMENT

1. Integrated and Adaptive Weed Management Strategies

Weeds can grow or reproduce aggressively, be unsightly, and limit growth of other desirable plants by blocking light or using up the available nutrients in the soil. Weeds can be invasive, noxious, and/or non native plants. Some weeds can easily become dominant on disturbed sites due to their rapid rate of reproduction, ease of establishment, and rapid germination. Depending on the severity of the displacement of other plants, these species can be defined as noxious weeds or invasive weeds.

A "noxious weed" is any plant designated by a Federal, State or county government as injurious to public health, agriculture, recreation, wildlife, or property. Invasive vegetation is defined as any plant species listed as an obnoxious weed on the Skagit County Noxious weed list. Invasive plants include not only noxious weeds, but also other plants that are not native to this country. Some invasive plants can produce significant changes to vegetation composition or structure or ecosystem function. In the City of Mount Vernon, some of the common weed species include English ivy, Himalayan blackberry, reed canary grass, Japanese knotweed, Scotch broom, and purple loosestrife.

A ***weed*** is a plant that is considered to be a nuisance in a garden, lawn, or natural area.

A ***noxious weed*** is any plant species listed on the state or county noxious weed list

An ***invasive weed*** is a plant species which reproduces rapidly and outcompetes other native plants. These species are listed as obnoxious weeds on the Skagit County Noxious weed list.

In many restoration projects, weeds are managed rather than eradicated. Weed management strategies aim to minimize negative impacts weeds may have without necessarily eliminating them entirely. Weed management strategies should develop a healthy ecosystem which has reduced likelihood of additional weed invasions, prevents spread and reproduction of weeds that are present, and minimizes competition of weeds with beneficial species. Effective weed management strategies are marked by proactive and on-going control efforts that can shift efforts and vary through time to optimize control as conditions change in a variable environment.

2. List of Weeds and Specific Control Recommendations

The Skagit County Weed Control Board maintains a list of weed species which are subject to control in the county. In addition, other weed species, such as Himalayan blackberry, may be particularly problematic at restoration sites within the city of Mount Vernon, and control of these weeds of concern is recommended in restoration sites where native plants are getting established. In the following sections, five common, problematic weed species and their control measures are described in detail. Section three provides general specifications for methods of weed control.

a. Himalayan blackberry (*Rubus discolor*) is a highly invasive plant which effectively outcompetes native understory plants and prevents establishment of shade intolerant trees. This invasive blackberry, with large, widespread root masses, and dense vegetation, competes with native plants for nutrients, water, and sunlight. Himalayan blackberry is easily recognizable by

sprawling and trailing, angular canes with hooked prickles. Leaves are large, round to oblong and densely toothed, and are oriented in sets of 3 to 5.

Effective removal techniques include had pulling, mowing, grading, or herbicide use depending on site conditions and size of the weed infestation. For small infestestations which cover less than 200 square feet, hand-pulling or digging up of the entire root mass is recommended. Isolated plants should be removed immediately to prevent their spread. Hand pulling can be accomplished by cutting the main stems with pruners and digging up the root ball to ensure regrowth does not occur. Manual control may be most successful immediately after rain softens the soil and in naturally loose soils where the root mass can easily be removed. The site should be monitored throughout the growing season, and new sprouts should be removed as they appear.

At sites with larger infestations, the blackberry can be removed with weed-eaters, brush mowers, or machetes. Mowing should not be done on soils which are highly susceptible to compaction or erosion, or where soils are very wet. Ideally, the root ball should also be dug up and removed, as blackberry can resprout from a root mass. If the root ball is not removed, mowing may need to reoccur several years in a row to eliminate blackberry. In densely invaded sites, large-scale mechanical disturbance such as grading with heavy machinery can be used to remove blackberries. Mowing with large machinery can be very effective in controlling blackberries but may also harm desirable plants in the area. Whenever large dense areas of blackberry are removed, the bare areas created must be stabilized and seeded, mulched, and/or re-vegetated with native vegetation to prevent erosion and reinvasion of blackberries and other weeds. Follow-up management including yearly spot control for returning seedlings or re-growth and replanting of native plants must be done.

Blackberry shrubs are commonly found growing along wetland margins but are typically daughter plants off of a main cane. Control can be achieved by cutting the canes down to the ground. Blackberry roots can not withstand the anaerobic soil conditions without the supporting canes (King County Noxious Weed Control Program 2005).

Figure VI-1: Photograph of landscape overrun with blackberries.

b. English ivy (Hedra helix) is widely cultivated for landscaping purposes, but it easily escapes cultivation and becomes a weed by propagating in locations where it was not planted. Ivy forms thick mats which can smother herbs, trees and shrubs (see Figure V-1). Morphology of ivy plants differs for juvenile and mature individuals. Ivy plants exhibit the juvenile form for approximately 10 years, with light green leaves having 3 to 5 deep lobes, somewhat hairy shoots which can produce adventitious roots, and no flowers. Mature ivy plants have dark green leaves with slight or no lobes, produce flowers on vertical stems, and do not produce adventitious roots.

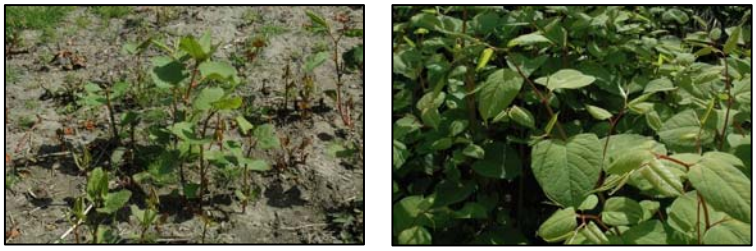
Although it is labor intensive, control of ivy can often be most effective through manual efforts. Hand pulling and digging up all shoots, leaves, and roots can result in complete removal of all plant material that is not easily accomplished with other methods. Alternatively, on flat sites, ivy may be eliminated by covering it with 8 inch thick layer of mulch. Herbicide use is not generally recommended control English ivy.

The disposal method is crucial for weed management. All stems must be removed from soil contact as fragments may be able to grow roots. Cuttings from ivy plants will desiccate and die after about a week of exposure to sunlight. Alternatively, covering the cuttings with a tarp or packing them in black plastic bags can prevent them from resprouting.

c. Japanese knotweed (*Polygonum cuspidatum*) is a fast-growing, stout plant with upright bamboo like stems that grows to heights between 3 and 16 feet (1-5 meters) tall. There are two similar knotweed species, Himalyan and giant knotweed, which can both hybridize with Japanese knotweed. The stems are often partially red or appear speckled with red. Small white or greenish flowers bloom at the bases of the leaves in July and August. Leaves are large and may be somewhat heart shaped. Japanese knotweed is a perennial plant which can persist through hard frosts in winter. Once it becomes established, knotweed is difficult to eliminate due to its extensive root system that may be more than 25 feet away from the parent plant and 7 feet below the surface. Knotweed can spread vegetatively; a small plant fragment can form a new plant colony. Following cutting, mowing, and digging, knotweed can resprout and grow quickly.

The most successful mechanical and manual control efforts for Japanese knotweed require frequent and persistent control efforts that effectively starve the root system. Cutting of all surface vegetation should occur early and often and be repeated several times each season until the plants are entirely removed. If using a mower or weed-eater, set the blade as close to the ground as possible and rake all remaining vegetation fragments to be dried away from soil. Mow at least every 2 to 3 weeks from March through August. Digging of the entire plant including all root material can be very effective, but the site must be checked repeatedly throughout the season for new sprouts. Be sure to collect and dry all plant material immediately so that it does not resprout at your site or elsewhere.

Figure VI-2: Photographs of Japanese knotweed.



d. Reed canary grass (*Phalaris arundinaceae*) is a large, coarse grass that can grow to 2 to 6 feet tall. By forming new plants from its root structure, reed canary grass forms dense stands that tend to prevent other plants from growing where it has become established. Reed canary grass is commonly found in and near wetlands, but it does not persist in areas with standing water for extended periods. A major distinguishing characteristic of reed canary grass is prominent, ¼ inch long, rounded ligule (membrane at the base of the leaf which surrounds the stem). Young inflorescences are green or slightly purple, and become tan to light brown as they mature. Inflorescences which form in June or July extend high above the leaves.

Hand removal may be feasible in small stands. Hand cutting may be most effective while the plant is in flower. Mowing may be successful at controlling the spread of reed canary grass by removing seed heads before the seeds mature and allows other native plants to compete with the new growth. Mowing should recur two times during the growing season (once in early summer, and once before the seeds mature in the fall) to promote native regrowth. Mowing closely followed by planting of live willow stakes can effectively decrease reed canary grass growth and can help change the site to a shrub or tree dominated community.

e. English holly (*Ilex aquifolium*) is a broadleaf evergreen which was introduced to the United States as an ornamental shrub. English holly becomes a large, dense shrub with seeds that may widely spread by birds. Holly plants quickly displace natives in the forest understory. Due to their attractive foliage and red berries, people often retain them in the landscape.
English holly can be removed by cutting the stem or, if the plant is small, digging it up from the ground. Because English holly does not have the same type of adventitious roots as species like English ivy, it is not necessary to take the same care with root removal (King County Natural Resources and Parks 2002). However, cutting an established tree at the base generally results in resprouting from the stump.

3. Weed Management Procedures

a. Hand pulling

PURPOSE

Hand pulling, similar to weeding in the garden, is generally suitable for small scale infestations of weeds. This method of weed removal requires frequent, persistent, and long term maintenance activities. Hand pulling allows site and species specific control, has a low impact to the desirable vegetation, results in immediate plant removal, and is inexpensive on a small scale.

SPECIFICATIONS

Weeding is most effective when the entire plant including the roots is removed from the ground. Native plants in the surrounding area should be left undisturbed as they can compete with and help minimize new weed growth and also provide habitat for wildlife.

When necessary, hand cutters or “weed whackers” can be used in addition to hand pulling. Since some weeds (such as Japanese knotweed) can form roots easily from small fragments of the

original plant, the plants and roots should be bagged, allowed to dry completely, burned, or deposited into a landfill. Special care should be taken to not spread fragments or seeds around the site or to other locations during pulling and transport.

If extensive areas are bare following hand pulling, the area should be mulched and/or planted quickly stabilize the soils. Methods for planting and a list of potential species are included in section IV.C.

LIMITATIONS

Hand pulling is slow and labor intensive. Therefore, it may not be practical for controlling large infestations. In addition, some species such as Himalayan blackberry can not feasibly be pulled by hand. Creation of plant fragments and facilitation of seed dispersal can occur with hand pulling should be avoided as it may increase the spread of the weeds in the future. Removal of weeds from aquatic areas should be done with great care to avoid negative impacts to water quality.

b. Competitive Exclusion

PURPOSE

The goal of weed management through competitive exclusion is to establish desirable vegetation that can compete with and reduce the growth and success of undesirable weeds. In a stable, self-sustaining ecosystem with a dense canopy native species, weeds are not likely to thrive or become dominant. In a healthy ecosystem, weeds are typically excluded because they can not compete successfully against the native, well-established species. In other words, the resources that the weeds need are not available when the environment is healthy and functioning properly.

SPECIFICATIONS

Broad scale seeding or planting of a cover crop can discourage reinvasion of weeds on relatively bare ground. Weed management through competitive exclusion in accomplished to establishment of a healthy forest community by planting native trees, shrubs, and herbs.

LIMITATIONS

Weed management through competitive exclusion will work only if weeds are not yet well established at a site. Frequent monitoring and maintenance will be needed to ensure that weeds do not become dominant again.

c. Large-Scale Mechanical Removal

PURPOSE

When weeds are already well established or dominate a site, large scale mechanical removal may be necessary. Large scale mechanical removal consists of grading or tilling the site with large machinery to remove all weeds from the site. This large disturbance must be followed immediately with seeding or planting with native plants and erosion control methods.

SPECIFICATIONS

Large scale weed removal should never be conducted in, around, or near streams, rivers or wetlands unless all necessary permits have been attained. A stormwater pollution prevention plan and a grading permit may be required before mechanical removal of weeds can occur.

To conduct large scale, mechanical weed management, the entire site may need to be mowed and graded. The site is then either stripped to a depth of at least one foot or buried under two feet or more of clean fill to prevent regrowth of existing weeds. The site should be graded appropriately to include microdepressions and other surface microtopography that will help promote a healthy ecosystem. On the newly barren soil, stabilization must be implemented immediately such as through planting a dense cover crop which will discourage reinvasion by weeds or through placement of coir cloth (a biodegradable netting), straw, or mulch suited to the scale of the disturbance. Disking and plowing prepares the site for formal planting. A suite of native species tailored to the site should be planted in the appropriate season. Frequent monitoring and weed management must be carried out to prevent reinvasion of weeds.

LIMITATIONS

Ensure that appropriate permits are attained prior to commencing large scale mechanical removal of weeds. Slope stabilization procedures, such as installation of coir cloth, may be necessary to prevent massive soil erosion. Installation of the native vegetation protects the slope by reducing surface soil erosion since root systems of plants serve to anchor the soil while also intercepting rainfall to minimize erosion.

d. Chemical Control

PURPOSE

Herbicide use should be considered only as a last option in weed management. Herbicides can be harmful to humans and the environment if they are not applied correctly and in the appropriate amounts. Only some types of herbicide are acceptable for use in weed management of buffers near riparian or aquatic ecosystems as most herbicides can cause damage to fish, aquatic communities and water quality. This guide does not recommend the use of herbicides for restoration projects within the City of Mount Vernon.

SPECIFICATIONS

If herbicide use is prescribed, it must be done in accordance with federal and state law. The applicator should be appropriately trained and must wear the necessary protective clothing. Herbicide use should be minimized so that only the amount that is necessary to control the weeds should be applied. Only the minimum mixing ratio that can gain control of the weeds should be used. Following initial herbicide use, a management plan should include hand pulling or physical control of weeds rather than continued herbicide usage. Herbicides should be applied through spot treating rather than broad application.

LIMITATIONS

Most herbicides are not approved for use in or near aquatic ecosystems such as streams, rivers, or wetlands. Herbicides can harm beneficial, native plants as well as the undesirable weeds.

C. Planting and Management of Plant Communities

Native plants have adapted over thousands of years to the weather, soils, and topography of Puget Sound. Well-established native plant cover provides habitat for wildlife and fish, improves soil stability and prevents invasion by non-native, undesirable weeds. This section describes some methods to re-establish native vegetation in buffer enhancement projects.

1. List of Native Plants

In designing a restoration/revegetation project, determine the appropriate species or a suite of species that is suited to your particular site depending on the physical characteristics of the habitat within your site. Important factors to consider when choosing species for a site include the proximity to a wetland, frequency of inundation, and amount of shade and sun. Appendix B provides a list of native plant species suitable for restoration planting in Mount Vernon buffers and waters/wetlands. However, in order to maximize success of restoration efforts, planting decisions must be tailored to the particular location. For example, some species can tolerate periodic to frequent flooding while other species are not able to withstand even a day of flooding. Please consult a native plant nursery, master gardener, landscape architect or the Washington Native Plant Society for more detailed information on specific plant choices for your site.

Native plant nurseries can be identified through the Washington Native Plant Society (http://www.wnps.org/landscaping/nurserylist.html) or your local phone book.

2. Re-vegetation/ Plant Community Assembly Profiles and Example Layouts

Planting layouts include a list of native species which are appropriate for the conditions at your site and a plan for how these species should be laid out on the ground. Table VI-1 is a list of the various plant communities that occur in Mount Vernon. Greater detail about the plant communities below, such as plant type, common and scientific name, wetland indicator status, type of plant material and on-center spacing distances, is included as Appendix C. The suitable community for your restoration site should be chosen to match the physical conditions of the site. The city biologist, an environmental consultant, or native plant nursery staff can assist with selecting the appropriate community for your site. All species selected for planting in restoration sites should be native species (Appendix B).

Table VI-1: Mount Vernon plant communities.

Plant Community	Plant Community Type	Location
A	Scrub-Shrub Forested Wetland	Depressional Wetland
B	Floodplain Forested Wetland	Above the channel and Across to the Adjacent Hillslope
C	Riparian-Upland Transitional Forest	Depressional and Riverine Wetland Buffer
D	Hillslope Scrub-Shrub Forested Wetland	Hillslope Wetland
E	Western Hemlock Hillslope Forest	Hillslope Wetland Buffer

3. Calculation of Planting Density

Plant layouts can be designed based on the desired number of stems per acre or the desired spacing between plants. Table VI-2 can be used to convert between plant spacing and plant density (stems per acre). This table is useful in determining the number of plants that will be needed for a given area in your restoration project.

Table VI-2: Calculation of planting densities based on plant spacing.

Plant Spacing vs. Density for On-Center Spacing

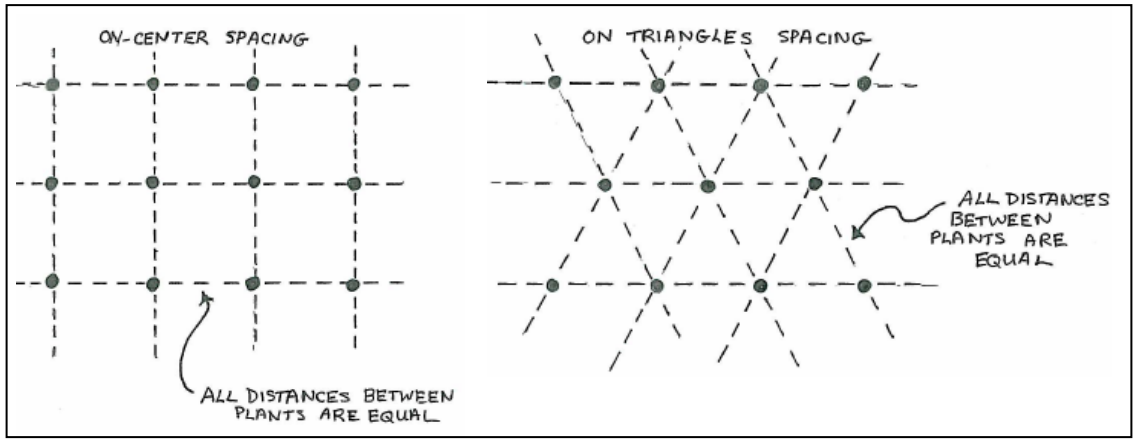
Spacing (ft)	Density (stems/acre)	Spacing (ft)	Density (stems/acre)	Spacing (ft)	Density (stems/acre)	Spacing (ft)	Density (stems/acre)	Spacing (ft)	Density (stems/acre)	Spacing (ft)	Density (stems/acre)	Spacing (ft)	Density (stems/acre)
0.1	4,356,000	2.1	9,878	4.1	2,591	6.5	1,031	16.5	160	26.5	62	43	24
1.2	1,089,000	2.2	9,000	4.2	2,469	7.0	889	17.0	151	27.0	60	44	23
0.3	484,000	2.3	8,234	4.3	2,356	7.5	774	17.5	142	27.5	58	45	22
0.4	272,250	2.4	7,563	4.4	2,250	8.0	681	18.0	134	28.0	56	46	21
0.5	174,240	2.5	6,970	4.5	2,151	8.5	603	18.5	127	28.5	54	47	20
0.6	121,000	2.6	6,444	4.6	2,059	9.0	538	19.0	121	29.0	52	48	19
0.7	88,898	2.7	5,975	4.7	1,972	9.5	483	19.5	115	29.5	50	49	18
0.8	68,062	2.8	5,556	4.8	1,891	10.0	436	20.0	109	30.0	48	50	17
0.9	53,778	2.9	5,180	4.9	1,814	10.5	395	20.5	104	31.0	45	55	14
1.0	43,560	3.0	4,840	5.0	1,742	11.0	360	21.0	99	32.0	43	60	12
1.1	36,000	3.1	4,533	5.1	1,675	11.5	329	21.5	94	33.0	40	65	10
1.2	30,250	3.2	4,254	5.2	1,611	12.0	303	22.0	90	34.0	38	70	9
1.3	25,775	3.3	4,000	5.3	1,551	12.5	279	22.5	86	35.0	36	75	8
1.4	22,224	3.4	3,768	5.4	1,494	13.0	258	23.0	82	36.0	34	80	7
1.5	19,360	3.5	3,556	5.5	1,440	13.5	239	23.5	79	37.0	32	85	6
1.6	17,016	3.6	3,361	5.6	1,389	14.0	222	24.0	76	38.0	30	90	5
1.7	15,073	3.7	3,182	5.7	1,341	14.5	207	24.5	73	39.0	29	95	5
1.8	13,444	3.8	3,017	5.8	1,295	15.0	194	25.0	70	40.0	27	100	4
1.9	12,066	3.9	2,864	5.9	1,251	15.5	181	25.5	67	41.0	26	150	2
2.0	10,890	4.0	2,723	6.0	1,210	16.0	170	26.0	64	42.0	25	200	1

Table VI-2 (continued): Calculation of planting densities based on plant spacing

Plant Spacing vs. Density for Triangular Spacing

Spacing (ft)	On Triangles Density (stems/acre)	Spacing (ft)	On Triangles Density (stems/acre)	Spacing (ft)	On Triangles Density (stems/acre)	Spacing (ft)	On Triangles Density (stems/acre)	Spacing (ft)	On Triangles Density (stems/acre)	Spacing (ft)	On Triangles Density (stems/acre)	Spacing (ft)	On Triangles Density (stems/acre)
0.1	10,059,751	2.1	22,811	4.1	5,984	6.5	2,381	16.5	370	26.5	143	43	54
0.2	2,514,938	2.2	20,785	4.2	5,703	7.0	2,053	17.0	348	27.0	138	44	52
0.3	1,117,750	2.3	19,017	4.3	5,441	7.5	1,788	17.5	328	27.5	133	45	50
0.4	628,734	2.4	17,465	4.4	5,196	8.0	1,572	18.0	310	28.0	128	46	48
0.5	402,390	2.5	16,096	4.5	4,968	8.5	1,392	18.5	294	28.5	124	47	46
0.6	279,438	2.6	14,881	4.6	4,754	9.0	1,242	19.0	279	29.0	120	48	44
0.7	205,301	2.7	13,799	4.7	4,554	9.5	1,115	19.5	265	29.5	116	49	42
0.8	157,184	2.8	12,831	4.8	4,366	10.0	1,006	20.0	251	30	112	50	40
0.9	124,194	2.9	11,962	4.9	4,190	10.5	912	20.5	239	31	105	55	33
1.0	100,598	3.0	11,178	5.0	4,024	11.0	831	21.0	228	32	98	60	28
1.1	83,138	3.1	11,178	5.1	3,868	11.5	761	21.5	218	33	92	65	24
1.2	69,859	3.2	9,824	5.2	3,720	12.0	699	22.0	208	34	87	70	21
1.3	59,525	3.3	9,238	5.3	3,581	12.5	644	22.5	199	35	82	75	18
1.4	51,325	3.4	8,702	5.4	3,450	13.0	595	23.0	190	36	78	80	16
1.5	44,710	3.5	8,212	5.5	3,326	13.5	552	23.5	182	37	73	85	14
1.6	39,296	3.6	7,762	5.6	3,208	14.0	513	24.0	175	38	70	90	12
1.7	34,809	3.7	7,348	5.7	3,096	14.5	478	24.5	168	39	66	95	11
1.8	31,049	3.8	6,967	5.8	2,990	15.0	447	25.0	161	40	63	100	10
1.9	27,866	3.9	6,614	5.9	2,890	15.5	419	25.5	155	41	60	150	4
2.0	25,149	4.0	6,287	6.0	2,794	16.0	393	26.0	149	42	57	200	3

Figure VI-3: Diagram of On-Center and Triangular Spacing.



