Wetland Mitigation in Washington State
Part 2: Developing Mitigation Plans

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U.S. Army Corps of Engineers
Seattle District

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Region 10

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Chapter 1 - Introduction

This document is the product of a joint effort between the Washington State Department of Ecology (Ecology), the Seattle District of the United States Army Corps of Engineers (Corps), and Region 10 of the United States Environmental Protection Agency (EPA), herein called the agencies. The agencies provide this guidance to help the regulated community comply with environmental laws and policies and to improve the quality and effectiveness of mitigation in Washington State.

Part 2 of this two-part document contains information on developing mitigation plans, including the following:

- Phases of mitigation plan development (conceptual, draft, and final).
- Level of detail expected for a mitigation plan.
- Level of expertise needed to develop a mitigation plan.
- Factors to consider when developing a mitigation project.
- Numerous appendices, including outlines and checklists for mitigation plans.

Part 2 replaces and expands on the 1994 *Guidelines for Freshwater Mitigation Plans and Proposals* (Ecology 1994), with more details on environmental considerations for mitigation planning.

Part 1 provides a brief background on wetlands, an overview of the wetland regulatory process, detailed policies and guidance pertinent to wetland mitigation, particularly *compensatory mitigation*, and a discussion of other aspects of mitigation. Part 1 replaces the portions of the 1997 Ecology publication, *How Ecology Regulates Wetlands* (McMillan 1998), pertaining to wetland mitigation.

Each part has been written so it can be used independently. The agencies, however, recommend that both parts be read and in sequential order because both contain important information for those doing mitigation. Refer to Part 1, Chapter 1, which discusses the purpose of the document (both parts) and provides some background information as well as an overview of some recent changes in how wetland mitigation is viewed and practiced.

"The agencies" as used in this document refers to the Corps, EPA, and Ecology. However, other agencies, including local governments, also have regulatory authority in regard to wetlands and compensatory mitigation. Their requirements or recommendations for mitigation may or may not be consistent with the guidance in this document.

1.1 Organization and Overview of the Document

Part 2 provides technical guidance for developing compensatory mitigation projects and preparing their associated plans. Chapter 2, *Developing Mitigation Plans,* describes, in general terms, the plan that should be submitted to the agencies to obtain approval for a mitigation project. It includes phases of plan development, expectations of what is to be found in a report, and the level of expertise needed. Chapter 3, *Factors to Consider While Developing a Compensatory Mitigation Project,* provides a discussion and technical guidance on the various actions (e.g., selecting a site) involved in developing a mitigation project and factors to consider (e.g., source of water, soils) while planning the project.

A number of appendices are provided, including an outline for draft and final mitigation plans, and checklists. The appendices identify the information usually needed by the agencies to evaluate a proposal for an individual mitigation project. Review of compensatory mitigation projects can be expedited if this pertinent information is included in mitigation plans. It is also helpful if documents submitted use a standard format that is acceptable to the agencies for the organization and reporting of this crucial information. Refer to the Appendices for details on what should be submitted.

Although the agencies have attempted to be comprehensive in presenting this guidance, it may not describe all the information that may be needed because project and site-specific conditions vary considerably. In addition, the guidance does not necessarily cover all ways data can be collected and analyzed and mitigation plans written. Because wetland science and regulations change over time, this guidance is subject to revision. Make sure you have the most recent version of this document and any addenda (find the most up-to-date version at: http://www.ecy.wa.gov/biblio/0606011b.html or via the Seattle Corps Regulatory Branch and EPA Region 10 Wetlands home page [see *On-Line Resources*]).

Mitigation plans for wetland mitigation banks are not addressed in Part 2

This document does not address the process for obtaining approval for proposals and plans for developing wetland mitigation banks. Please refer to the Draft State Wetland Banking Rule (WAC 173-700), which can be found on-line at http://www.ecy.wa.gov/laws-rules/activity/wac173700.html. It outlines the review and approval process and provides technical guidance on designing and constructing a wetland mitigation bank. Prospective bank sponsors should also contact the Corps Seattle District (see Appendix B, Agency Contacts) to initiate the review process for developing mitigation banks.

Ecology published its draft rule for a certification program for wetland mitigation banks pursuant to the Wetlands Mitigation Banking Act (Chapter 90.84 RCW), which is consistent with the 1995 Federal Guidance for the Establishment, Use and Operation of Mitigation Banks (60 FR 58605-58614). Although the rule was withdrawn prior to its adoption, Ecology uses it as its primary guidance for the review of wetland bank proposals. Please check the Ecology Wetland Mitigation Banking home page at http://www.ecy.wa.gov/programs/sea/wetmitig for the current status.

See also Part 1, Section 4.2.1, for a discussion of mitigation banking, including the use of compensation credits from a bank and a general description of the review process.