4. Live Stakes

PURPOSE

Live stakes are used in many planting and bioengineering techniques, including general willow and alder planting, live siltation, brush layering, and fascines. Live staking is a simple and natural method to stabilize slumping materials and to "pin" sods and mesh to a slope. Live stakes can be inserted into silty, erodable soils in the spring and the cuttings can grow over the summer, producing roots that help bind unstable materials to decrease future erosion. Species that can be installed as cuttings include willows and shrub dogwoods.

SPECIFICATIONS

Table VI-3 lists common species planted as cuttings within Western Washington. Cuttings should harvested from living trees or shrubs. Each stake should be ½ to 2 inches in diameter and about 3 feet in length. Side branches must be removed entirely but bark should not be damaged. Large pruning shears can be used to make smooth and even stem bases on each stake. Stakes should be trimmed and left inundated for approximately 12 hours immediately prior to planting. Live stakes are often cut and installed while they are dormant.

The stake should be placed in the ground with the buds pointing upwards. About four-fifths of the length of the stake should be below ground and angled downstream. The cutting can be gently tapped into the soil or a metal bar can be used to make a pilot hole to minimize damage to the cutting during installation. Stakes should be randomly placed (rather than in a straight line) with two to four stakes per square yard.

When preparing for construction and planting at a restoration site, only enough material to use in one day should be cut. Prior to construction or planting, cuttings should be protected from direct sunlight, drying out, and heat. The cuttings should be stored in water or moist soil until they can be planted. Immediately before planting, stakes or branches can be cut to appropriate lengths and side branches can be removed.

Table VI-3: Common species which can be planted as live stakes in Western Washington

Scientific Name	Common Name
Salix sitchensis	Sitka willow
Salix lucida (lasiandra)	Pacific willow
Salix scouleriana	Scouler's willow
Salix hookeriana v. piperi	Hooker's/Piper's willow
Salix hookeriana	Hooker's willow
Populus balsamifera	Black cottonwood
Cornus sericea	Red-osier dogwood

LIMITATIONS

Only some species are able to be grown efficiently through live cuttings. Seeds, plugs or seedlings should be transplanted to establish other species.

ADDITIONAL NOTES

Additional details on live stake cuttings can be found on the King County website (http://dnr.metrokc.gov/wlr/pi/Cutting.htm) in the Guidelines for Bank Stabilizaton Projects in the Riverine Environments of King County (Johnson, A.W. and J.M. Stypula 1993) published by the King County Department of Public Works, Surface Water Management Division, Seattle, Wash.

Figure VI-4: Illustration on how to prepare live stake cuttings.

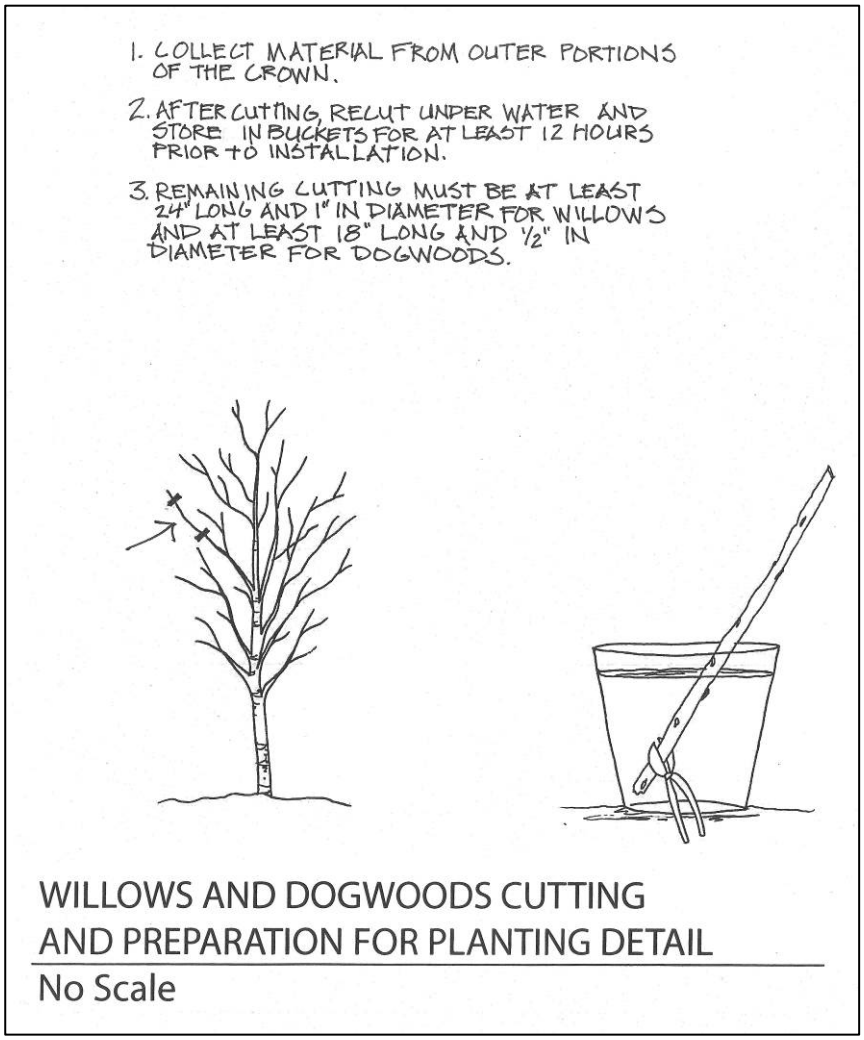
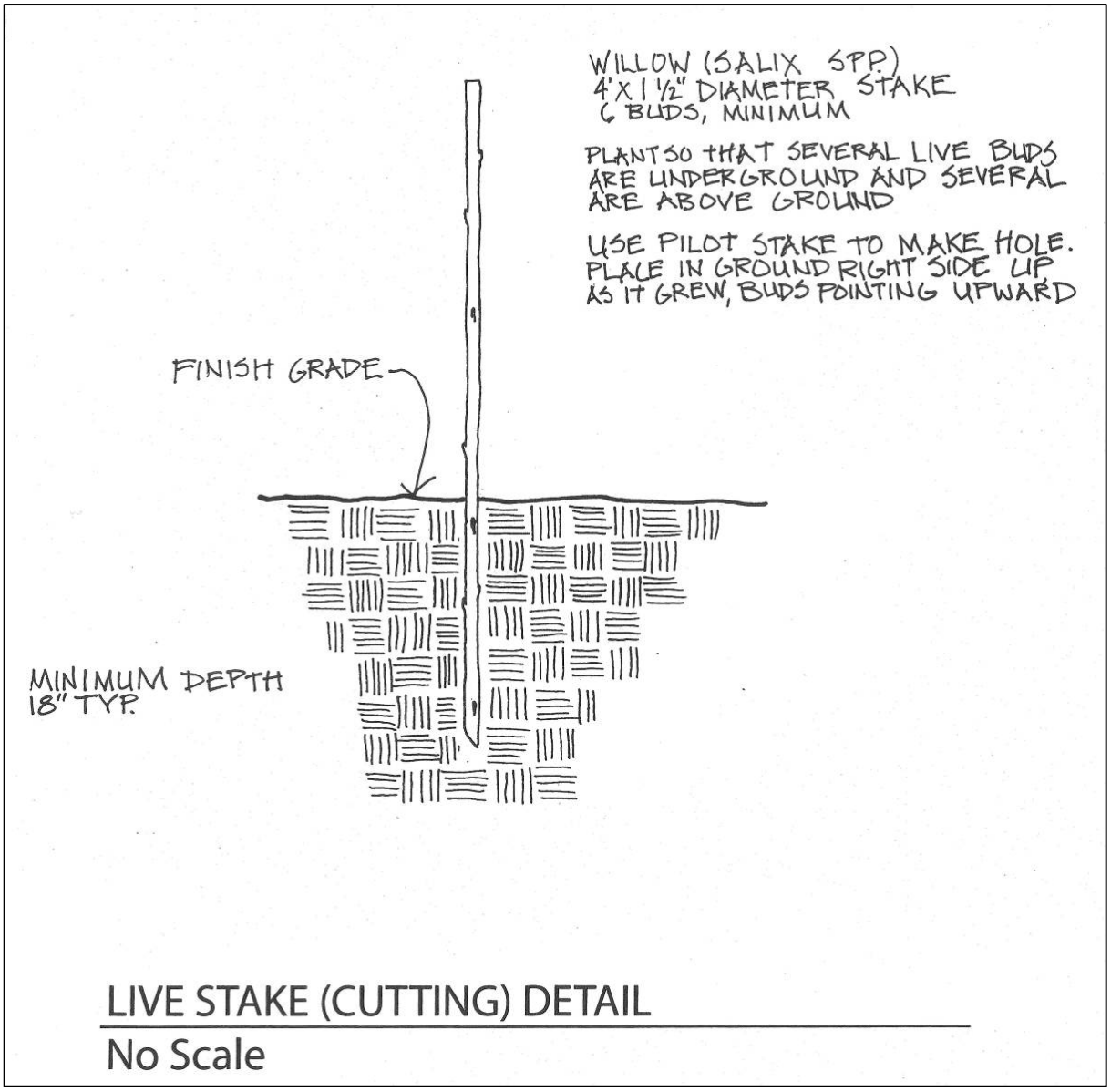


Figure VI-5: Illustration on how to plant live stake cuttings.



5. Rhizome Planting

PURPOSE

Rhizomes are the creeping, underground stems possessed by some plant species (including many wetland plants) that allow rooting and production of new shoots and leaves at each node. Planting rhizomes of some species will often result in more rapid success in revegetation of these species than planting from seed.

SPECIFICATIONS

Planting rhizomes directly into mud is generally most successful. If the soil is dry, dig holes so that the rhizome is supported and roots can hang slightly lower. The base of the rhizome should be in complete contact with the soil, and the top of the rhizome should be just below the surface of the soil. Rhizomes should generally be placed 6 to 20 inches apart.

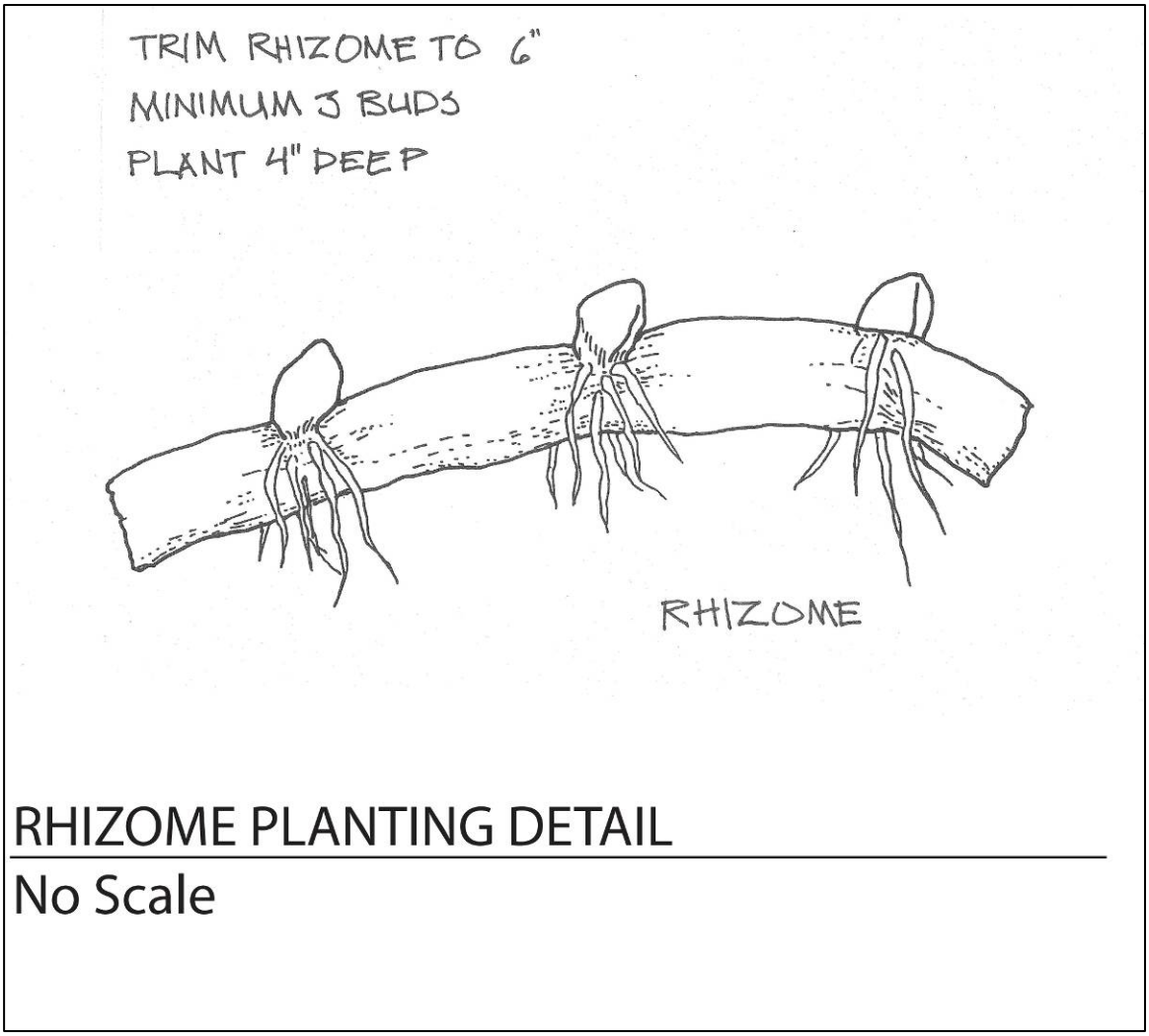
LIMITATIONS

Only some species can effectively propagate through rhizomes.

ADDITIONAL NOTES

The volume of the rhizome cutting may be related to its tendency to root and grow; therefore if propagation material is abundant, plant larger pieces of rhizome. A minimum of 3 buds should be present on each cutting.

Figure VI-6: Illustration on how to prepare rhizome cuttings.



6. Herb, Grass and Fern Planting

PURPOSE

Herbs, forbs, grasses, sedges, rushes, and ferns can be planted on a site as vegetation mats, plugs, sprigs, or flats, through direct seeding, and with transplants (single plants).

SPECIFICATIONS

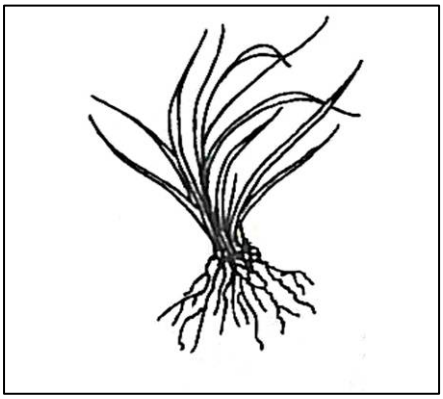
When working with transplants, plugs, sprigs and mats, it is essential that you keep the plant material, particularly roots, constantly moist and away from direct sunlight and wind immediately after harvesting, while transporting the vegetation to the site, and during planting. If harvesting plants from a nearby site, you should remove and prepare only the vegetation that can be planted on the same day as harvesting.

Select native plant species that are adapted to the microclimate at the location of planting. For example, some species are adapted to withstand or thrive with frequent flooding, while other species can not survive in saturated soils. Your native plant supplier should be able to assist you with selecting appropriate species for your location.

a) Plug Planting

Plug planting is a relatively inexpensive method to establish vegetation on a site. Plugs are best used as a supplementary method to intersperse a variety of species to a site. Plug planting can be used to increase diversity and abundance of wetland emergent herbs, sedges, and rushes where the soil is saturated or inundated. As with transplanting young plants, the species and planting locations must be carefully tailored to the site. Mortality of plugs may be high if careful planting procedures are not followed.

Figure VI-7: Plug illustration.

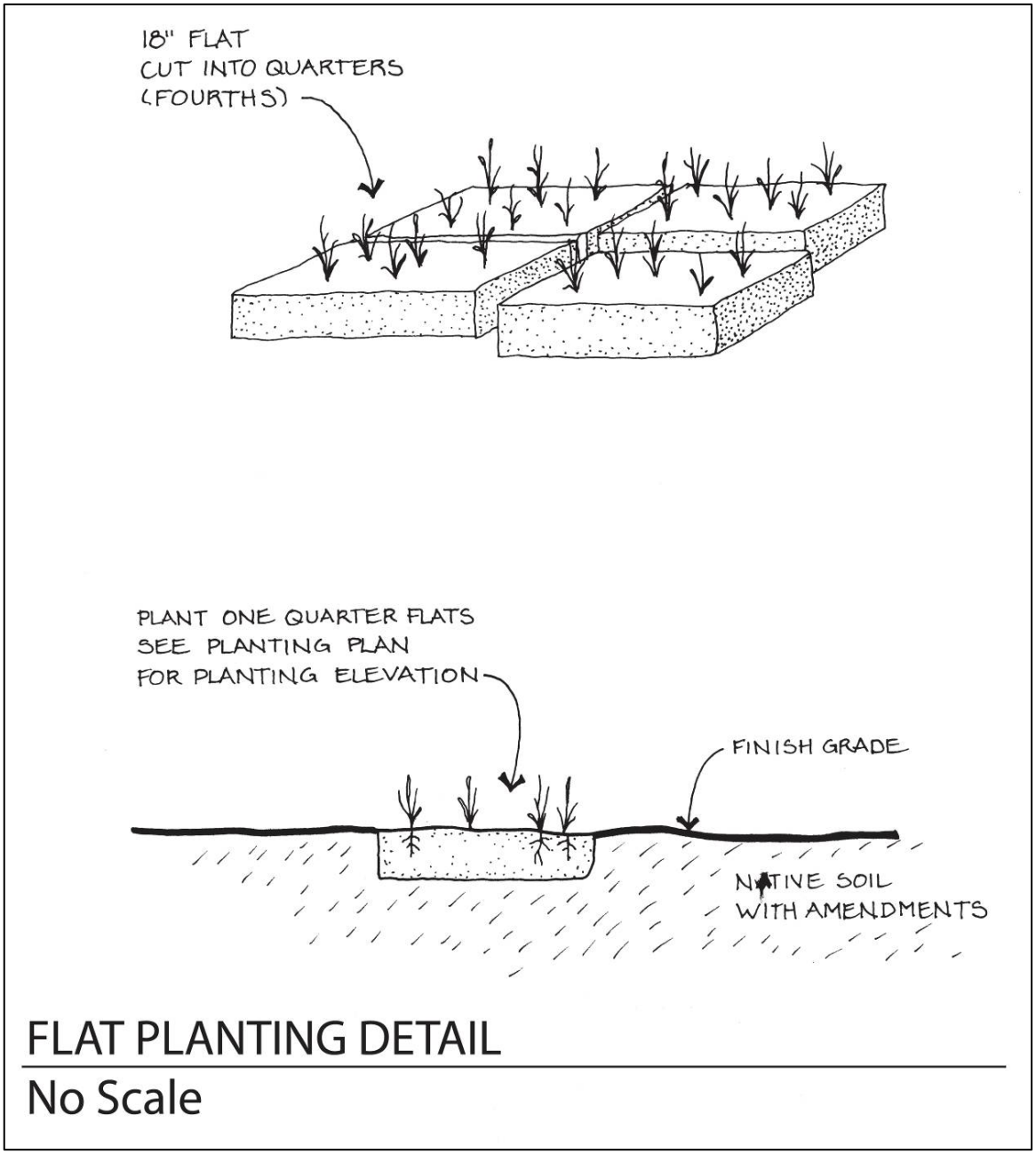


Plugs should remain moist and be watered prior to transplanting. Plugs should be placed into bare patches. If bare patches do not exist, an areas approximately 1 ft^2 should be cleared prior to planting. A small shovel or dibber can be used to make holes that are the same size as the plug, as good root to soil contact must be established for each plant to survive. The plug can be placed in the hole so that the surface of the plug is slightly below the surface of the soil. Pinch the soil above the plug to ensure that the plug is contained and shielded from drying out. Plugs can be protected from grazing damage using clean, rinsed cardboard milk cartons.

b) Flat Planting (mats)

Dig a shallow level hole or trench that is approximately the same length, width and depth as the portion of the flat that you will plant. Divide an 18 inch flat approximately into quarters and plant the entire section so that it is level with the original soil surface. Be sure that there is a good connection between the edges of the flat and the native soil so the roots on the edges of the mat will not dry out. Generously water the installed sections of the flat in to the soil.

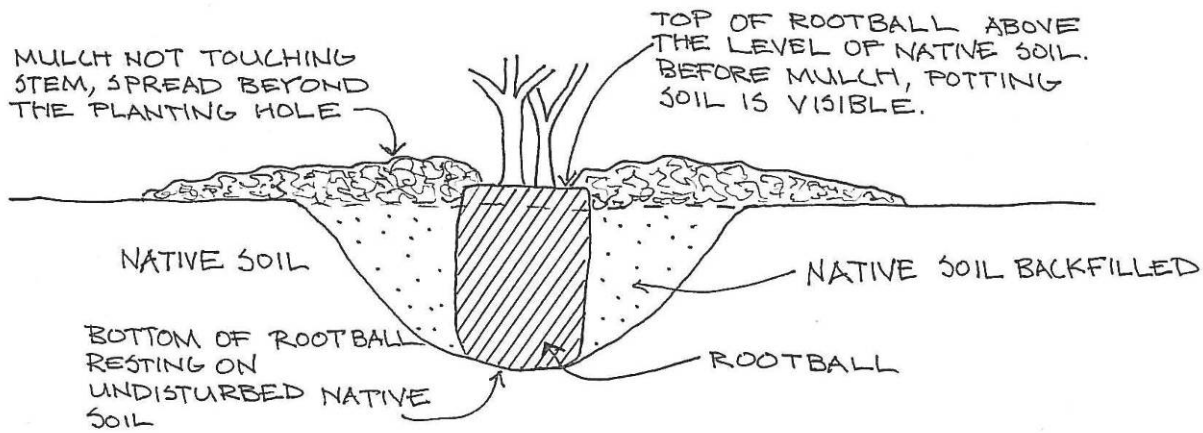
Figure VI-8: Illustration on how to plant flats.



c) Transplanting Pots

To plant herbs, grasses or shrubs grown in pots (i.e., 1-gallon), dig a hole that is approximately as deep as the root system of the transplant and at least twice as wide. Remove the plant from the pot and place it in the hole. Ensure that the base of the stem of the transplant is either flush or slightly above the surrounding soil surface. Backfill the hole with amended native soil and tamp lightly around the root ball of the transplant. Apply a small amount of slow release osmocote fertilizer to assist growth of the transplant. Add mulch around the plant to retain moisture and reduce weed growth.

Figure VI-9: Illustration on how to transplant herbs, grasses or shrubs grown in pots.



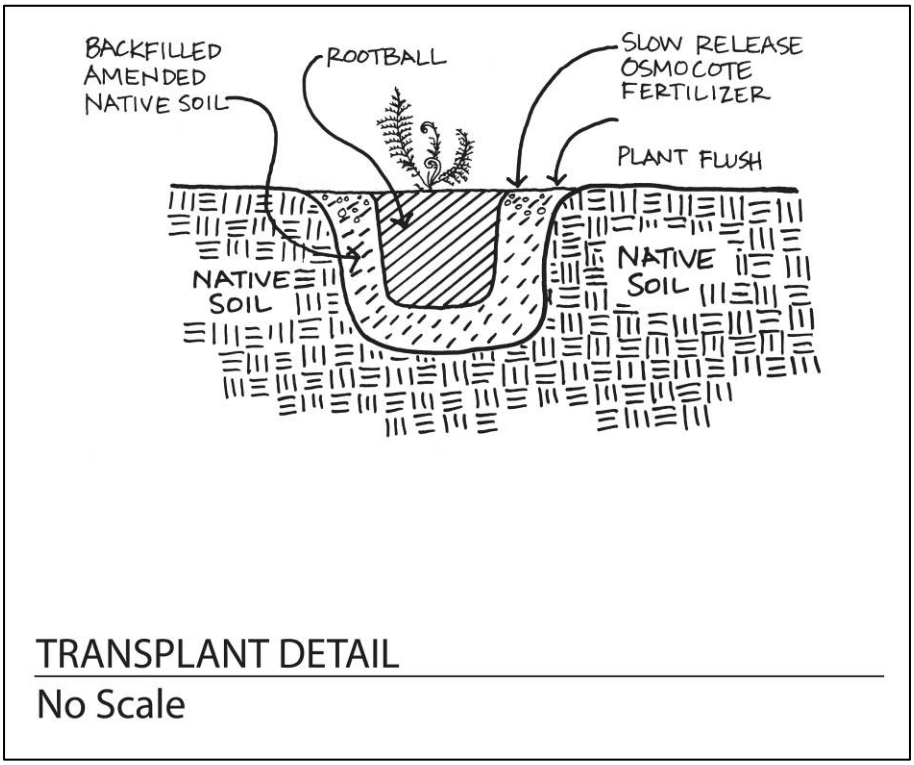
TRANSPLANT DETAIL

No Scale

d) Planting Herbs, in Compacted or Poor Soils

If the soils are highly compacted or poor quality, planting may be more successful if the initial hole is larger and deeper than the plant.

Figure VI-10: Illustration on planting herbs in compacted or poor soils.



7. Planting Trees and Shrubs

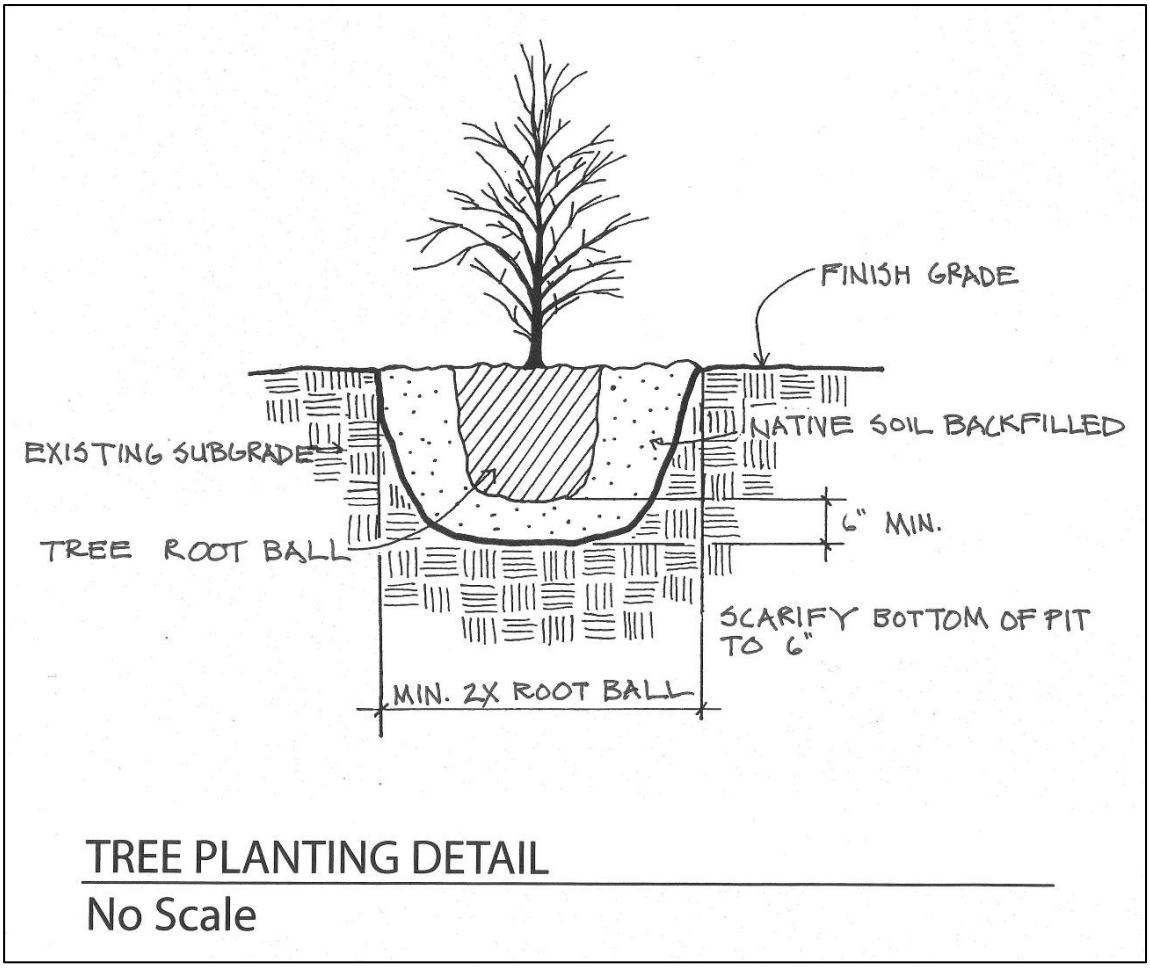
PURPOSE

Seedling or sapling trees and shrubs can be planted in order to quickly attain the desired habitat structure.

SPECIFICATIONS

Locate the appropriate microsite conditions (i.e. frequency of flooding, elevation, amount of shade) for the tree species you plan to install. The current amount of shade, and the frequency of inundation and saturation should be considered when choosing a species to plant at a particular site. To plant a tree, prepare a hole that is wider and deeper than the root ball. Scarify the bottom of the hole and place the transplant into the hole with backfill covering over the root material. Ensure that the stem is covered with soil just to its base, completely covering the root system but no farther. Compress the soil gently around the root system. Water new transplants generously to decrease transplant shock. Provide appropriate protection (i.e., tree shelters) from wildlife herbivores which could visit your site (see Section VI-C.9).

Figure VI-11: Illustration on how to plant trees and shrubs.



8. Tree staking

PURPOSE

Staking is occasionally required to help a transplanted tree as it is becoming established. Most trees do not need to be staked, and staking should be done with great care so as to not do more long term damage than good to your newly planted tree.

SPECIFICATIONS

Stakes should be aligned at right angles to the prevailing winds so that the tree can move back and forth without hitting itself on the stake. Place stakes as low as possible, and less than 2/3 the height of the tree. Keep the stakes 12 to 18 inches away from the trunk so that the roots have room to stretch out. Use a flexible material such as garden tape or a piece of an old pair of panty hose to loosely tie the tree to the stake so that the trunk can gain strength from movement and develop the correct trunk taper. Remove the stake when roots have become established in the native soil within one growing season or at most within a year.

Figure VI-12: Illustration on how to plant and stake a tree.

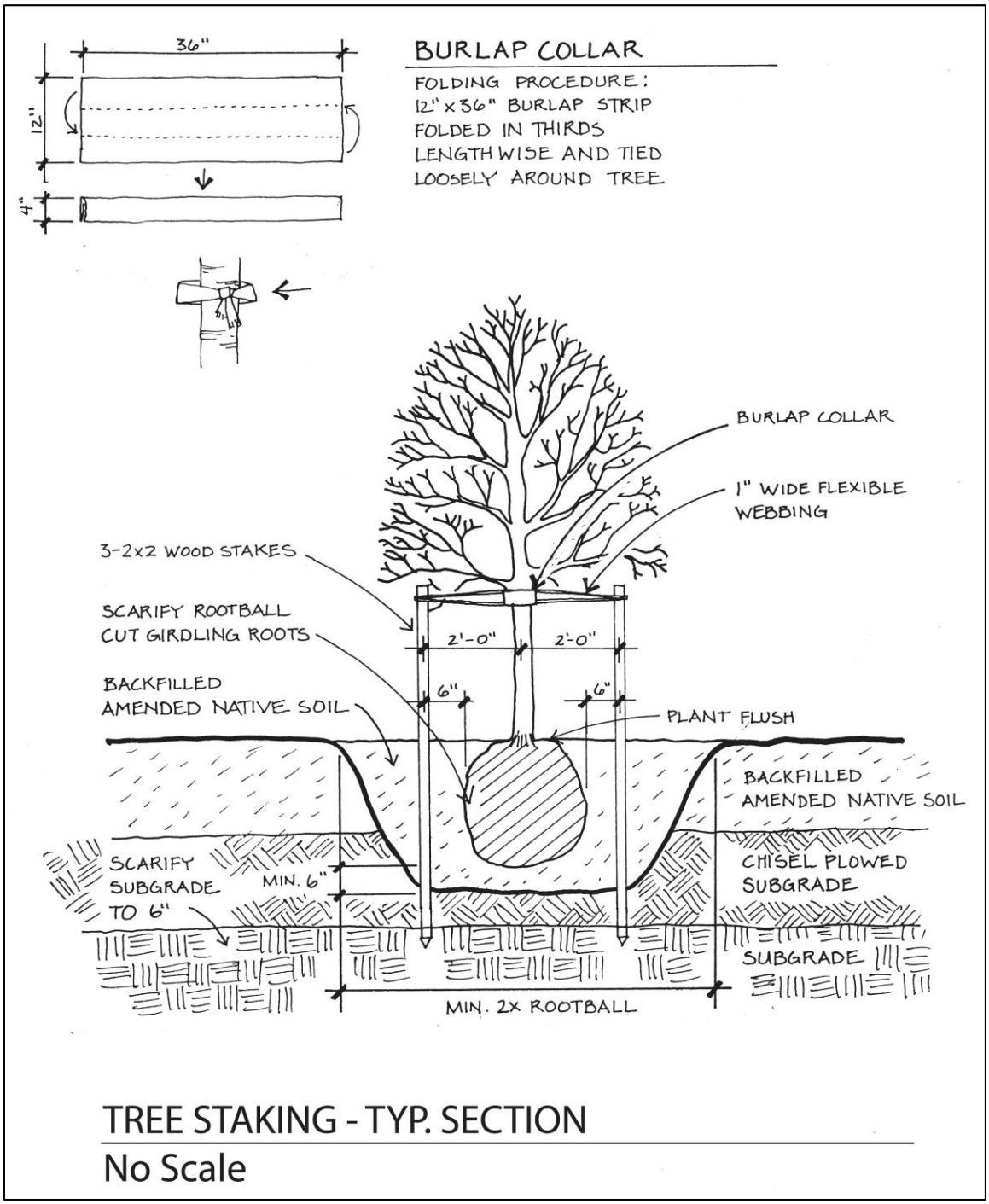
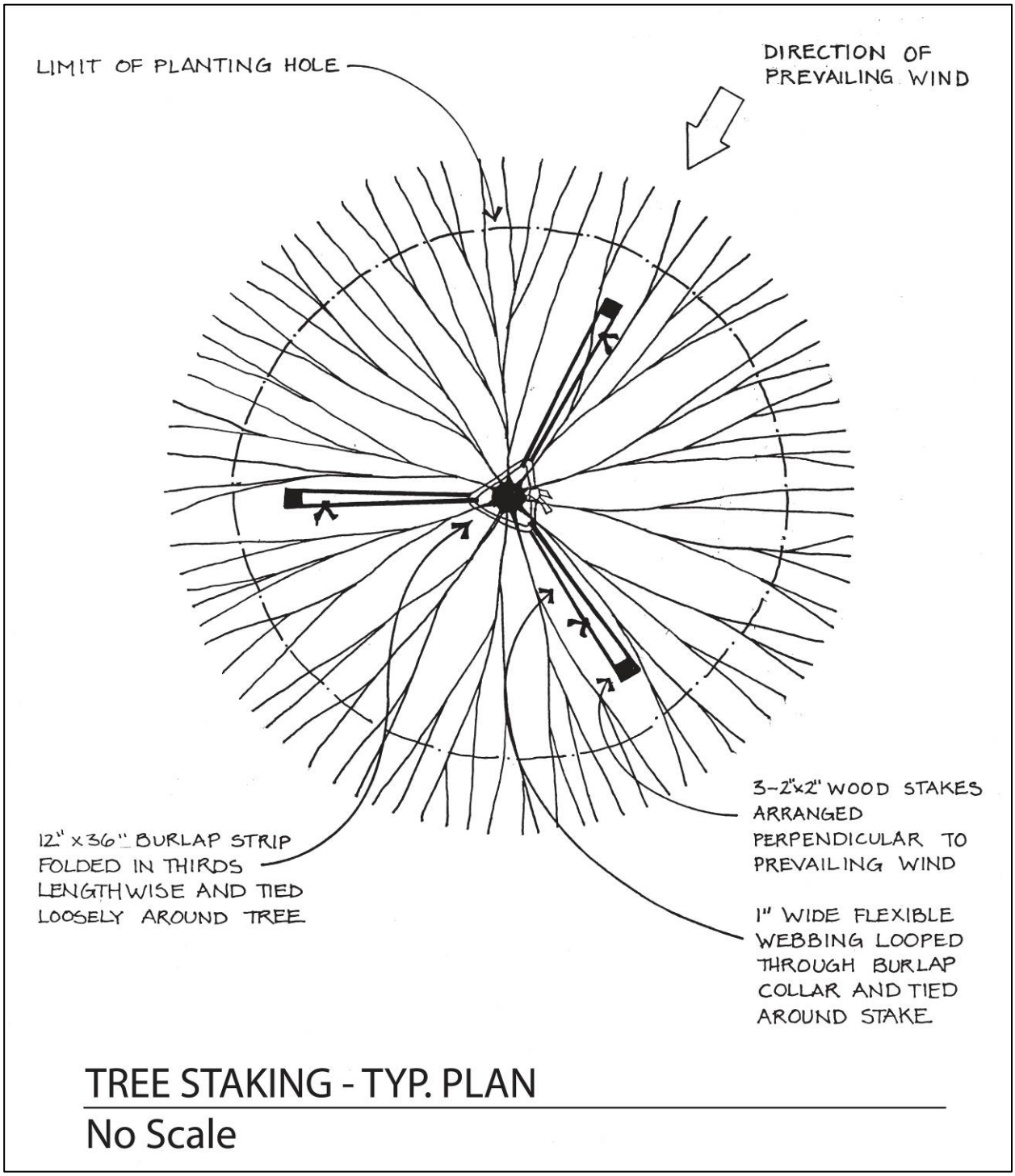


Figure VI-13: Illustration of an overhead view of tree staking.



9. Protection for new transplants

a. Mulch

PURPOSE

Mulch is simply a protective layer of a material that is spread on top of the soil. Organic mulch is composed of grass clippings, straw, bark chips, or similar materials. Mulch protects the soil and allows water to seep into the soil rather than immediately run off. Mulch inhibits invasive plants from taking over a site again and, as the mulch degrades, it adds nutrients to the soil to increasing plants' chances of survival.

SPECIFICATIONS

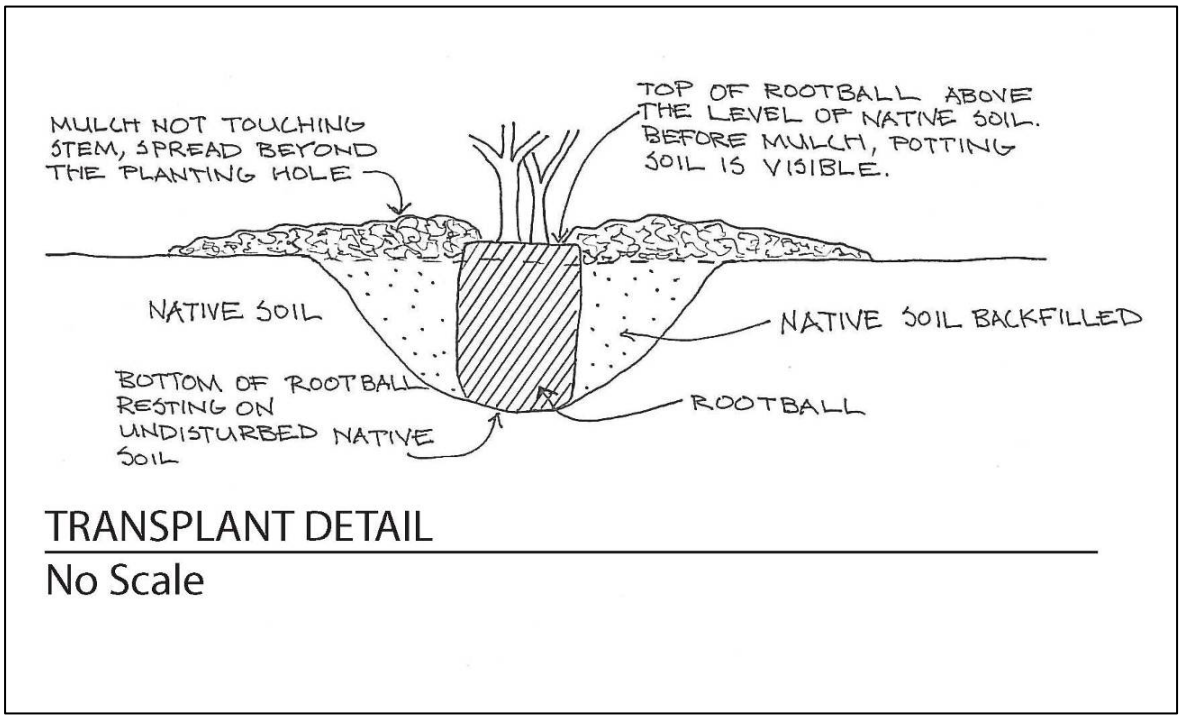
Mulch is applied by spreading desired material in a thin layer on the soil. Weeds should be clipped or pulled and removed prior to installation of mulch. Weeds should not stick out from above the mulch layer. The NRCS provides information comparing various types of mulch that can be used. Do not place mulch within the first inch or two around the trunk of trees and shrubs.

Table VI-4: Information about various types of mulch for protecting new transplants.

Material	Apply	Notes
Bark mulch	2 - 4"	Smaller chips are easier to spread, especially around small plants. Excellent for use around trees, shrubs. When spreading mulch around trees, keep the mulch an inch or two away from the trunk. A couple inches of mulch is adequate. There is no need to apply the mulch 6 or 8 inches high, as often is seen.
Wood chips	2 - 4"	Similar to bark mulch. If using fresh wood chips that are mixed with a lot of leaves, composting may be beneficial.
Leaves	3 - 4"	Best to chop and compost before spreading. If using dry leaves, apply about 6 inches.
Grass clippings	2 - 3"	Thicker layers tend to compact and rot, becoming quite slimy and smelly. Add additional layers as clippings decompose. Do not use clippings from lawns treated with herbicides.
Compost	3 - 4"	Excellent material for enriching soil.

Information from NRCS: http://www.nrcs.usda.gov/FEATURE/backyard/mulching.html

Figure VI-14: Illustration describing how to place mulch around new transplants.



b. Tree Protectors

PURPOSE

Tree protectors (*a.k.a*. tree shelters) effectively prevent browsing on new plants by herbivores such as deer, rabbits, gophers, and other rodents. Tree protectors are typically placed around newly planted trees, shrubs, and herbs in areas frequented by herbivores. Shelters can help reduce herbivory, weed competition and water loss due to wind. Tree shelters have been shown to greatly increase the survival rate of young seedlings.

SPECIFICATIONS

Tree shelters are tubes made of recycled polyethylene or a biodegradable material that can be wrapped around or placed over seedlings. Tree shelters come in a variety of heights (i.e. 3, 4 or 5 feet in length). Lighter colored shelters should be used in partial light situations.

Tree shelters should be installed when the seedlings are planted to help decrease transplant shock and minimize risk of herbivory on the new plants. Specific installation procedures will depend on the type of tube selected. The necessary height of the tube can be determined by figuring the highest browse level by herbivores present at the site. Shorter tubes are effective for rodents and small mammals while tubes must be at least 4 feet tall to prevent browsing by deer. In general, the tube is placed over the seedling and secured in place with a bamboo or pointed wooden stake. Stakes should penetrate into the ground at least 8 inches and extend about 4 inches above the

uppermost tie, but not exceed the length of the tube. The tube can be tied loosely to the stake using zip ties or other fastener. The tube should be pushed at least 2 inches into the ground. Periodic readjustment and replacement of tubes will be necessary. Most tubes are biodegradable within 2 to 5 years and should not be removed before that time period.