Links to on-line references

The document contains many references to additional sources of information pertinent to wetland mitigation. If connected to the Internet use the external hyperlinks to referenced documents. Just press the CTRL key and click on the link.

See the *Tools and On-Line Resources* and *References* sections at the end of the document for a list of Internet addresses and references for hyperlinked documents.

Glossary

The first time a term defined in the glossary is used in a chapter it will be *italicized*. It may or may not be defined in the text. If not, go to the *Glossary* at the end of the document.

Clarification of Mitigation Terms

"Mitigation" literally means to reduce the severity of an action or situation.

"Wetland mitigation" is usually implemented as a sequence of steps or actions in order to reduce impacts to wetlands. So, *mitigation sequencing* refers to the prescribed order of the different mitigation steps (see Part 1, Section 3.5.1, *Mitigation Sequencing*).

Wetland *compensatory mitigation* is the stage of the mitigation sequence, where impacts to wetland functions are offset (i.e., compensated for) through creation (establishment), restoration (re-establishment, rehabilitation), enhancement, or preservation of other wetlands. Because regulatory requirements and policies tend to focus on compensatory mitigation, the term "mitigation" is often used to refer to compensation, which is just one part of the overall mitigation sequence.

Throughout this document the term "mitigation" is used interchangeably with the term "compensation" unless referring to the entire mitigation sequence (i.e., "mitigation site," "compensatory mitigation site," or "compensation site" refers to the site that is being used for compensation).

Construction or *constructing* as used in this document includes all activities used to create (establish), restore (re-establish and rehabilitate), enhance, and preserve a site for use as compensation for unavoidable wetland impacts. Construction associated with a mitigation site includes activities such as moving earth, building weirs, plugging ditches, breaking drain tiles, removing dikes, planting vegetation, removing cattle.

In the context of this document, *development project* means any activity that will result in negative impacts to a wetland (e.g., constructing a residential subdivision, single-family residence, commercial facility, or roads; installing utility lines, etc.).

The term *impact site* is used to describe the area of wetland that is being indirectly or directly affected by the development project.

Mitigation projects may include one site or multiple sites. When site is used it may also mean sites (plural).

Chapter 2 - Developing Mitigation Plans

2.1 Phases of Mitigation Plan Development

Mitigation plan development should proceed through several phases (i.e., conceptual, draft, and final plans). There are specific issues the applicant must address at each phase in the process. This chapter describes the information that applicants need for each phase, the components and level of detail needed in a mitigation plan, and the level of expertise needed to develop a mitigation plan.

Phases of Mitigation Plan Development

- Conceptual Mitigation Plan
- Draft Mitigation Plan
- Final Mitigation Plan

Project proponents should involve the agencies during the development of a mitigation plan. Involvement allows the agencies to discuss approaches and goals, to help identify mitigation opportunities, to evaluate preliminary project designs, and to comment on the more detailed elements of the design before too much effort is spent on designing the mitigation project. Early and periodic meetings can increase the likelihood of the mitigation plan meeting regulatory requirements, reduce potential costs and frustration with the approval process, and ensure that any actions taken by the applicant, such as purchasing a site for the mitigation project, will be worthwhile.

Furthermore, restoring, creating, or enhancing wetlands is still an evolving science, and the successful replacement of wetland functions is not always assured. A review of conceptual and draft plans by the agencies and, in some cases, a larger group of technical experts may be very helpful in developing a final plan that will have a higher probability of compliance and attaining its ecological goals.

2.1.1 Conceptual Mitigation Plan

A conceptual mitigation plan should focus on describing the goals, site locations, and design alternatives. A fully developed mitigation and monitoring plan is not necessary at this stage in the process. It is a general, narrative description that should contain maps and drawings of the development site, the wetland being affected, and the potential options for how to compensate for the impacts, including the site proposed for *compensatory mitigation*. It usually is based on existing information in conjunction with a field evaluation.

The conceptual plan should be brought to any pre-application meetings and/or submitted with application materials. The conceptual mitigation plan provides the agencies an opportunity to identify whether the proposal appears to be feasible, what impacts will need to be mitigated, and outline what the compensation requirements will be. Their feedback on the proposal will assist the applicant in developing a more detailed draft mitigation plan.

A conceptual plan is highly recommended

A conceptual plan starts the dialogue between the applicant and the agencies. Before putting too much work into a plan, arrange a pre-application meeing with agency staff and present the development proposal and conceptual mitigation plan. Get feedback from agency staff early. Many applicants have spent considerable time and money on a detailed mitigation proposal, only to find that the location or design is not acceptable to the agencies. A conceptual plan can help save time and money in the long run.