Figure VI-15: Illustration describing how to install a tree protector.

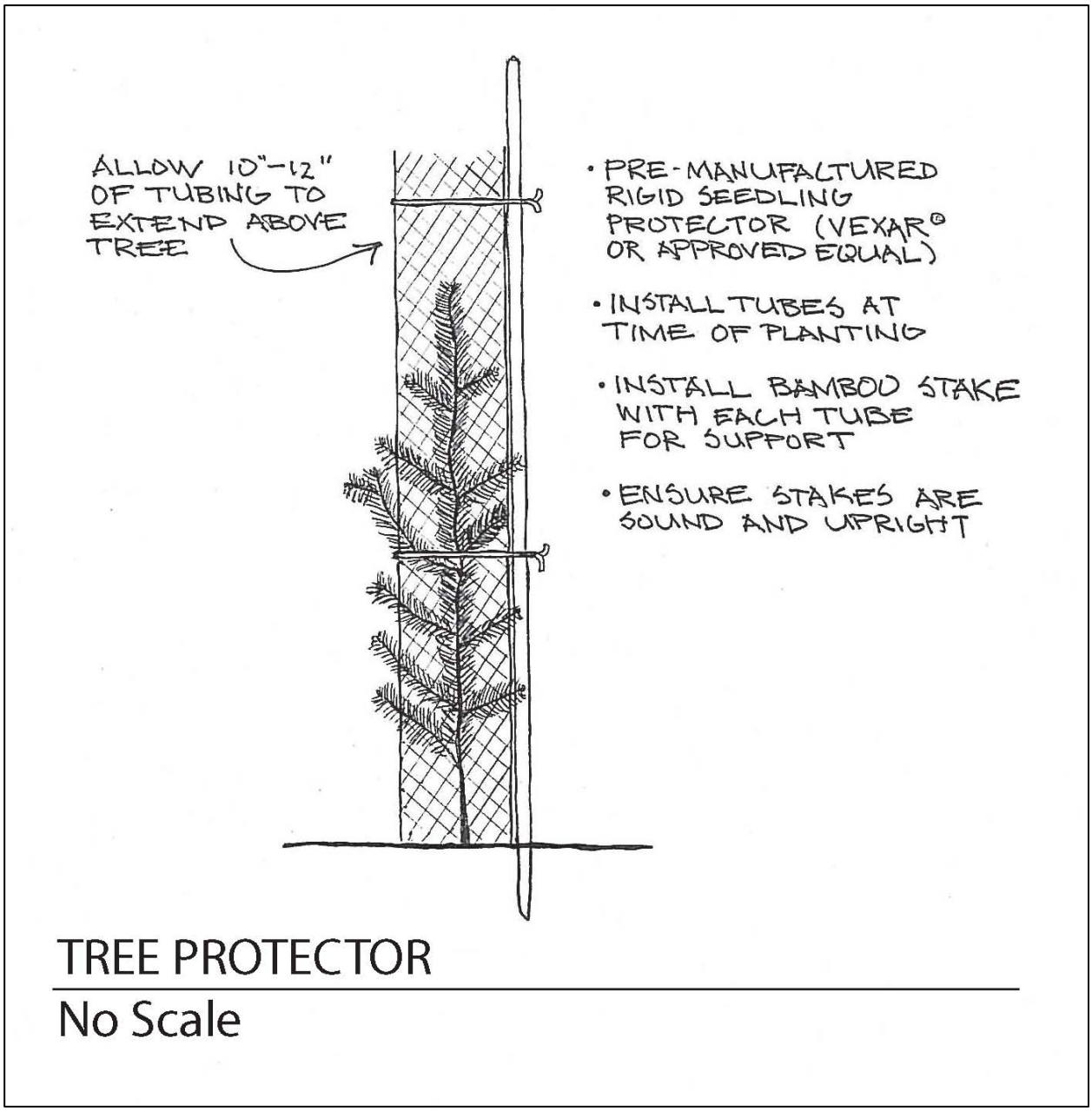
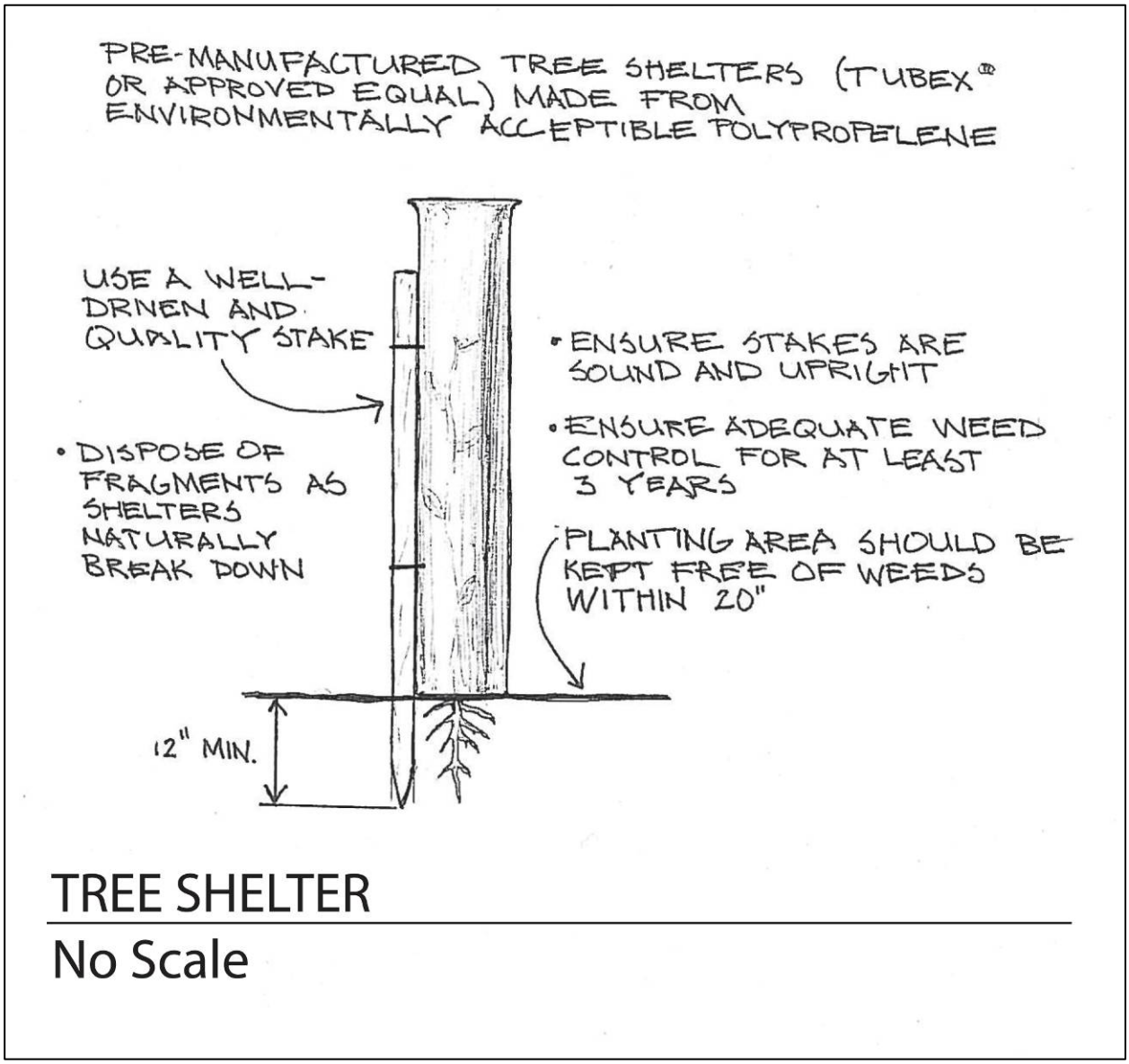


Figure VI-16: Illustration on how to install a pre-manufactured tree shelter.



D. MICROTOPOGRAPHY, WOOD, AND HABITAT STRUCTURE

1. Down Wood

PURPOSE

Down wood provides shelter and foraging habitat for many species of birds. By leaving down wood in place or even importing wood from construction or logging sites, you can enhance your natural landscape. In addition, as down wood decomposes, it helps to enrich the soil with nutrients. Down wood may also help to reduce soil erosion and collect debris on sloped soils.

SPECIFICATIONS

Down wood is an easy procedure that can quickly create habitat structure. Creation of down wood is as easy as leaving fallen trees or branches in place or importing intact logs, trunks, or branches from another location to your site. If you find another location with down wood suitable for your site such as at a near by park, you must attain the appropriate permission to collect fallen wood material from other locations before removing it from the site.

2. Standing Wood (Snags)

PURPOSE

Standing wood, or snags, provide foraging and nesting opportunities for many native insect-eating bird species such as nuthatches, woodpeckers, and wrens. Many native songbirds are cavity-nesters, meaning they excavate their own nest holes or use abandoned cavities in dead or dying trees. Large snags can provide nesting habitat for large birds including hawks and eagles.

SPECIFICATIONS

Creation of snags can be as easy as leaving dead trees that do not present a hazard standing in place to the more complex protocol of importing and installing dead logs at a site. Alternatively, if suitable trees are not present on-site, a log can be secured in the soil with a portion protruding above ground.

3. Brush Piles (Above and Below Ground)

PURPOSE

Brush piles provide foraging and nesting habitat for a variety of birds, reptiles, and mammals. Brush piles attract insects that provide an important food source for these animals. As brush piles decompose with time, they replenish nutrients and provide organic matter to the soil.

SPECIFICATIONS

While haphazard piles of limbs, leaves, and twigs may be used by wildlife, a carefully constructed brush pile will provide a much more useful habitat. The goal is to create ground-level pathways into the brush with internal spaces where creatures can find places to perch safely off the ground.

Brush piles can be constructed either with a pallet or a teepee form. The pallet brush pile is constructed with a base of stacked tree tops, tree stumps, old Christmas trees, and limbs with leaves and twigs placed on top. The teepee form brush pile consists of several log layers that are placed at right angles to each other. For construction of the teepee, the logs are about 6 feet long and should be placed about 10 inches apart within each layer. The teepee version uses about eight 6- to 8-foot untrimmed branches arranged in a teepee fashion, either standing alone or over a tree stump. When completed a brush pile can be between 4 and 6 feet tall and about 10 to 15 feet in diameter.

When creating brush piles, they should not be isolated from other potential habitat and cover. They should be close to existing shrubs or trees. The piles should be well drained and should not be placed on frequently flooded soils. Brush piles will naturally decay with time and they should be inspected annually to ensure stability of the structure and determine whether a new pile should be constructed.

LIMITATIONS

Some neighborhoods and locations do not allow large brush piles to be constructed or do not allow the brush piles to be in sight. Brush piles are flammable. Keep them away from buildings and trees. Ensure that children do not play on the brush piles.

4. Small Microdepressions

PURPOSE

Microdepressions are shallow, gently sloping low spots in the topography. Microdepressions create habitat structure and increase community diversity relative to completely flat or nearly, level ground. Construction of a microdepression is often paired with construction of a small mound using the soil that was removed from the depression. These small depressions and corresponding mounds are typically about 10 feet wide and about 25 feet long. Since microdepressions can often retain water, species adapted to frequent saturation or inundation must be selected.

SPECIFICATIONS

Sedges, rushes and willows are often planted in and near microdepressions. Species that are more adapted to frequent saturation or inundation should be selected for planting at the lowest elevation in a microdepression. Species should be planted in one or more rings according to elevation within the microdepression as well as on the associated mound (if applicable).

Table VI-5 provides suggested species that can be planted within the depression and on the mound and an example planting layout using a subset of these species is illustrated below.

Microdepression Planting

Mound species

Oregon ash	*Fraxinus latifolia*
Western red cedar	*Thuja plicata*
Douglas fir	*Pseudotsuga menziesii*
Paper birch	*Betula papifera*
Western hemlock	*Tsuga heterophylla*
Red huckleberry	*Vaccinium parvifolium*
Salal	*Gaultheria shallon*
Pacific (red) willow	*Salix lasiandra*
Redosier dogwood	*Cornus sericea*
Red elderberry	*Sambucus racemosa*

Depression species

Hardhack spirea	*Spirea douglasii*
Bog birch	*Betula glandulosa*
Sitka sedge	*Carex sitchensis*
Slough sedge	*Carex obnupta*
Baltic rush	*Juncus balticus*
Small-fruited bulrush	*Scirpus microcarpus*
Water parsley	*Oenanthe sarmentosa*

Figure VI-17: Illustration of microdepressions from an overhead and horizontal view.

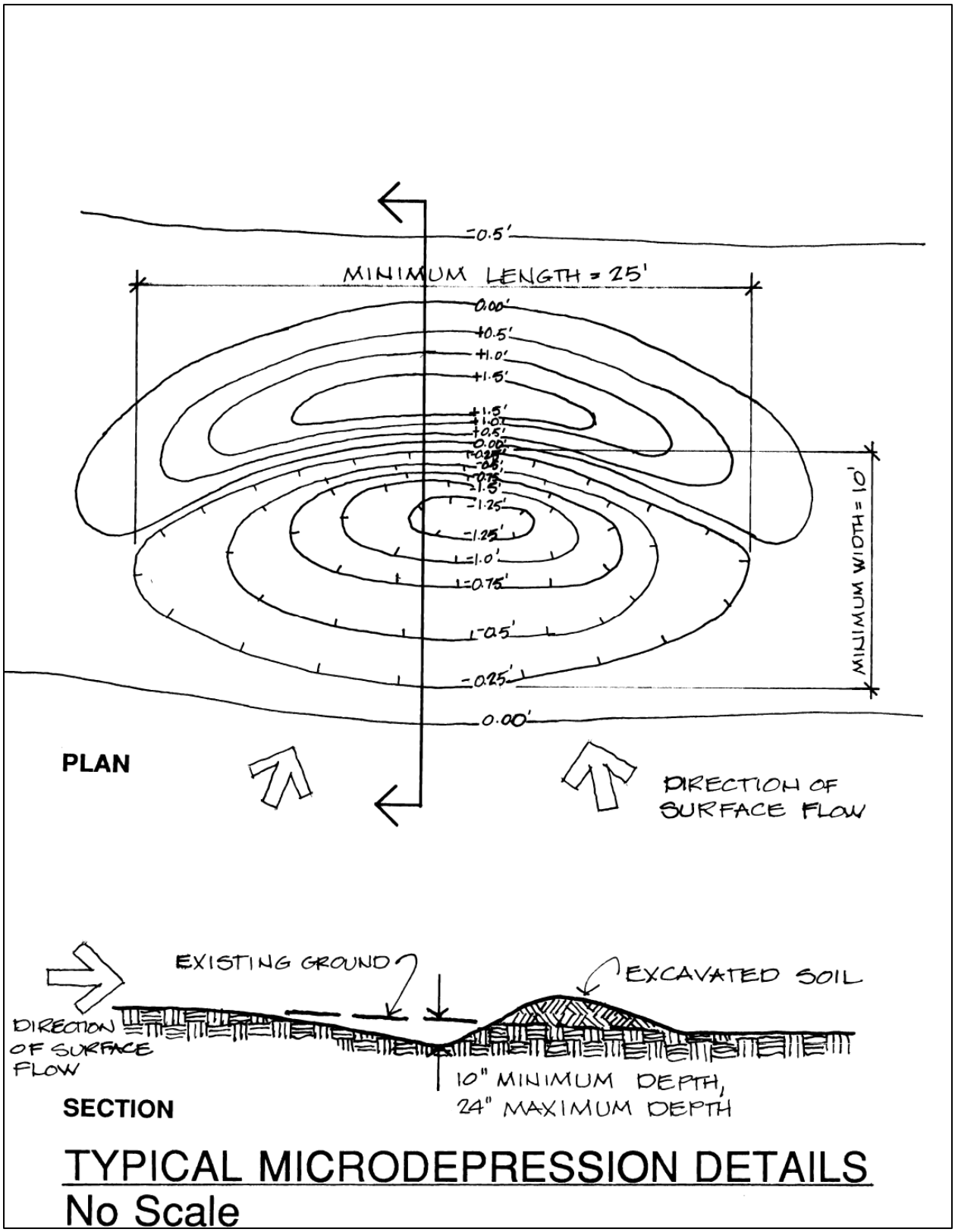
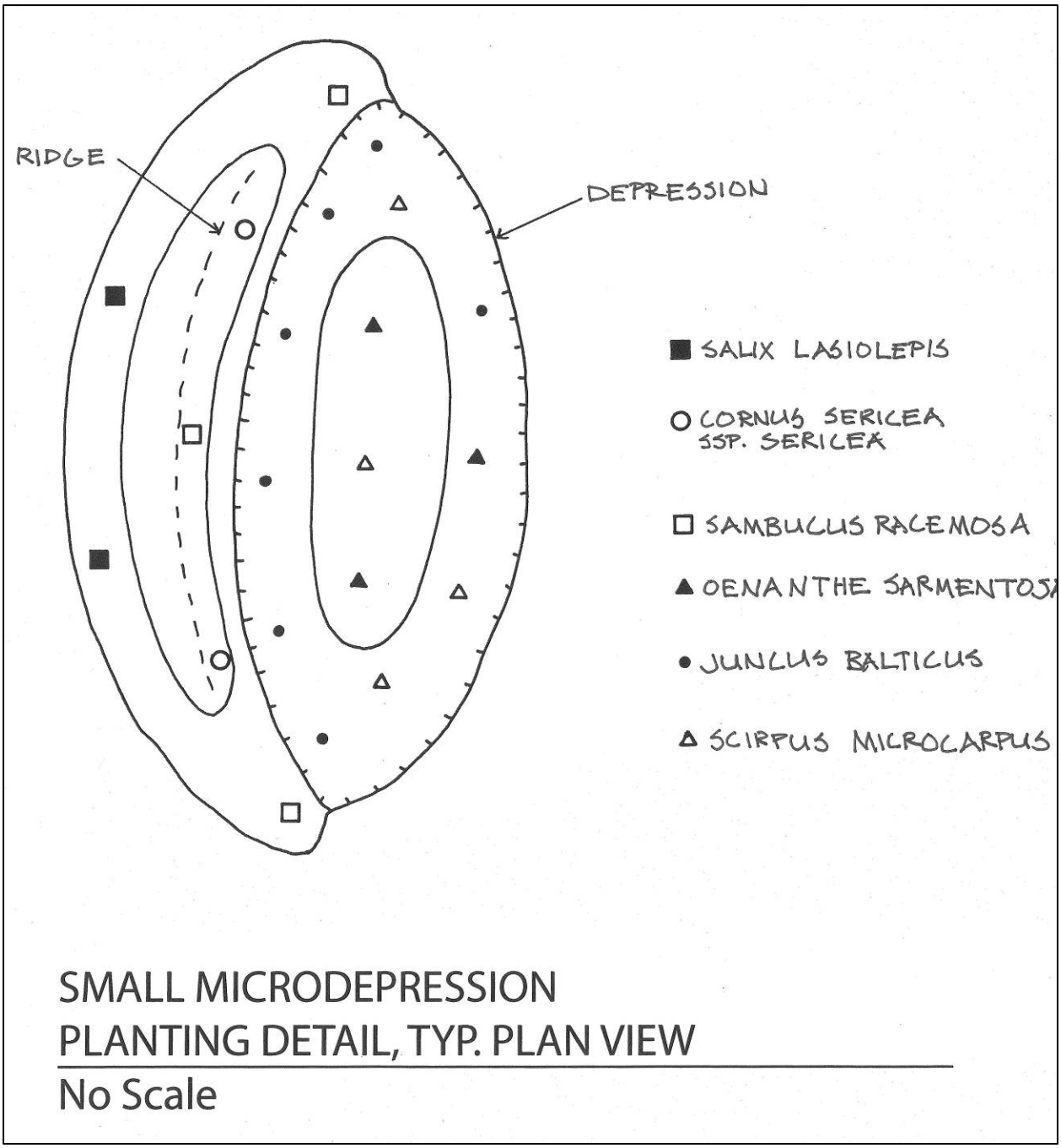


Figure VI-18: Planting recommendations for a microdepression.



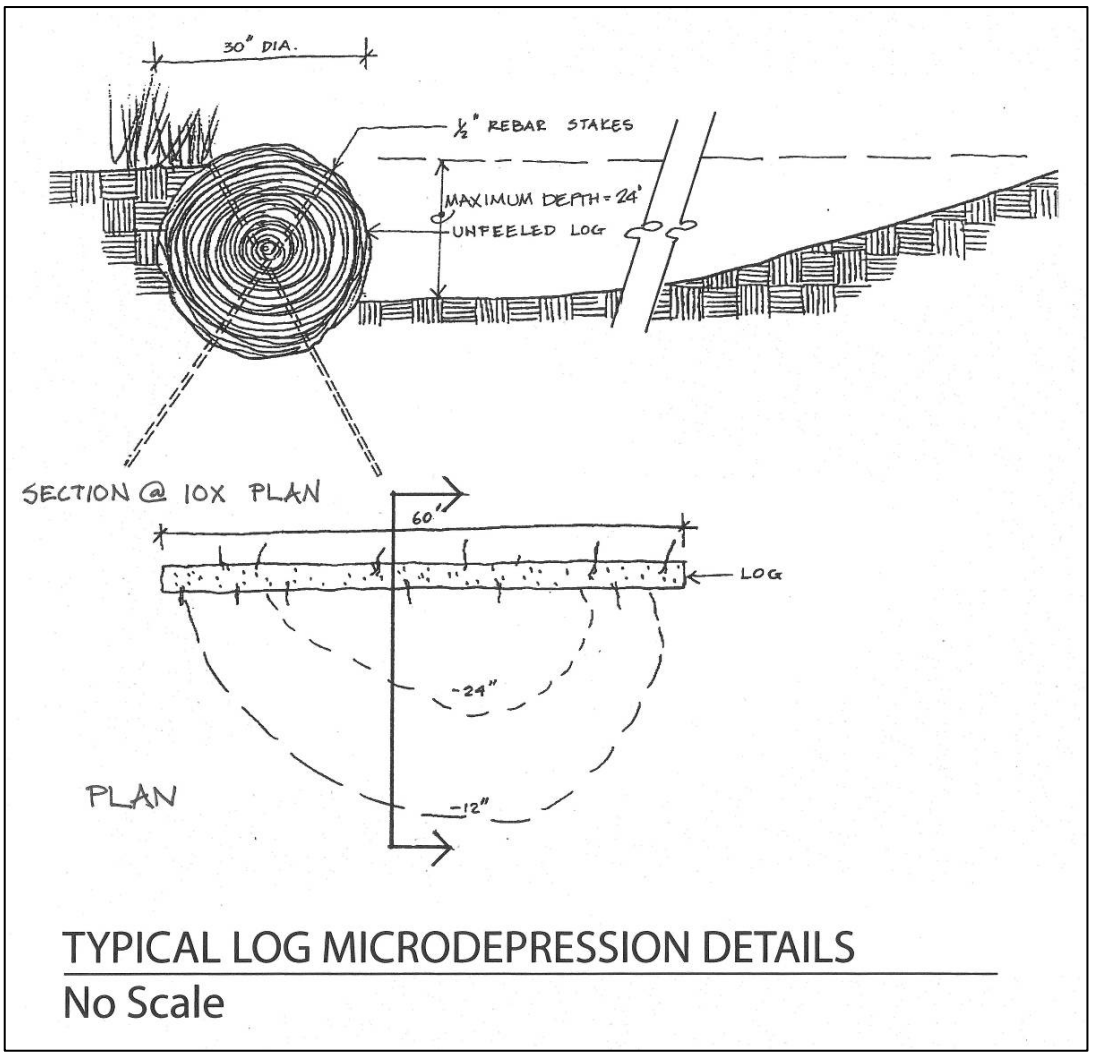
5. Down Wood Within Microdepressions

PURPOSE

Placing woody debris within a microdepression can improve habitat quality for birds and mammals. This type of microdepression is created using the trunk of a tall tree (~ 30 inch diameter) as one edge of the depression. As the tree decomposes, it provides nutrients, habitat structure, and shelter for a variety of animals.

SPECIFICATIONS
A log microdepression is created by placing a felled log within a shallow excavated depression. Ideally the log shold be approximately 60 feet long and the entirety of the depression will be about 60 feet wide. Seeding or planting should be done within the microdepression.

Figure VI-19: Illustration describing construction of a lob microdepression.



E. SLOPE AND SOIL STABILIZATION AND BIOENGINEERING

1. Wattle Installation on a Slope

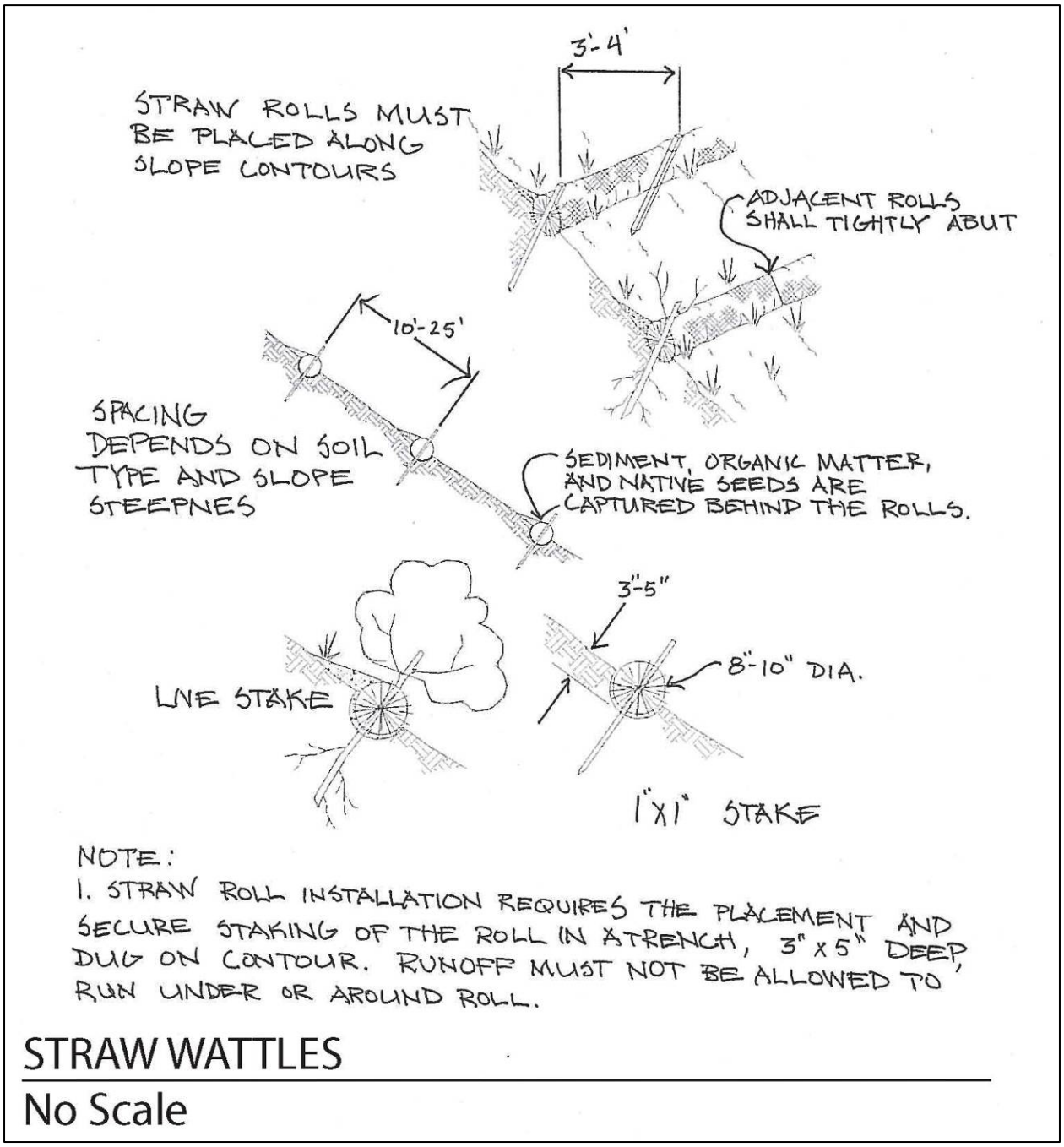
PURPOSE

Straw wattles provide temporary erosion control on slopes. They consist of straw wrapped in biodegradable tubular encasing material creating rolls that are 8 to 10 inches in diameter and 25 to 30 feet in length. Wattles are installed in shallow trenches and staked parallel to the contour of the slope. Wattles decrease erosion and transport of sediment from a site by reducing flow velocities, spreading out the flow of rill and sheet runoff, and retaining sediment.

SPECIFICATIONS

Straw wattles may be installed along the contour of slopes which may have a tendency to erode. They are often installed after large scale mechanical disturbances occur on slopes. Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle. Wattles may require maintenance to ensure they are in contact with the soil and thoroughly entrenched, especially after significant rainfall on steep or sandy soils. Inspect the slope after significant storms. Repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Figure VI-20: Illustration describing straw wattle installation.



2. Coir Roll

PURPOSE

Coir rolls are coconut fiber (coir) logs that provide a growth medium for new plantings, increase swale, shoreline or slope stabilization, assist in erosion control through slowing surface water movement and trapping sediment. As they are biodegradable and recycled, coir logs are an environmentally friendly alternative to rip rap, concrete stabilization structures and are more durable than hay bales. They provide surface protection that allows vegetation to become established around them. The biodegradable material typically lasts between 4 and 6 years. They are manufactured by a variety of suppliers and can be installed either as unplanted or planted logs.

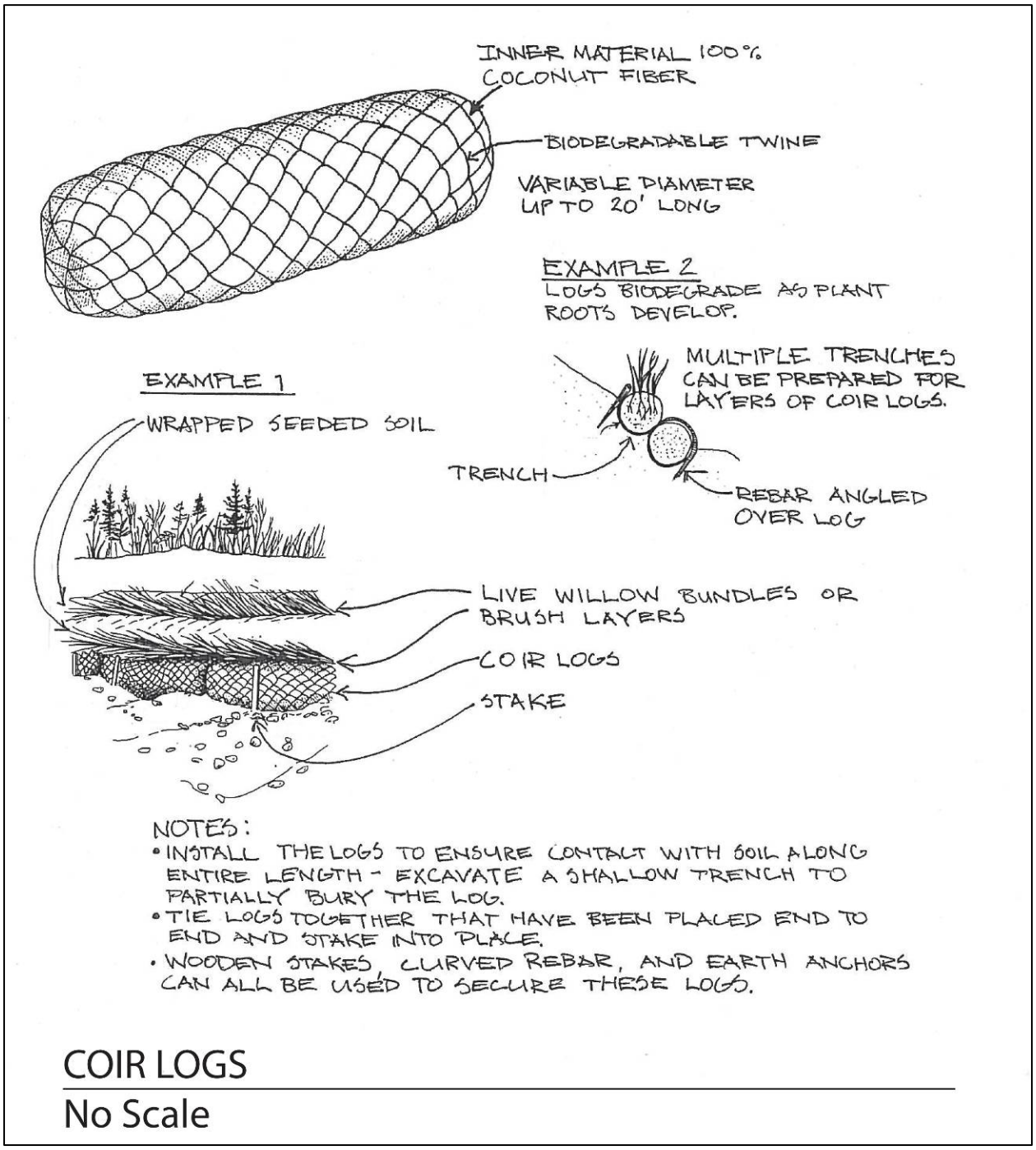
SPECIFICATIONS

Coir rolls are generally used along slope contours, in swales, at stream bank edges, and shorelines. Each 20 foot long roll should be anchored in a minimum of four to six locations using 2” x 2” wooden stakes that are 12 to 24 inches long or more depending on the site conditions.

LIMITATIONS

Coil logs are often used as shoreline stabilization. Appropriate permits must be attained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-21: Coir Roll Illustration.



3. Brush Layering

PURPOSE

Brush layering is an inexpensive and effective soil stabilization method to establish vegetation over large areas. Along streambanks, brush layering provides immediate habitat for fish.

SPECIFICATIONS

Benches or terraces that are at least 18 inches deep are dug along the contour of a slope beginning at the toe of the slope and moving upwards. The trench for the second terrace, and each subsequent terrace, must be spaced between 3 and 6 feet above the previous trench. Only short segments of ditches should be dug at a time in areas that may be prone to bank failure. The horizontal surface, or platform of each trench, should be angled upwards at least 10 degrees. Dormant cuttings with branches still attached are placed onto the platform with ¼ of their total length protruding from the slope surface so that at least ¾ of their length will be covered with soil. The branches can be placed crosswise (rather than completely parallel) to each other to allow maximum stabilization after backfilling with soil. Cuttings of a variety of species and a range of thicknesses or age classes should be intermixed within each brush layer. Young rooted plants may be combined with dormant cuttings in alternating layers or within the same layer.

Dig benches starting at the toe of the slope so that the lowest ditch can be filled easily with excess soil from the next ditch constructed upslope. Brush layering can be combined with other revegetation and streambank stabilization techniques. Live stakes can be interspersed between layers for higher density revegetation. The toe of the slope along stream banks should be further stabilized with live siltation, rootwads, coir logs, or tree revetments. Do not conduct work within waters or wetlands without first attaining appropriate permits.

LIMITATIONS

Appropriate permits must be attained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-22: Illustration describing brush layering – section view.

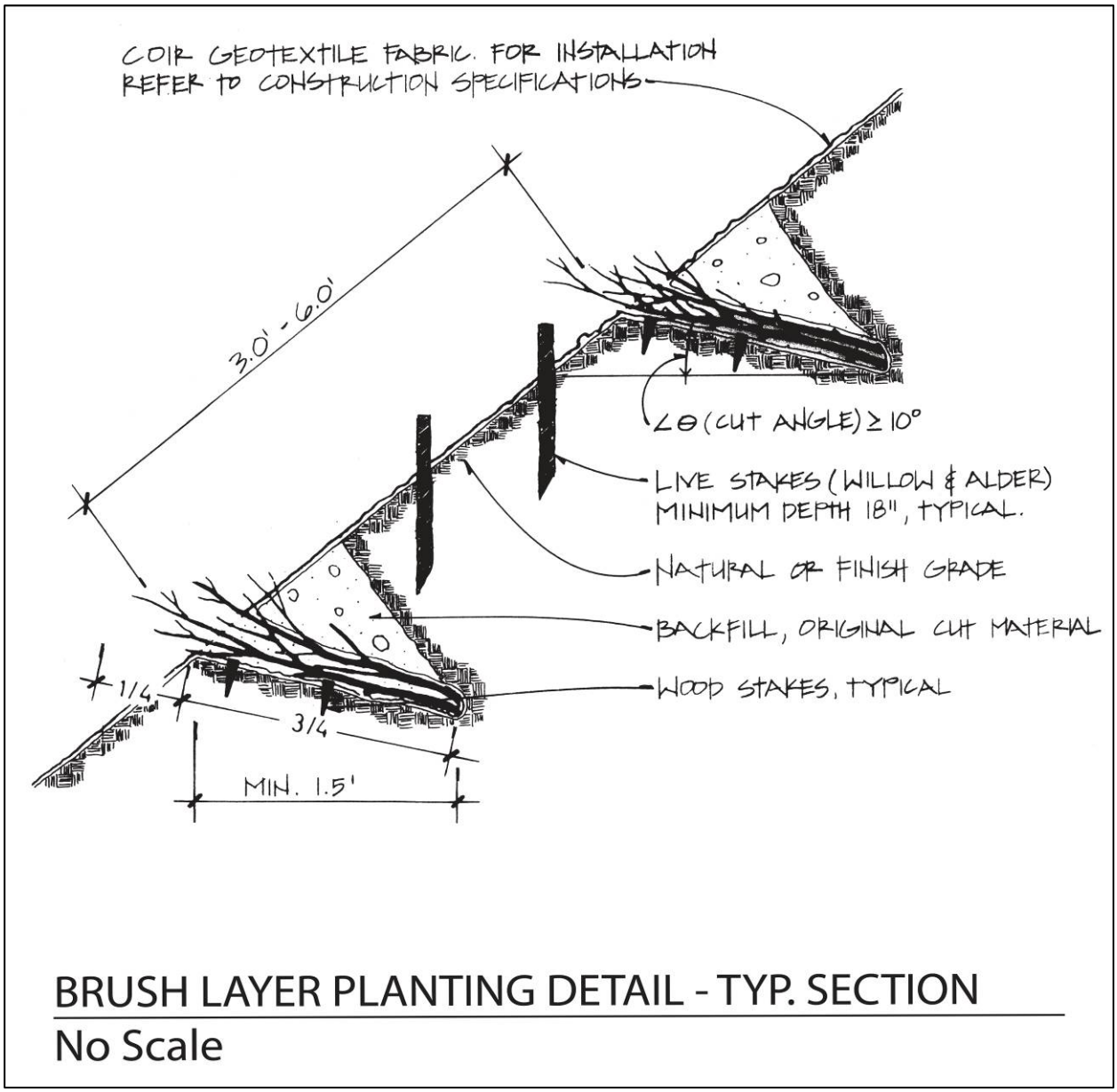
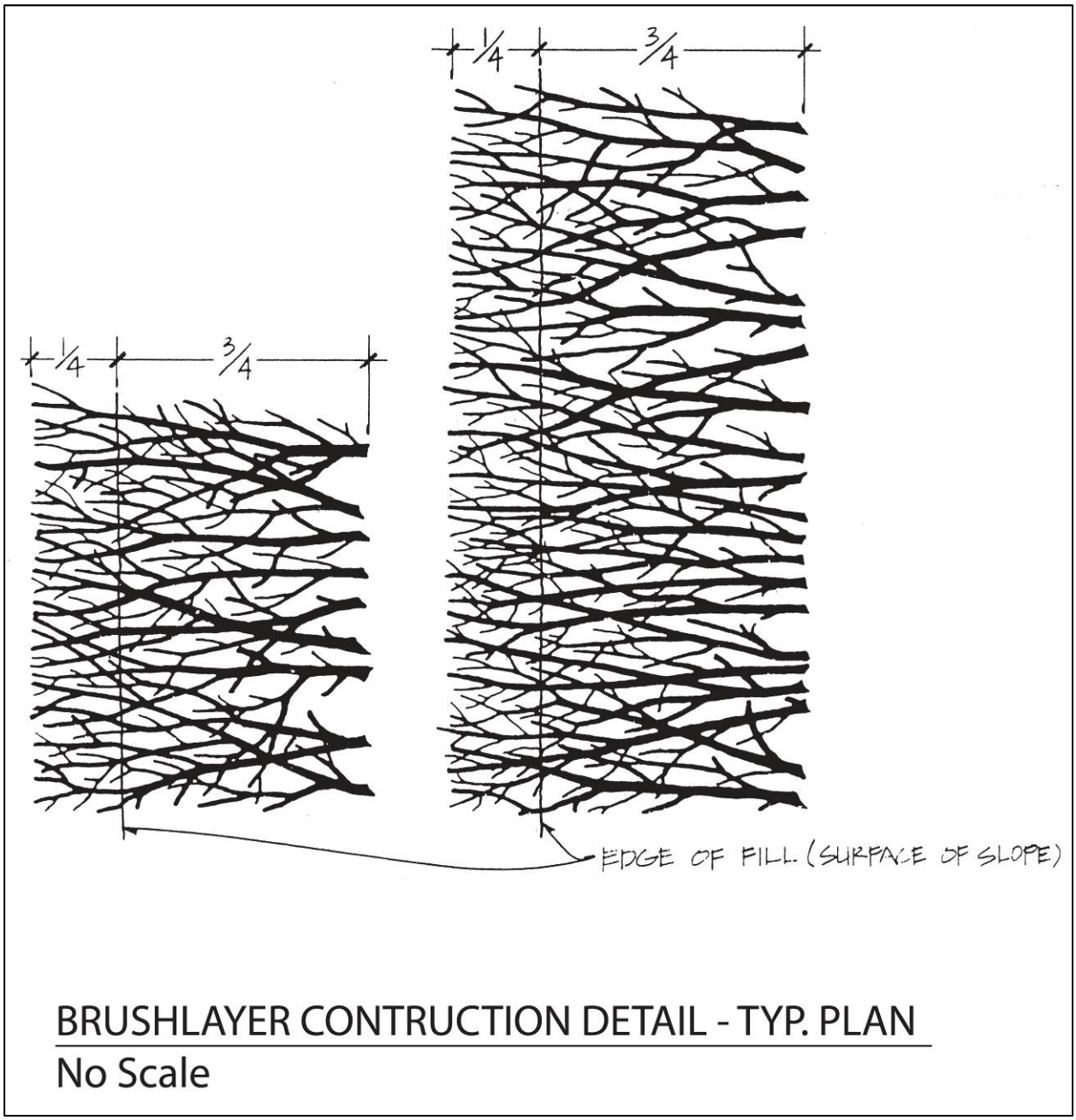


Figure VI-23: Illustration describing brush layering – section view.



4. Grass Rolls

PURPOSE

Grass rolls consist of sod chunks that are aligned tightly and held together within biodegradable fabric tied with twine and anchored in place with stakes (in low flow environments) or with earth anchors (in higher energy areas). Grass rolls are used where seeding is not practical due to fluctuating water levels and in areas with low to moderate flows. This revegetation technique also aids in erosion control and provides moderate structural stability. These rolls are used effectively using sedges in wetland restoration. Be sure to acquire all necessary permits before conducting work in waters or wetlands.