The conceptual plan for compensatory mitigation should generally include the following information:

- Identification of unavoidable impacts and why the applicant believes they are unavoidable and cannot be further minimized. Include the estimated size (in acres) and nature of the impacts to wetlands and other *aquatic resources*.
  - Description of the existing site conditions (water regime, vegetation, soils, landscape position, surrounding land uses, and functions).
  - Description of the potential impacts in terms of acreage by *Cowardin Classification*, *hydrogeomorphic (HGM) classification*, and *wetland rating* as determined by the eastern or western Washington State rating systems (Hruby 2004a and 2004b).
- Summary of the proposed approach for mitigation. Identify how potential impacts from the development project will be avoided, minimized, and compensated (i.e., mitigation sequencing).
- Overall goals of the proposed mitigation, including a brief description of the targeted functions, landscape position/HGM classification, and categories of wetlands.
- Potential compensatory mitigation site, including location and rationale for selection.
  - Discussion of the approach used to identify opportunities for compensation sites (using watershed analyses or existing watershed plans is recommended).
  - Description of the existing conditions of the potential site (landscape position, surrounding land uses, acreage of wetland/upland, vegetation, soils, sources of water).
- Proposed construction activities and timing of activities.
- Proposed mechanisms to protect the mitigation site over the long term (e.g., site ownership, conservation easement, deed restriction).

Detailed hydrologic studies are generally not required for a conceptual plan. However, when wetland creation or re-establishment is proposed, the plan should include a description of the proposed *hydroperiod* for the site and design considerations to ensure there is sufficient water to support the proposed compensatory mitigation project.

Information needed for proposals to use compensation credits from a mitigation bank

If a conceptual proposal for mitigation includes the use/purchase of credits from a mitigation bank, the agencies will need information similar to that needed for an individual concurrent mitigation project (see general outline above). The conceptual proposal for the use/purchase of compensation credits from a bank should include:

- A general description of the proposed impacts including acreage, type, and functions.
- A proposal to use credits from a specific bank (as part of the potential options presented for how to compensate for the impacts of the development project).
- The rationale for the use of the mitigation bank. Describe how the functions provided by the mitigation bank will provide adequate compensation for the impacts.

If the agencies have agreed that the conceptual proposal to purchase bank credits would likely compensate for the proposed impacts, then a final mitigation plan should be prepared. The final mitigation plan for the use of a mitigation bank is much less detailed than a final mitigation plan for an individual concurrent mitigation project (see the recommended outline in Appendix C). The final plan should include the information from the conceptual plan as well a detailed justification for the use of credits, the number of credits to be purchased, and the timing for purchase of credits. The number of credits purchased and the timing purchase will also be included as permit conditions.

The agencies will be developing more specific guidance on what information will be needed for the use of credits from mitigation bank. Check the following web page for updates: http://www.ecy.wa.gov/programs/sea/wetmitig .

2.1.2 Draft and Final Mitigation Plans

The second phase generally involves developing a draft mitigation plan that includes a detailed plan for maintaining and monitoring the compensatory mitigation project. This should generally not be attempted until the agencies have agreed that the conceptual mitigation plan would likely provide appropriate and practicable compensation for the proposed impacts.

The draft mitigation plan provides all the information necessary to actually implement the project. It describes in greater detail the proposed mitigation project. This includes the amount and types of wetlands that will be lost or degraded, the type and amount of mitigation proposed, general construction techniques, and proposed maintenance and monitoring plans. It should include specifications on site design, such as construction details, grading plans, and planting schedules. (See Appendix C, *A Recommended Outline for Draft and Final Mitigation Plans*, for more details on what the draft plan should contain).

Draft mitigation plans may not be necessary for mitigation projects where agency comments on the conceptual plan are minor or are easily addressed in the final plan. It is recommended that applicants consult with agency staff to determine whether draft plans are needed for their projects.

A final plan should be developed only after public comment periods end and the Corps has made a preliminary determination that the proposed project complies with the Section 404 (b)(1) Guidelines. Any comments from the agencies on the conceptual and draft mitigation plans should be addressed and reflected in the final mitigation plan and its drawings.

A field review of the project by the agencies may be needed prior to gaining approval of draft and final mitigation plans. This will, to a large degree, depend on the size and scope of the project and any issues that may have arisen during review of the conceptual or draft mitigation plans.

Once approved, the implementation of the final mitigation plan normally becomes a condition of the wetland permit (Corps 404 permit and/or Ecology 401 Water Quality Certification [or on Tribal lands, EPA]). It is also important to involve the local governments or tribe that have jurisdiction over the project.

The authors of the *Washington State Wetland Mitigation Evaluation Study* (Johnson et al. 2000 and 2002) made several recommendations regarding the format of compensatory mitigation plans:

- A detailed summary should be provided at the beginning of the mitigation plan.
- Baseline information on the impact site should be presented in one section at the beginning of a mitigation plan.
- Baseline information on the proposed mitigation site should be presented in one section, along with information on the mitigation project.
- Goals, objectives and performance standards of the mitigation project should be presented in one section.
- Monitoring, maintenance and *contingency plans* should be presented in one section (a clear tie should be made between monitoring and performance standards).