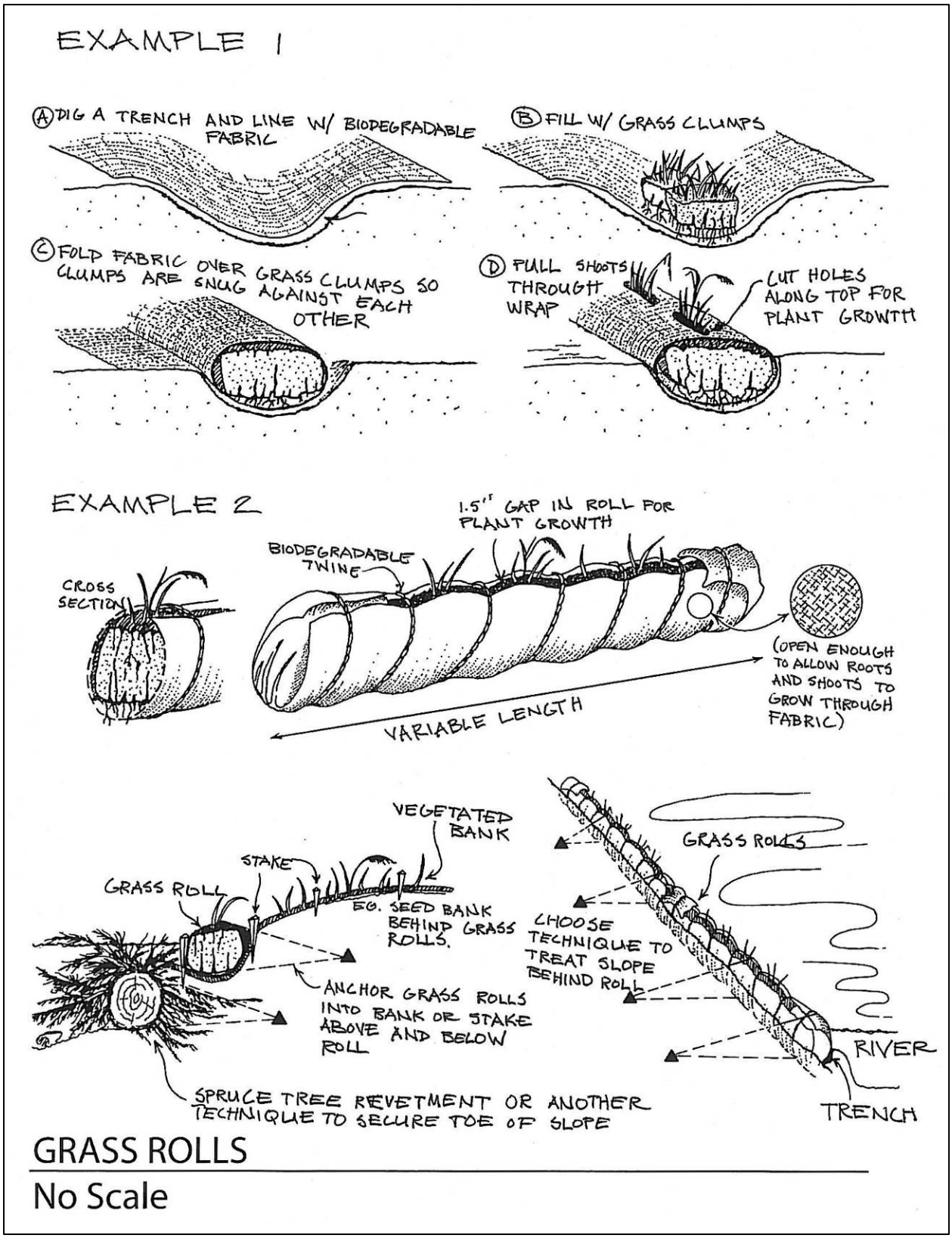
SPECIFICATIONS

Grass rolls are constructed using biodegradable fabric, clumps of sod composed of grasses and/or sedges, and twine. A shallow trench should be dug along the contour of a slope slightly above the Ordinary High Water (OHW) level where the grass roll will be placed. The biodegradable fabric should be placed flat on the ground across the trench. Place medium sized chunks of grass and/or sedge sod containing soil around the roots into the trench. Wrap the biodegradable fabric loosely over the sod and tie the sod rolls every few inches with twine. Be sure to allow the leaf blades (sod shoots) to protrude from the top of the roll by cutting slits in the fabric where necessary.

LIMITATIONS

Grass rolls should not be used in areas with high pedestrian or recreation use as grasses and sedges are sensitive to foot traffic. Access to new plantings should be minimized to aid in revegetation success or elevated walkways must be constructed to reduce disturbance. Appropriate permits must be attained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-24: Illustration describing how to build and install a grass roll.



5. Live Bundle (Fascine)

PURPOSE

Live bundles consist of a stack of dormant branches bound together to create log-like structure that will quickly root to provide plant cover. They serve to revegetate and stabilize slopes, secure the toe of streambanks, and provide a transition from one revegetation technique to another. They provide immediate physical protection to a site prior to plant growth.

SPECIFICATIONS

Native dormant branches are collected in 6 to 8 inch diameter bundles and bound together with untreated, biodegradable twine into a log-like structure. Specifically, tie several ½- to 2- inch diameter, 3- to 4-foot long branches together. Orient the cut ends of the branches in opposite directions to make a uniform diameter bundle. Tie the bundle at multiple locations approximately every 1 to 2 feet with biodegradable twine. Each completed bundle should be between 5 and 10 feet in length by overlapping branches continuously to the desired length.

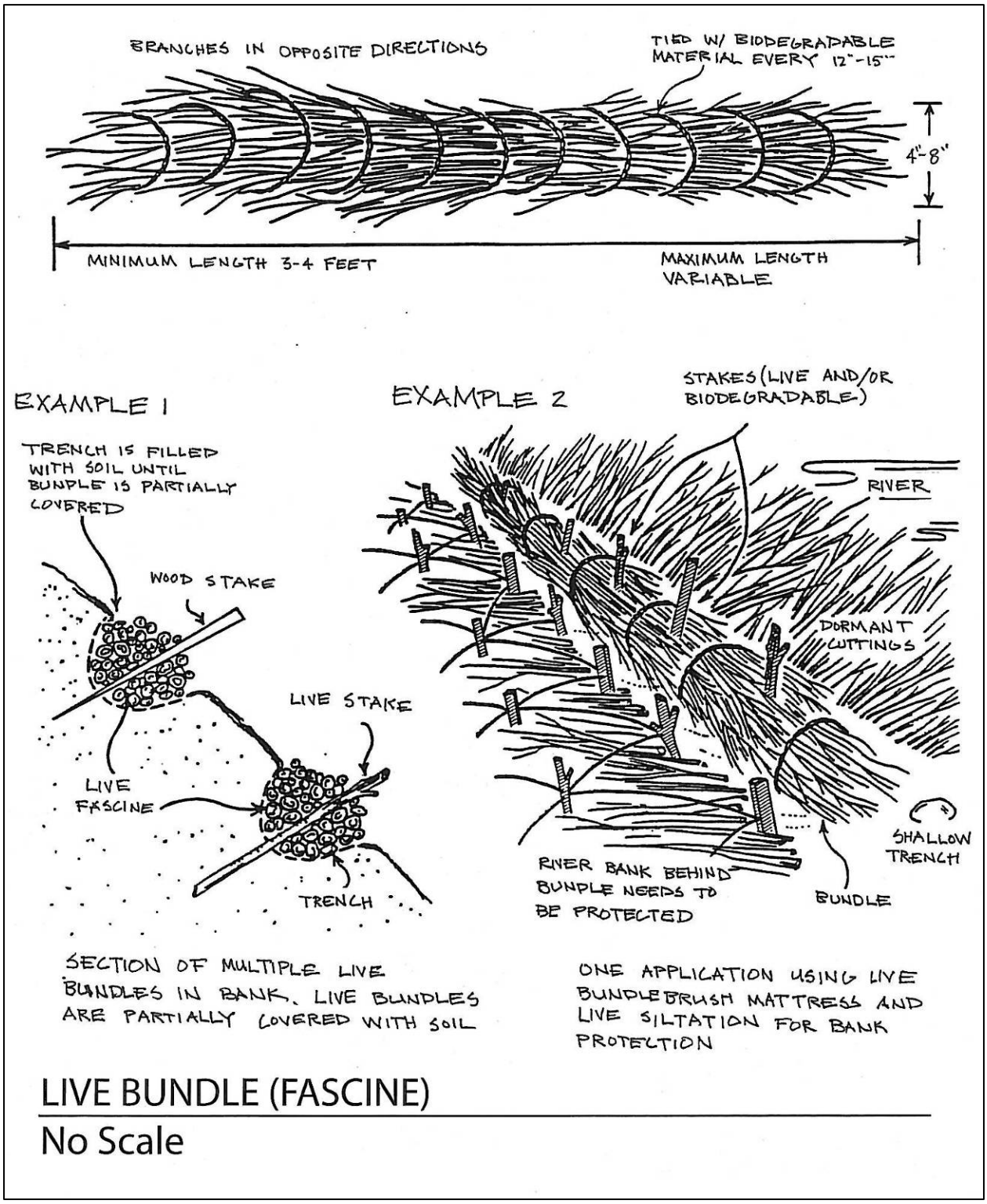
To install the bundle, dig shallow trench along the contour of a slope. The trench should slope downward and back into the slope so that about ¾ of the bundle will lie below the soil surface. Lay the bundle into this trench and compact the soil by tamping and/or watering. To secure the bundles in place, 2-foot long live willow stakes or untreated, wooden stakes should be driven through the bundle and into the slope every 2 to 3 feet. Stakes should be driven so that less than 3 inches of the stake remains above the fascine. Additional live willow stakes can be placed downslope of the bundle for added support, especially on steep slopes. By using dormant branches, the bundle should be able to grow so the bundle should not be completely covered with soil.

Multiple bundles can be used on a restoration site. Depending on site conditions and the restoration design, the bundles can be placed (1) end-to-end to form a continuous line along the contour, (2) staggered to reduce surface erosion potential, or (3) upturned in a concave orientation with the ends pointing upward on a slope

LIMITATIONS

Appropriate permits must be attained before conducting work within waters and wetlands below the ordinary high water line.

Figure VI-25: Construction and installation of a live bundle.



6. Coir Cloth / Willow Stake Bioengineering

PURPOSE

Coir fiber matting is a biodegradable netting which is often installed on bare slopes where live stakes will be planted. Coir fiber matting provides temporary erosion control to resist the forces of running water until the vegetation can become established and slows weed recruitment.

SPECIFICATIONS

To install the coir cloth, create a smooth soil surface by removing stones, dirt clods, and debris that may prevent contact of the entire matting with the soil. Lay the mat directly on the smoothed, graded slope. Ensure that the matting lies smoothly and loosely on the soil surface by unrolling the matting without stretching it. Bury the top edge of the matting in a narrow trench that is 6 to 12 inches deep, cover it with soil and tamp firmly. When more than one roll of coir clot is used on the slope, overlap 6 to 12 inches of the edge of the upper roll over the buried end of the second lower roll. Place 12 to 24 inch long wooden stakes cut at an angle or staples 1 to 3 feet apart as anchors to hold down the edges and junctions of mats.

Prepare live stakes (see Section VII.C.4 for more detail). The basal end of the stakes should be cut at an angle to facilitate insertion into the soil which the top should be blunt so that it can be tamped into the soil. Stakes should be tamped through the coir cloth approximately 3 to 4 feet apart. Orient the stakes with the buds pointing upward perpendicularly to the slope. Tamp approximately ¾ of the length of the stake into the ground. Trim the upper 1 to 2 inches of the finished live stake to remove the area that may have been damaged from tamping.

LIMITATIONS

Coir cloth must be monitored for wear and tear until vegetation becomes established. Minimal foot or equipment traffic should be conducted over the coir cloth if the soil is wet.

Figure VI-26: Construction of bioengineering with coir cloth and live willow stakes.

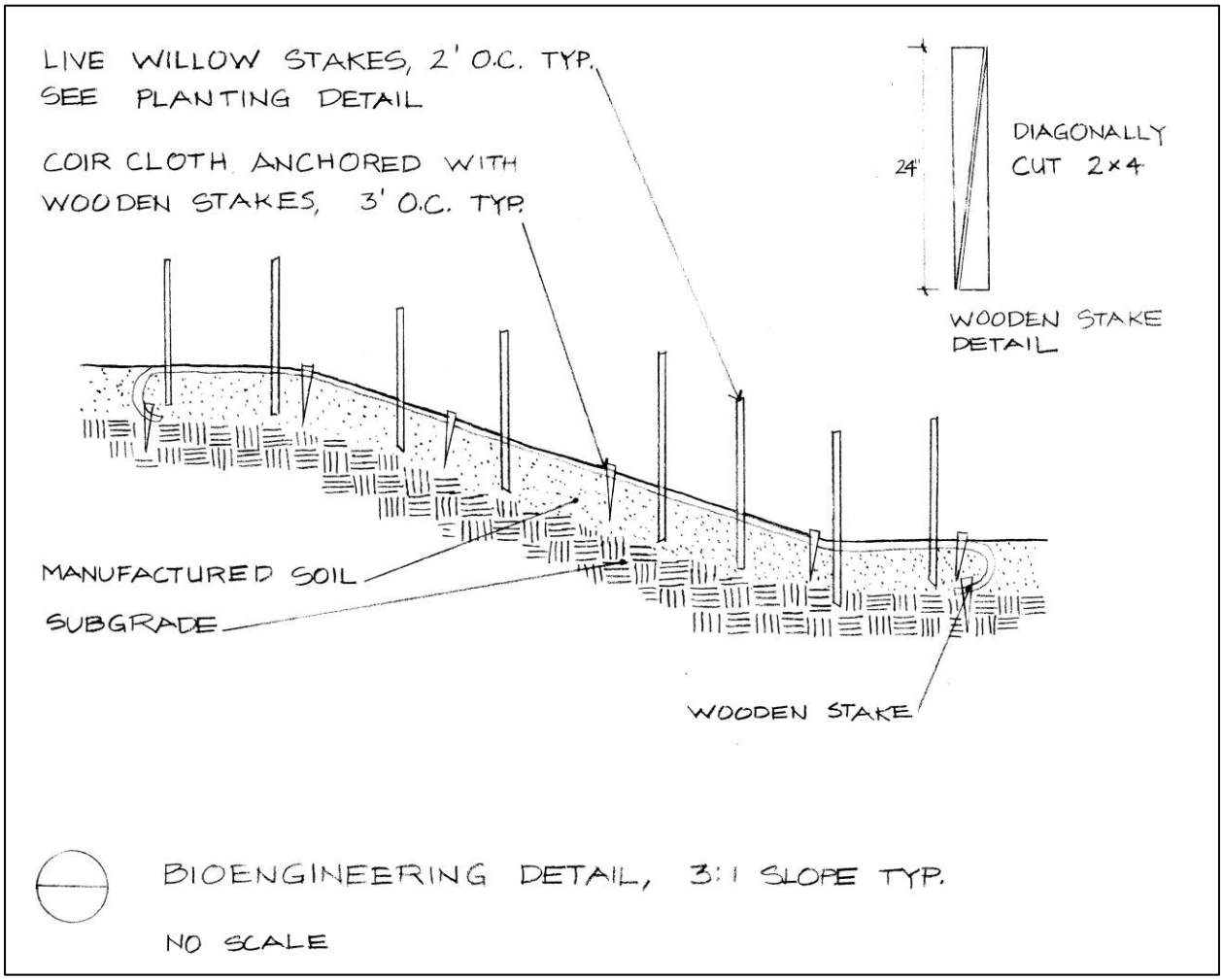
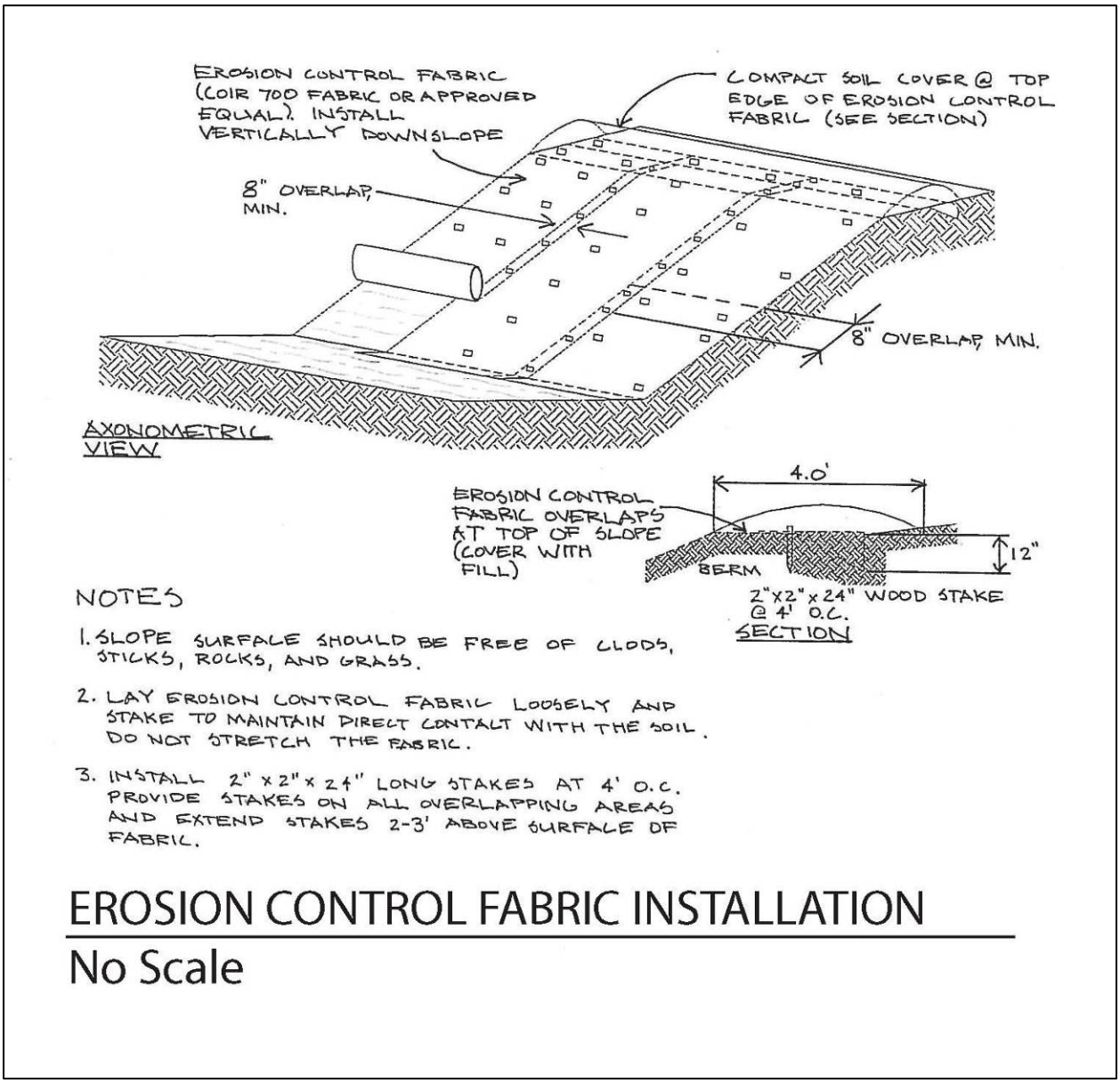


Figure VI-27: Illustration describing how to install erosion control fabric.



7. Vegetated Geogrid Slope Stabilization

PURPOSE

A vegetated geogrid consists of brush layers and encapsulated soil lifts providing structure for a stable steep slope. Geogrid material is flexible synthetic mesh composed of a variety of plastics and manmade fibers which are manufactured specifically for slope stabilization and earth retention and are not affected by the chemicals found in most soil environments. The woven and stretched material is designed to allow soil and rock to mesh with the material to "lock" it into place and reinforce soil on a slope. Slope stabilization using a geogrid can provide a steeper than normal slope face that can be naturally landscaped.

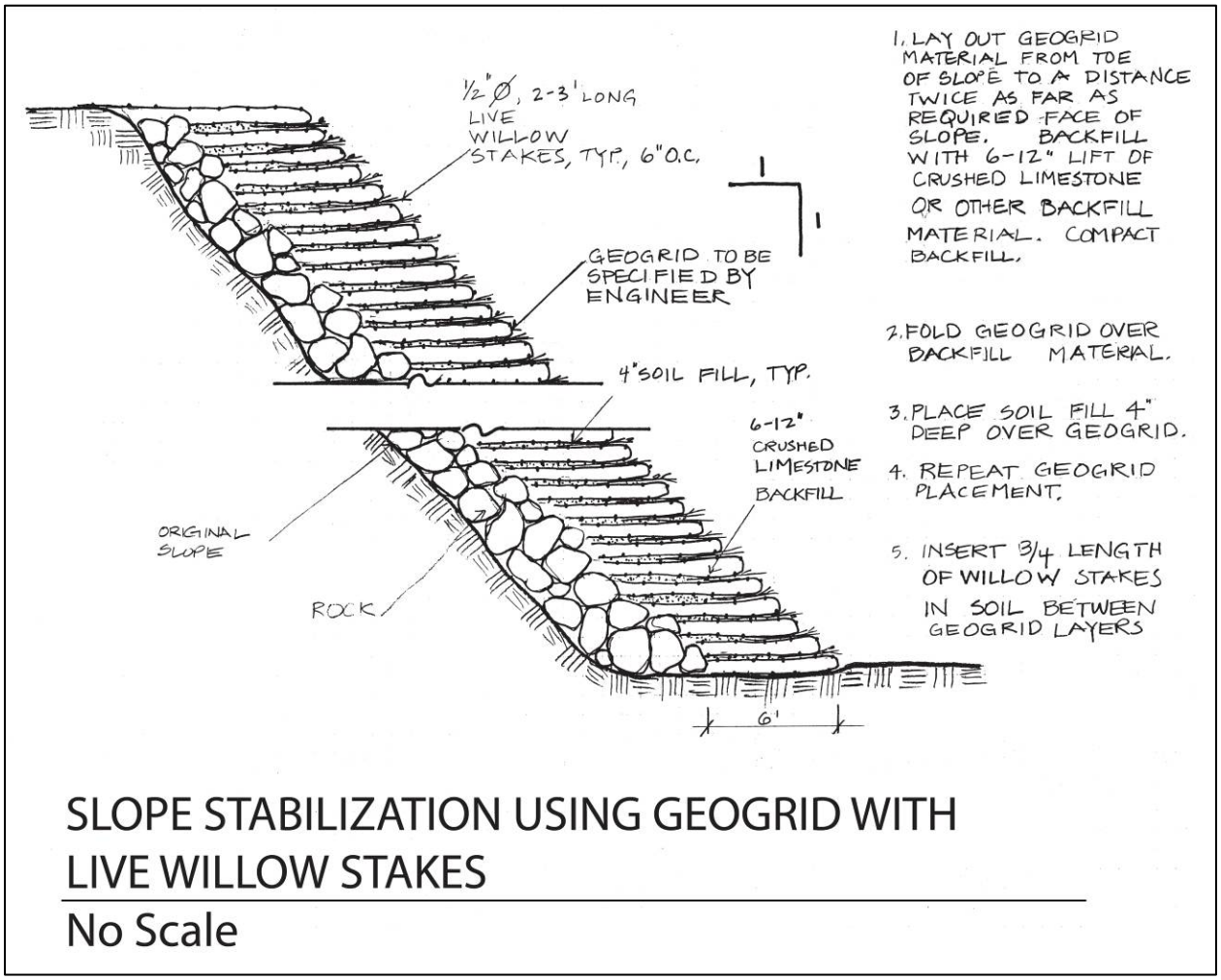
SPECIFICATIONS

As this is a soil bioengineering project, consult with an experienced and qualified individual (engineer, environmental consultant, etc.) for this type of work. In general, the vegetated geogrid slope stabilization consists of geogrid material that is secured around layers of soil. Coarse rock or drainage panels are generally placed vertically along the back side (native eroding slope or cut bank) to allow movement of groundwater into the reinforced portion of the slope, prevent buildup of hydrostatic pressure behind the constructed, stabilized slope. Geogrid layers become sequentially shorter as they progress up the slope to create a slope with the desired gradient. As the slope is being formed, a layer of live stakes is placed between each pair of geogrid encased soil layers. Live stakes will take root quickly and increase the internal stability of the reinforced slope. Backfill material suitable for encasing in the geogrid should be chosen under guidance from an experienced professional.

LIMITATIONS

Geogrid installation can provide good slope structure but is labor intensive and can be expensive to install. Construction of a vegetated geogrid is expensive, labor intensive, and time-consuming. However, it provides immediate slope stabilization and rapid vegetative cover. It has greater visual aesthetic than traditional slope stabilization techniques, and it provides habitat for a variety of animals. Appropriate permits must be attained if this work will be conducted within or near waters or wetlands. An engineer or consultant should assist in determining a safe slope gradient for your location.

Figure VI-28: Illustration describing geogrid slope stabilization.



8. Sediment Fence

PURPOSE

A sediment fence is used to prevent coarse suspended sediment from leaving the site in sheet flow to natural drainage ways or storm drains. Sediment fences provide a physical barrier which slows water, causing deposition of suspended particles. These barriers also promote sheet flow and discourage formation of eroded gullies.

SPECIFICATIONS

Sediment fences should be installed along the contour of a slope where the topography is sufficiently flat to allow storage of runoff water without overtopping the fence. The sediment fence consists of a 2' or higher vertical geotextile fabric fence that is braced by steel or wood posts spaced 6' or less apart and may be supported by a mesh wire backing for extra strength (posts are often spaced approximately 8' apart if wire mesh backing is used). These fences should never be installed across channels, streams, or ditches.

a. Standard Sediment Fence

Standard sediment fences are used when the area draining to the fence is on a gentle or shallow slope (i.e. 4H:1V or less). Standard sediment fences should be installed if they are expected to be in place for five months or less. If the area draining to the fence is expected to produce light to moderate sediment loads, the standard sediment fence may be installed. If any of these conditions are not met, construction of a heavy duty sediment fence should be considered.

b. Heavy Duty Sediment Fence

Heavy duty sediment fences are used when the slope of the area draining to the fence is moderately steep. The heavy duty sediment fence is installed using the standard sediment fence through installation with steel "T-posts". A wire mesh is installed behind the geosynthetic filter fabric to provide additional strength and support. While the heavy duty sediment fence is more rugged than the standard sediment fence, it should only be left in place for eight months or less. If the area draining to the fence is expected to produce more than moderate sediment loads, additional slope stabilization procedures should be installed in addition to the heavy duty sediment fence.

LIMITATIONS

Sediment fences should not be left in place for more than about 8 months. Sediment fences should never be installed across channels, streams, or ditches.

Figure VI-29: Standard sediment fence construction.

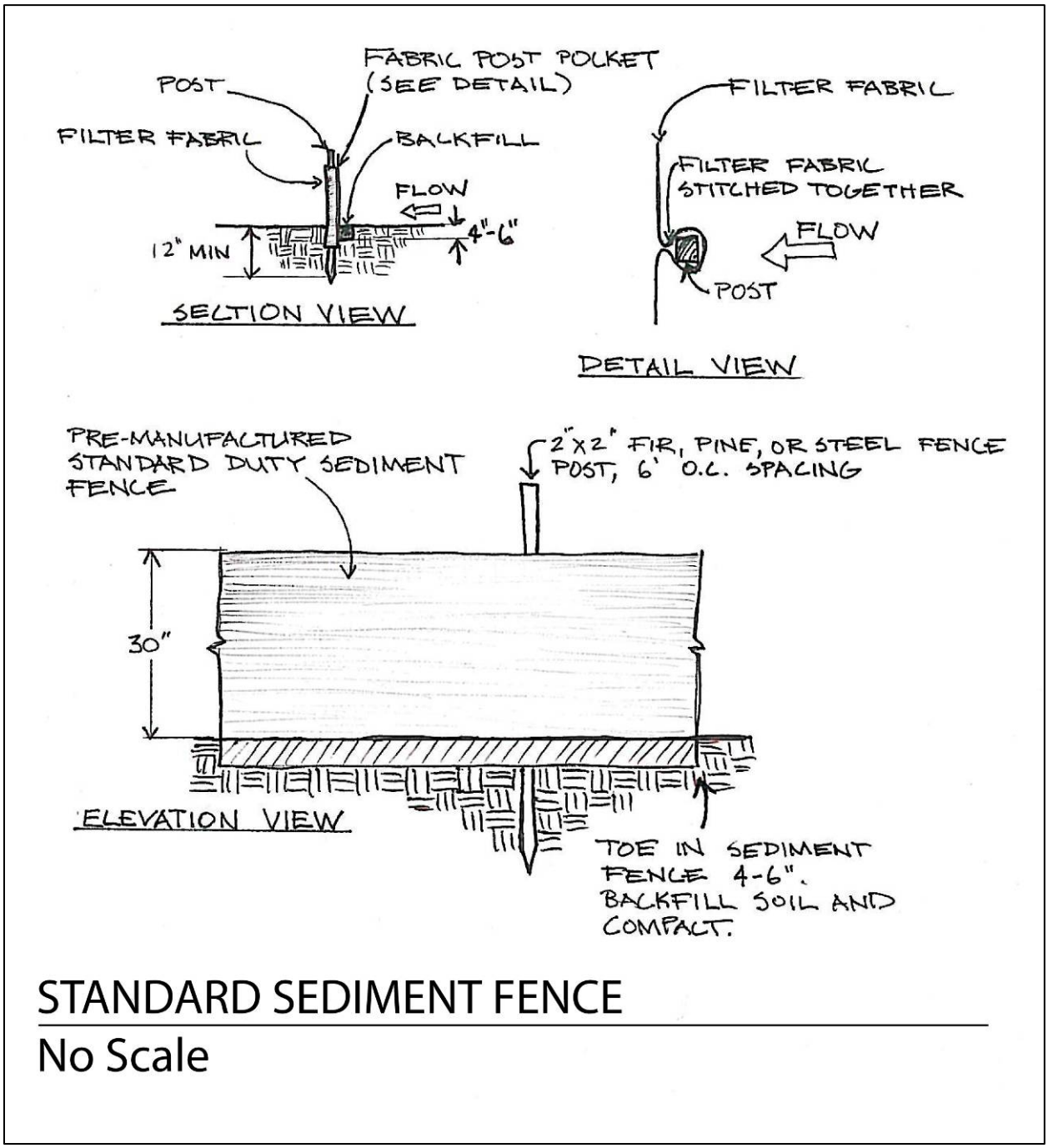
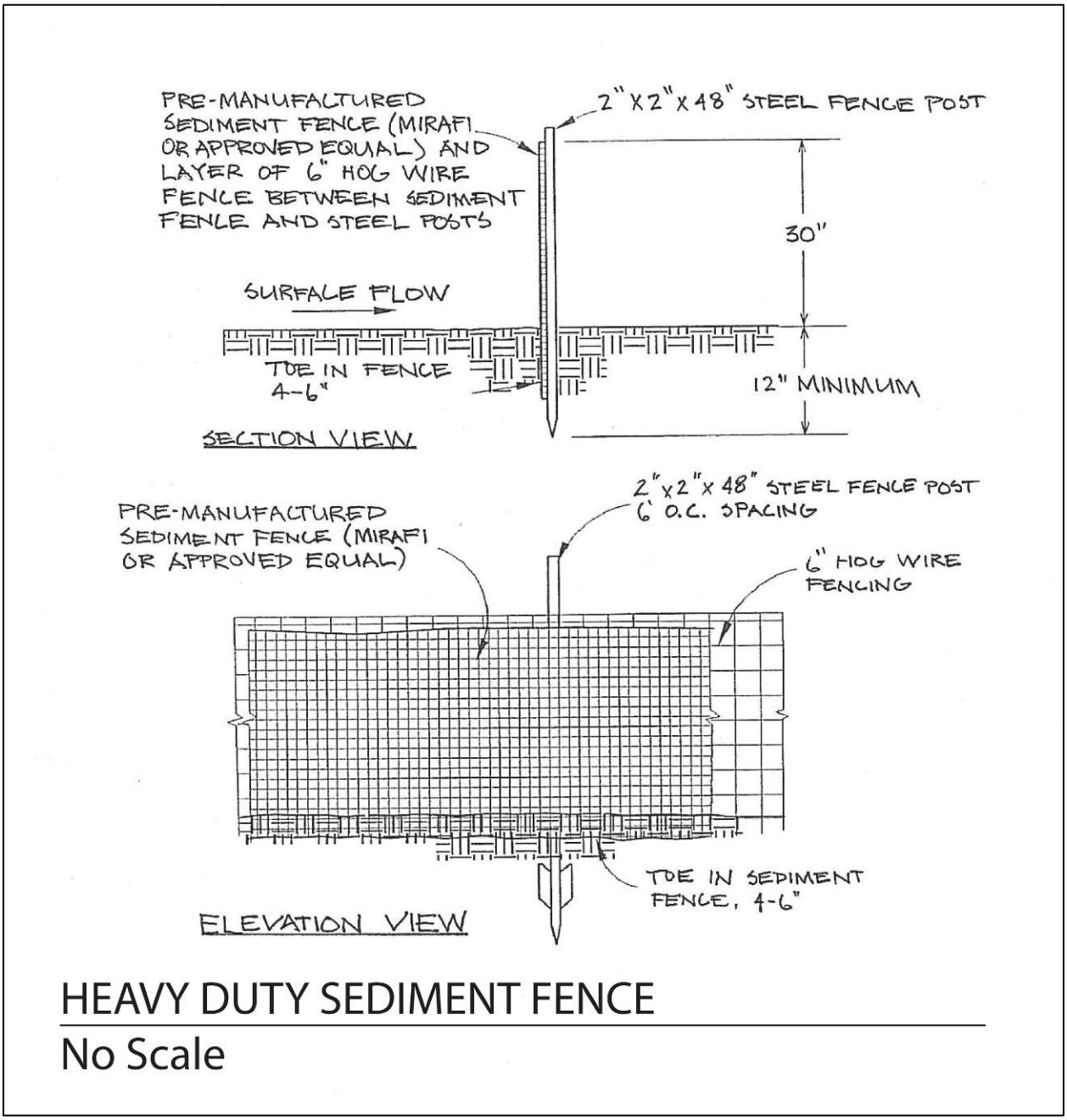


Figure VI-30: Heavy duty sediment fence construction.



9. Goose fencing

PUROPOSE

Geese can be a nuisance and may decimate a restoration site by foraging on newly established plants at a restoration site. If they are present in large flocks, they may alter the nutrient dynamics. Goose fencing serves to "irritate" the geese by preventing easy access between grassy areas and the water.

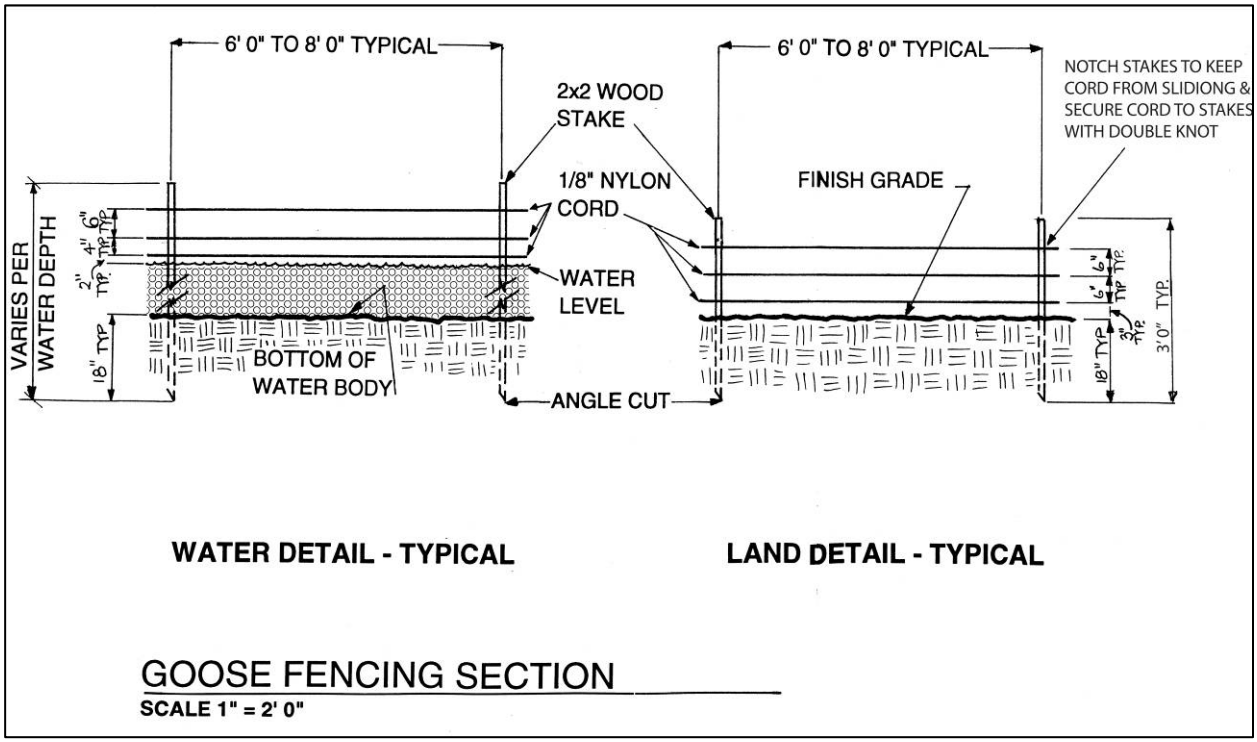
SPECIFICATIONS

The most effective fencing to protect against geese consists of stakes connected by 2 or 3 nylon cords or strings at approximately 2, 4 and 6 inches off the ground. Goose fencing should be located at edge of a water body along the shore/water interface or immediately upslope from the waters edge. Geese typically prefer short or cut grass areas for ease of grazing while maintaining ability to easily detect predators.

LIMITATIONS

Goose fencing must be maintained regularly.

Figure VI-31: Installation and construction of goose fencing – section view.



CHAPTER VII MONITORING PROGRAMS

A. INTRODUCTION

Any enhancement, restoration, or mitigation plan requires monitoring through time to ensure that the plan is achieving the desired environmental functions. Therefore, a monitoring program must be included as an integral part of any enhancement, restoration, or mitigation plan.

B. MINIMUM SUBMITTALS FOR A MONITORING PROGRAM

The following items should be included in any monitoring program:

ESSENTIAL ELEMENTS OF A MONITORING PROGRAM

- *A. INTRODUCTION*
  1. Purpose of Project
  2. Site Characteristics
     a. Location and Context
     b. Size
     c. Description
  3. Regulatory Requirements (Federal, State, and Local)
- *B. PROJECT SPECIFICATIONS*
  1. Articulation of Overall Project Goals
  2. Articulation of Project Standards and Targets
     a. Reference Standards
     b. Project Target(s)
     c. Project Standards
  3. Success Criteria
  4. Adaptive Management Strategy and Contingency Measures
- *C. MONITORING PERIOD SPECIFICATIONS*
  1. Define "Time Zero"
  2. Establish Baseline
  3. Establish Monitoring Interval and Frequency
- *D. ASSESSING FUNCTIONS OVER TIME*
  1. Hydrology
  2. Bio-geochemistry
  3. Plant Community
  4. Faunal Support

Technical terms are defined in Table VII-1, and the process of establishing a monitoring program is described in the following section.

Table VII- 1. Definition of Terms Used in the Monitoring Plan

Reference Standards	Conditions exhibited by a group of reference waters/wetlands that correspond to the highest level of functioning (highest sustainable capacity) across the suite of functions of the subclass.
Site Potential	The highest level of functioning possible given local constraints of disturbance history, land use, or other factors. Site potential may be equal to or less than levels of functioning established by reference standards.
Project Target	The level of functioning identified or negotiated for a restoration or creation project. This target must be based on reference standards and/or site potential and be consistent with restoration or creation goals. Project targets are used to evaluate whether a project is developing toward reference standards and/or site potential.
Project Standards	Performance criteria and/or specifications used to guide the restoration or creation activities towards the project target. Project standards should include and specify reasonable contingency measures if the project target is not being achieved.

C. ESTABLISHING A MONITORING PROGRAM

The goal of a monitoring program is to document the success of the buffer, stream, or wetland functional restoration and to prepare for the implementation of contingency measures, should the need arise. Monitoring, including any necessary maintenance such as weed control and planting, should generally be conducted at least annually for a period of five, ten, or more years depending on the site.

The restoration design process should include a clear articulation of project goals which should be stated in the monitoring program report. Most restoration and enhancement projects have multiple goals. For example, project goals could include restoration of native forest, stabilization of a slope in a riparian buffer, or habitat improvement in a wetland buffer.

Project targets and standards should be established based on the path that will achieve the stated goal. Project targets and standards are often organized in functional categories such as Hydrology, Biogeochemistry, Plant Community and Faunal Support. The monitoring design should include methods to quantify and document each Project Target and Project Standard and identify criteria for success (See examples in Section VII. D).

In case Project Standards and/or Success Criteria are not met, an adaptive management strategy with contingency measures should be established in the monitoring plan. In the event of failure to achieve a Project Standard, immediate (*i.e.*, within two weeks) consideration of the recommended contingency measure(s) should occur and be implemented. If the recommended contingency measure(s) does/do not make sense for reasons such as timing for planting,

unforeseen circumstances, etc. then immediate development and consideration of logical alternative contingency measure(s) should occur. If contingency measures are implemented, they should be reported in the yearly Monitoring Report. Example Project Target, Standards, Success Criteria, and Contingency Measures are provided below.

D. EXAMPLE PROJECT TARGETS, PROJECT STANDARDS, SUCCESS CRITERIA AND CONTINGENCY MEASURES

The following project targets pertain to fictitious example restoration project. The restoration plan for this example includes grading to create a slope with the desired gradient, excavating several microdepressions to increase surface variation (microtopography), and planting trees, shrubs and native grasses. The following four project targets, organized according to function, are examples which might be included in the monitoring plan for this project.

1) Hydrology Function

Example Project Target: Increase long and short term storage of flood flows in waters and wetlands within the mitigation area

Project Standards:

a. Maintain cross-sectional area and geometry of microdepressions, and
b. Maintain longitudinal slope between microdepressions, and
c. Establish and maintain 95% native tree and shrub canopy cover within the microdepressions after three full growing seasons from time zero
d. Establish and maintain 95% canopy coverage of seeded native grass species within the microdepression areas at the end of one full growing season from time zero

Success Criteria:

a. Stable cross-sectional area and geometry of microdepressions, and
b. Stable longitudinal slope between microdepressions, and
c. Achievement and maintenance of 95% tree and shrub canopy cover within microdepressions after three full growing seasons from time zero, and
d. Achievement and maintenance of 95% canopy coverage of seeded native grass species within the excavated microdepression areas at the end of one full growing season from time zero

Recommended Contingency Measures:

a. Re-excavate microdepressions to design dimensions
b. Reconstruct longitudinal slope between microdepressions and stabilize with large wood
c. Replant trees and shrubs in gaps to achieve target canopy coverage
d. Re-seed gaps to achieve target graminoid canopy cover

2) <u>Biogeochemistry Function</u>

Example Project Target: Increase elemental cycling on the floodplain within the mitigation area

<u>Project Standards</u>:

a. Maintain cross-sectional area and geometry of microdepressions, and
b. Maintain longitudinal slope between microdepressions, and
c. Establish and maintain 95% survival of planted trees and shrubs within the mitigation area at the end of 3 full growing seasons from time zero, and
d. Establish and maintain 95% canopy coverage of seeded native grass species within the mitigation area at the end of one full growing season from time zero

<u>Success Criteria:</u>

a. Stable cross-sectional area and geometry of microdepressions, and
b. Stable longitudinal slope between microdepressions, and
c. Achievement and maintenance of 95% tree and shrub canopy cover within microdepressions after three full growing seasons from time zero
d. Achievement and maintenance of 95% canopy coverage of seeded native grass species within the excavated microdepressions at the end of one full growing season from time zero

<u>Recommended Contingency Measures:</u>

a. Re-excavate microdepressions to design dimensions
b. Reconstruct and stabilize longitudinal slope between microdepressions with large wood
c. Replant trees and shrubs in gaps to achieve target canopy coverage
d. Re-seed gaps to achieve target graminoid canopy cover

3) <u>Plant Community Function</u>

Example Project Target: Establish and maintain a native plant community within the mitigation area

<u>Project Standards:</u>

a. Establish and maintain 95% survival of planted trees and shrubs within the mitigation area at the end of 3 full growing seasons from time zero, and
b. Establish and maintain 50 % canopy coverage of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero, and
c. Establish and maintain 95% canopy coverage of seeded native grass species within the mitigation area at the end of one full growing season from time zero

Success Criteria:

a. Achievement and maintenance of 95% tree and shrub survival within the mitigation area after three full growing seasons from time zero
b. Achievement and maintenance of 50% canopy coverage of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero
c. Achievement and maintenance of 95% canopy coverage of seeded native grass species within the mitigation area at the end of one full growing season from time zero

Recommended Contingency Measures:

a. Replant trees and shrubs in mitigation area to achieve target survival
b. Replant trees and shrubs in mitigation area to achieve target canopy coverage
c. Re-seed mitigation area to achieve target graminoid canopy cover

4) Faunal Support Function

Example Project Target: Increase vertical and horizontal habitat structure within the mitigation area

Project Standards:

a. Establish and maintain 95% survival of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero, and
b. Establish and maintain 50 % canopy coverage of planted trees and shrubs within the mitigation at the end of 5 full growing seasons from time zero, and
c. Exclude livestock grazing from the mitigation area for a period of 5 years via fencing

Success Criteria:

a. Achievement and maintenance of 95% tree and shrub survival within the mitigation area after three full growing seasons from time zero
b. Achievement and maintenance of 50% canopy coverage of planted trees and shrubs within the mitigation area at the end of 5 full growing seasons from time zero
c. Exclusion of domestic livestock from the mitigation area for at least five years

Recommended Contingency Measures:

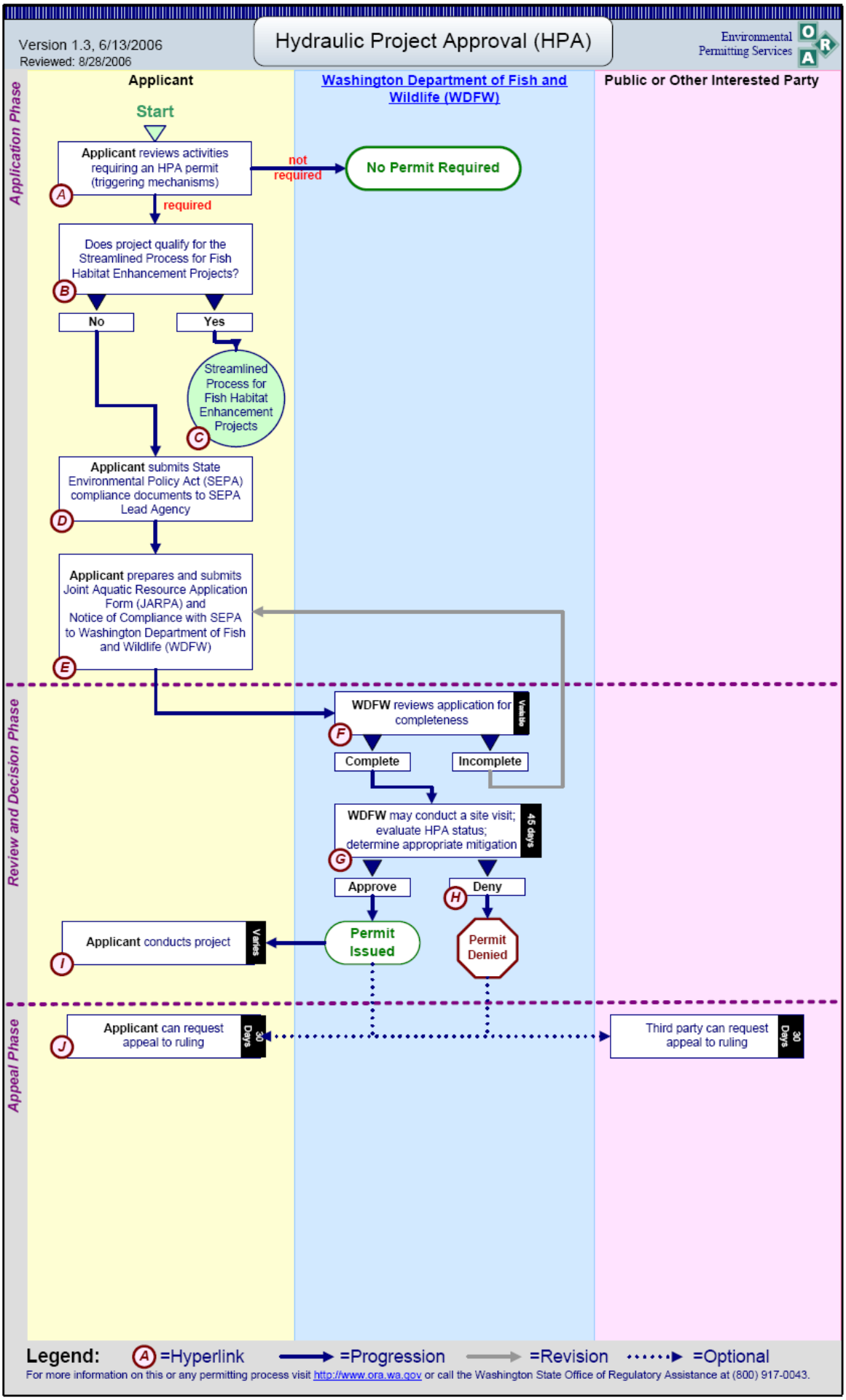
a. Replant trees and shrubs in mitigation area to achieve target canopy coverage
b. Replant trees and shrubs in mitigation area to achieve canopy coverage
c. Maintain, improve or replace fencing to preclude any grazing by domestic livestock

E. IMPLEMENTING THE MONITORING PROGRAM

A monitoring program begins with Baseline (Time Zero) Monitoring. Permanent photo points that can be revisited each year should be established. In each photo, be sure to include a reference point (and/or take GPS coordinates) and an object or person for scale, so that comparisons can be made through time from each location. Topographic surveys, soil profiles, and/or vegetation cover and planting specifications should be recorded. Conduct monitoring annually, at a minimum, or more often depending on the regulatory requirements from federal, state, and local jurisdictions of the project.

APPENDIX A

HPA PERMIT PROCESS


Version 1.3, 6/13/2006
Reviewed: 8/28/2006
Hydraulic Project Approval (HPA)
Environmental Permitting Services
Applicant
Washington Department of Fish and Wildlife (WDFW)
Public or Other Interested Party
Application Phase
Start
Applicant reviews activities requiring an HPA permit (triggering mechanisms)
A
not required
No Permit Required
required
Does project qualify for the Streamlined Process for Fish Habitat Enhancement Projects?
B
No
Yes
Streamlined Process for Fish Habitat Enhancement Projects
C
Applicant submits State Environmental Policy Act (SEPA) compliance documents to SEPA Lead Agency
D
Applicant prepares and submits Joint Aquatic Resource Application Form (JARPA) and Notice of Compliance with SEPA to Washington Department of Fish and Wildlife (WDFW)
E
Review and Decision Phase
WDFW reviews application for completeness
Varies
F
Complete
Incomplete
WDFW may conduct a site visit; evaluate HPA status; determine appropriate mitigation
45 days
G
Approve
Deny
H
Permit Issued
Permit Denied
Applicant conducts project
Varies
I
Appeal Phase
Applicant can request appeal to ruling
30 Days
J
Third party can request appeal to ruling
30 Days
Legend:
A =Hyperlink
=Progression
=Revision
=Optional
For more information on this or any permitting process visit http://www.ora.wa.gov or call the Washington State Office of Regulatory Assistance at (800) 917-0043.

APPENDIX B

PLANT SPECIES SUITABLE FOR RESTORATION PLANTING IN MOUNT VERNON WATERS/WETLANDS AND BUFFERS

Appendix B: Plant Species Suitable for Restoration Planting in Mount Vernon Waters/Wetlands and Buffers

Latin Name	Common English Name	NWI Indicator Status
Trees		
Abies amabilis	Pacific silver fir	FACU
Abies grandis	Grand fir	FACU-
Abies lasiocarpa	Sub-alpine fir	FACU
Acer glabrum	Douglas maple	FAC
Acer macrophyllum	Big leaf maple	FACU
Alnus rubra	Red alder	FAC
Alnus sinuata	Sitka alder	Not listed
Arbutus menziesii	Madrone	Not listed
Betula papyrifera	Paper birch	FAC*
Chamaecyparis nookatensis	Alaska cedar	Not listed
Cornus nuttallii	Pacific dogwood	Not listed
Corylus cornuta	Hazelnut	FACU
Fraxinus latifolia	Oregon Ash	FACW
Picea glauca	White spruce	Not listed
Picea sitchensis	Sitka spruce	FAC
Pinus albicaulis	White-bark pine	Not listed
Pinus contorta	Shore Pine	FAC
Pinus monticola	Western white Pine	FACU
Populus tremuloides	Quaking aspen	FAC+
Populus trichocarpa	Black cottonwood	FAC
Picea sitchensis	Sitka spruce	FAC
Prunus emarginata	Bitter cherry	FACU
Pseudotsuga menziesii	Douglas fir	FACU*
Pyrus fusca	Crabapple	Not listed
Quercus garryana	Oregon white oak	Not listed
Rhamnus purshiana	Cascara	Not listed
Taxus brevifolia	Pacific yew	NI (FAC-)
Thuja plicata	Western red cedar	FAC
Tsuga heterophylla	Western hemlock	FAC+
Tsuga mertensiana	Mountain hemlock	FACU

Latin Name	Common English Name	NWI Indicator Status
Shrubs		
Acer circinatum	Vine maple	FAC-
Amelanchier alnifolia	Serviceberry	FACU
Arctostaphylos columbiana	Bristly manzanita	Not listed
Arctostaphylos nevadensis	Kinnikinnik	Not listed
Arctostaphylos uva-ursi	Bearberry	FACU-
Berberis aquifolium	Tall Oregongrape	Not listed
Berberis nervosa	Cascade Oregongrape	Not listed
Cassiope mertensiana	White mountain heather	FACU+
Ceanothus sanguineus	Redstem ceanothus	UPL
Cladothamnus pyroliflorus	Copperbush	Not listed
Cornus canadensis	Bunchberry	FAC
Cornus sericea ssp. sericea	Red stem dogwood	FACW+
Cornus stolonifera	Red-osier dogwood	Not listed
Corylus cornuta	Hazelnut	FACU
Crataegus douglasii	Black hawthorn	FAC
Empetrum nigrum	Crowberry	FAC
Gaultheria shallon	Salal	FACU*
Holodiscus discolor	Ocean spray	NI
Juniperus communis	Mountain juniper	Not listed
Juniperus scopulorum	Rocky Mountain juniper	Not listed
Kalmia occidentalis	Western swamp laurel	Not listed
Ledum glandulosum	Trapper's tea	FACW+
Ledum groenlandicum	Labrador tea	OBL
Linnaea borealis	Twinflower	FACU-
Loiseleuria procumbens	Alpine azalea	Not listed
Lonicera ciliosa	Orange honeysuckle	Not listed
Lonicera hispidula	California honeysuckle	Not listed
Lonicera involucrata	Four line honeysuckle	FAC+*
Lupinus arboreus	Tree lupine	Not listed
Menziesia ferruginea	Fool's huckleberry	FACU+
Myrica gale	Sweet gale	OBL
Oemleria cerasiformis	Indian plum	FACU
Oplopanax horridum	Devil’s club	FAC+

Latin Name	Common English Name	NWI Indicator Status
Pachistima myrsinites	Mountain box	Not listed
Philadelphus lewisii	Mock-orange	Not listed
Phyllodoce empetriformis	Red mountain heather	FACU*
Phyllodoce glanduliflora	Yellow heather	FACU*
Physocarpus capitatus	Ninebark	FACW-
Potentilla fruticosa	Shrubby cinquefoil	Not listed
Prunus subcordata	Klamath plum	Not listed
Pyrus fusca	Western crabapple	FACW
Rhamnus purshiana	Cascara	FAC-
Rhododendron albiflorum	White rhododendron	FACU
Rhododendron macrophyllum	Western rhododendron	Not listed
Rhododendron occidentale	Western azalea	Not listed
Ribes bracteosum	Stink currant	FAC+
Ribes divaricatum	Coast black gooseberry	FAC*
Ribes howellii	Maple-leaf currant	Not listed
Ribes lacustre	Prickly currant	FAC+
Ribes sanguineum	Red-flowered currant	Not listed
Rosa gymnocarpa	Wood rose	FACU
Rosa nuktana	Nootka rose	FAC
Rosa pisocarpa	Clustered rose	FAC
Rubus idaeus	Red raspberry	FACU
Rubus leucodermis	Blackcap	Not listed
Rubus nivalis	Snow bramble	Not listed
Rubus parviflorus	Thimbleberry	FAC-
Rubus spectabilis	Salmon berry	FAC+
Rubus ursinus	California blackberry	FACU
Salix commutata	Variable willow	
Salix hookeriana	Hooker's willow	FACW+
Salix lasiandra	Pacific willow	FACW+
Salix planifolia	Diamond leaf willow	OBL
Salix scouleriana	Scouler willow	FAC
Salix sessilifolia	Soft-leaved willow	FACW
Salix sitchensis	Sitka willow	FACW
Sambucus cerulea	Blue elderberry	FACU
Sambucus racemosa	Red elderberry	FACU

Latin Name	Common English Name	NWI Indicator Status
Shepherdia canadensis	Buffalo berry	NI
Sorbus scopulina	Cascade mountain-ash	FACU
Sorbus sitchensis	Sitka mountain-ash	Not listed
Spiraea betulifolia	Birch-leafed spirea	FAC*
Spiraea densiflora	Rosy spirea	Not listed
Spiraea douglasii	Hardhack	FACW
Spiraea pyramidata	Pyramid spiraea	Not listed
Symphoricarpos albus	Common snowberry	FACU
Symphoricarpos mollis	Creeping snowberry	Not listed
Vaccinium alaskense	Alaska blueberry	NI
Vaccinium deliciosum	Cascade huckleberry	Not listed
Vaccinium membranaceum	Mountain huckleberry	FACU+
Vaccinium ovalifolium	Oval-leafed huckleberry	UPL
Vaccinium ovatum	Evergreen huckleberry	Not listed
Vaccinium oxycoccos	Wild cranberry	Not listed
Vaccinium parvifolium	Red huckleberry	Not listed
Viburnum edule	Highbush cranberry	FACW
Sedges and Rushes		
Carex obnupta	Slough sedge	OBL
Carex stipata	Sawbeak sedge	OBL
Carex utriculata	Beaked sedge	OBL
Juncus acuminatus	Tapered rush	OBL
Juncus balticus	Baltic rush	FACW+
Juncus effusus	Soft rush	FACW
Juncus ensifolius	Dagger leaf rush	FACW
Scirpus acutus	Hardstem bulrush	OBL
Scirpus microcarpus	Small-fruited bulrush	OBL
Grasses		
Alopecurus aequalis	Short-awn foxtail	OBL
Calamagrostis canadensis	Bluejoint reedgrass	FACW+
Deschampsia caespitosa	Hairgrass	FACW
Festuca idahoensis	Idaho fescue	FACU*
Festuca rubra var. rubra	Red fescue	FAC+
Glyceria striata	Fowl mannagrass	OBL

Latin Name	Common English Name	NWI Indicator Status
Glyceria grandis	Reed mannagrass	Not listed
Hordeum brachyantherum	Meadow barley	FACW-
Ferns & Fern Allies		
Adiantum pedatum	Maidenhair fern	Not listed
Aspidotus densa	Indian's dream fern	Not listed
Asplenium trichomanes	Maidenhair spleenwort	FACU
Athyrium distentifolium	Alpine lady fern	Not listed
Athyrium felix-femina	Lady fern	FAC+
Blechnum spicant	Deer fern	FAC+
Botrychium multifidum	Leathery grape-fern	FAC
Botrychium virginianum	Virginia grape-fern	FAC*
Cheilanthes gracillima	Lace fern	Not listed
Cryptogramma crispa	Parsley fern	Not listed
Cystopteris fragilis	Fragile fern	FACU
Dryopteris exspansa	Shield fern	FACW
Gymnocarpium dryopteris	Oak fern	FAC*
Lycopodium alpinum	Alpine clubmoss	FAC
Lycopodium annotinum	Stiff clubmoss	FAC
Lycopodium clavatum	Running clubmoss	FAC
Lycopodium complanatum	Ground cedar	FAC
Lycopodium obscurum	Groundpine	Not listed
Lycopodium selago	Fir clubmoss	Not listed
Pityrogramma triangularis	Gold-back fern	Not listed
Polypodium glycyrrhiza	Licorice fern	Not listed
Polypodium hesperium	Western polypody	Not listed
Polystichum imbricans	Christmas-fern	Not listed
Polystichum munitum	Sword fern	FACU
Pteridium aquilinium	Bracken fern	FACU
Selaginella wallacei	Wallace's selaginella	Not listed
Thelypteris limbosperma	Mountain fern	Not listed
Woodsia oregana	Oregon woodsia	Not listed
Woodsia scopulina	Rocky Mtn. woodsia	Not listed

Latin Name	Common English Name	NWI Indicator Status
Herbs & Forbs		
Achillea millefolium	Yarrow	NI
Aruncus dioicus	Goat's beard	FACU+
Dicentra formosa	Bleeding heart	FACU*
Geum macrophyllum	Big-leaf avens	FACW+
Heracleum lanatum	Cow parsnip	FAC+
Linnaea borealis	Twinflower	FACU-
Lysichiton americanum	Skunk cabbage	OBL
Maianthemum dilatatum	Wild lily of the valley	FAC
Mimulus guttatus	Yellow monkey flower	OBL
Oenanthe sarmentosa	Water parsley	OBL
Petasites frigidus	Coltsfoot	FACW-
Smilacina racemosa	Large false Solomon's seal	Not Listed
Smilacina stellata	False Solomon's seal	Not Listed
Tiarella trifoliata	Foamflower	FAC-
Tolmiea menziesii	Piggy-back plant	FAC
Viola glabella	Smooth yellow violet	FAC

APPENDIX C

EXAMPLE PLANTING SCENARIOS FOR MOUNT VERNON WATERS/WETLANDS AND THEIR BUFFERS

Appendix C: Example Planting Scenarios for Mount Vernon Waters/Wetlands and Their Buffers

Plant Community A: Scrub-shrub Forested Wetland
Location: depressional wetland

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Black cottonwood	*Populus trichocarpa*	FAC	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
S	Redosier dogwood	*Cornus sericea*	FACW	stakes	1-1.5
S	Black twinberry	*Lonicera involucrata*	FAC+	1 gallon pot	3
S	Pacific ninebark	*Physocarpus capitatus*	FACW-	1 gallon pot	3
S	Snowberry	*Symphoricarpos albus*	FACU	1 gallon pot	3
S	Salmonberry	*Rubus spectabilis*	FAC+	1 gallon pot	3
S	Hooker's willow	*Salix hookeriana*	FACW-	stakes	1-1.5
S	Pacific willow	*Salix lasiandra*	FACW+	stakes	1-1.5
S	Scouler willow	*Salix scouleriana*	FAC	stakes	1-1.5
S	Sitka willow	*Salix sitchensis*	FACW	stakes	1-1.5
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Baldhip rose	*Rosa pisocarpa*	FAC	1 gallon pot	3
S	Nootka rose	*Rosa nutkana*	FAC	1 gallon pot	3

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status

Plant Community B: Floodplain Forested Wetland
Location: above channel across to adjacent hillslope

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Sitka spruce	*Picea sitchensis*	FAC	plug, bare root, or container	12
T	Red alder	*Alnus rubra*	FAC	plug, bare root, or container	12
T	Western hemlock	*Tsuga heterophylla*	FACU-	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9
S	Indian plum	*Omelaria cerasiformis*	FACU	1 gallon pot	3
S	Redosier dogwood	*Cornus sericea*	FACW	stakes	1-1.5
S	Hooker's willow	*Salix hookeriana*	FACW-	stakes	1-1.5
S	Pacific willow	*Salix lasiandra*	FACW+	stakes	1-1.5
S	Scouler willow	*Salix scouleriana*	FAC	stakes	1-1.5
S	Sitka willow	*Salix sitchensis*	FACW	stakes	1-1.5
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3
S	Stink currant	*Ribes bracteosum*	FAC+	1 gallon pot	3
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Baldhip rose	*Rosa pisocarpa*	FAC	1 gallon pot	3
S	Nootka rose	*Rosa nutkana*	FAC	1 gallon pot	3
G	Salal	*Gaultheria shallon*	FACU*	1 gallon pot	1.5
G	Sword fern	*Polystichum munitum*	FACU	1 gallon pot	1.5

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status

Plant Community C: Riparian-Upland Transitional Forest
Location: depressional and riverine wetland buffer.

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
T	Western hemlock	*Tsuga heterophylla*	FACU-	plug, bare root, or container	12
T	Douglas fir	*Pseudotsuga menziesii*	FACU	plug, bare root, or container	12
T	Sitka spruce	*Picea sitchensis*	FAC	plug, bare root, or container	12
T	Big leaf maple	*Acer macrophyllum*	FAC	plug, bare root, or container	12
S	Indian plum	*Omelaria cerasiformis*	FACU	1 gallon pot	3
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3
S	Stink currant	*Ribes bracteosum*	FAC+	1 gallon pot	3
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Serviceberry	*Amelanchier alnifolia*	FACU	1 gallon pot	3
S	Hawthorn	*Crataegus douglasii*	FAC	1 gallon pot	3
S	Bitter cherry	*Prunus emarginata*	FACU	1 gallon pot	3
S	Beaked hazelnut	*Corylus cornuta*	FACU	1 gallon pot	3

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status

Plant Community D: Hillslope Scrub-shrub Forested Wetland
Location: hillslope wetland

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Black cottonwood	*Populus fremontii*	FAC	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
S	Redosier dogwood	*Cornus sericea*	FACW	stakes	1-1.5
S	Black twinberry	*Lonicera involucrata*	FAC+*	1 gallon pot	3
S	Pacific ninebark	*Physocarpus capitatus*	FACW-	1 gallon pot	3
S	Snowberry	*Symphoricarpos albus*	FACU	1 gallon pot	3
S	Salmonberry	*Rubus spetabilis*	FAC+	1 gallon pot	3
S	Hooker's willow	*Salix hookeriana*	FACW-	stakes	1-1.5
S	Pacific willow	*Salix lasiandra*	FACW+	stakes	1-1.5
S	Scouler willow	*Salix scouleriana*	FAC	stakes	1-1.5
S	Sitka willow	*Salix sitchensis*	FACW	stakes	1-1.5
S	Red elderberry	*Sambucus racemosa*	FACU	1 gallon pot	3
S	Baldhip rose	*Rosa pisocarpa*	FAC	1 gallon pot	3
S	Nootka rose	*Rosa nutkana*	FAC	1 gallon pot	3

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status

Plant Community E: Western Hemlock Hillslope Forest
Location: hillsope wetland buffer

Type	Common Name	Scientific Name	WIS	Plant Material	On-Center Spacing (ft)
T	Douglas fir	*Pseudotsuga menziesii*	FACU*	plug, bare root, or container	12
T	Western red cedar	*Thuja plicata*	FAC	plug, bare root, or container	12
T	Western hemlock	*Tsuga heterophylla*	FACU-	plug, bare root, or container	12
S	Vine maple	*Acer circinatum*	FAC-	1 gallon pot	9
S	Indian plum	*Omelaria cerasiformis*	FACU	1 gallon pot	3
S	Fool's huckleberry	*Menziesia ferruginea*	FACU+	1 gallon pot	3
S	Red huckleberry	*Vaccinium parvifolium*	Not listed	1 gallon pot	3
S	Wood Rose	*Rosa gymnocarpa*	FACU	1 gallon pot	3
S	Alaska blueberry	*Vaccinium alaskense*	Not listed	1 gallon pot	3
S	Beaked hazelnut	*Corylus cornuta*	FACU	1 gallon pot	3
G	Bunchberry	*Cornus canadensis*	FAC-	1 gallon pot	3
G	Salal	*Gaultheria shallon*	FACU*	1 gallon pot	1.5
G	Cascade Oregon-grape	*Berberis nervosa*	Not Listed	1 gallon pot	1.5
G	sword fern	*Polystichum munitum*	FACU	1 gallon pot	1.5

Type: T = Tree; S = Shrub; G = Groundcover
WIS = Wetland indicator Status