More detail on the contents of final mitigation plans, in the form of a recommended outline, is provided in Appendix C. It describes each item found in the mitigation plan checklist given in Appendix D. The agencies reviewing mitigation plans will expect information on the points in the outline and checklist that are relevant to the project, with justification for exclusions. For example, if a category of information listed is not applicable to a specific project, the applicant should note the omission and provide a rationale. Those items in the recommended outline that have an asterisk may not be needed depending on the project. Review of a mitigation plan may be expedited if the checklist and an executive summary (Appendix F has an example) are presented with draft and final mitigation plans.

ecologist, wildlife biologist, hydrologist, civil engineer, soils scientist, geologist, landscape architect, construction contractor, fish biologist, and/or horticulturist).

It is recommended that the staff hired remain on a project from initial planning through completion of the project. Their historical knowledge will help provide consistency and minimize "surprises" or unforeseen problems at the site. New consultants hired after the planning has begun, for example, need time to become familiar with the project, and this can lead to delays in the schedule and additional costs. For suggestions on how to select a qualified wetland professional see Appendix G, *Hiring a Qualified Wetland Professional.*

Chapter 3 - Considerations for Developing a Mitigation Project

This chapter provides guidance on some of the more important factors that should be considered when developing an individual compensatory mitigation project and its plan. Developing compensatory mitigation plans is an iterative process from conceptual to final plan. The agencies use the plans during the regulatory review process to evaluate the efficacy of each proposal for compensation. The agencies determine whether key factors related to the following actions, discussed in this chapter, have been sufficiently considered when developing the project:

- Delineating Wetlands and Assessing Impacts.
- Identifying Project-Specific Goals.
- Selecting a Compensatory Mitigation Site.
- Designing a Compensatory Mitigation Project.
- Implementing a Compensatory Mitigation Project.
- Managing the Mitigation Project after Implementation.

More details on the specific information needed by the agencies are provided in the recommended outline for mitigation plans (Appendix C). In particular, the agencies will need the rationale regarding how various decisions have been made, such as why a particular mitigation site was chosen.

Tools and additional information available on-line can be found at the end of the document, *Tools and On-line Resources.*

3.1 Delineating Wetlands and Assessing Impacts

3.1.1 Wetland Delineation

Typically, wetland delineation is a required element of a compensatory mitigation plan. Wetland delineation establishes the existence (location) and physical limits (size) of a wetland for the purposes of federal, state, and local regulations. Wetland delineation is also an element of a "jurisdictional determination[1]" identifying which water bodies, including wetlands, within the project boundaries meet the definition of *waters of the United States*. (See also Part 1, Section 3.2 – *Do You Have a Wetland on Your Property?*)

Wetland delineations must be done in accordance with the currently acceptable methods. At present, this includes the 1987 *Corps of Engineers Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987) with all applicable guidance and the 1997 *Washington State Wetland Identification and Delineation Manual* (Ecology 1997, Chapter 173.22.080 WAC). The state manual includes guidance that clarifies the 1987 manual published by the Corps

1 A jurisdictional determination is the evaluation of a piece of property for the presence of wetlands that would fall under the regulatory authority of the Corps of Engineers.

as well as guidance on regional issues issued by the Seattle District of the Corps and EPA Region 10 office. The state manual is consistent with the Corps 1987 manual and is required by all state agencies in the application of any state laws and regulations addressing wetlands, as well as by any city or county implementing their regulations under the Growth Management Act (Chapter 36.70A.175 RCW).

On-line wetland delineation resources

The *Corps of Engineers Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987) can be found on-line at: http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/87_Manual.pdf.

The *Washington State Wetlands Identification and Delineation Manual* (Ecology 1997) can be found on-line at: http://www.ecy.wa.gov/biblio/9694.html.

The Routine Wetland Determination Data Forms can be found at: http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/Data_Sheets_for_Wet_Delineations.pdf

A list of helpful resources can be found on the Corps/ Seattle District regulatory home page at: http://www.nws.usace.army.mil/reg.html (Wetland and Water Resources).

Additional resources can be found at the end of this document, *Tools and On-line Resources.*

Wetland delineation should result in three things:

1. A wetland boundary clearly marked in the field.
2. A map that accurately represents the boundary and location of data collection points.
3. A report that explains how the boundary was determined. It should include:
    - A description of how and when the delineation was conducted.
    - Data sheets used to delineate the wetland area (see shaded box for on-line forms).
    - A map (topographic and aerial site maps are very helpful) with data plots and the boundaries of the delineated wetland areas clearly identified.
    - A soil survey map.
    - Photographs.

The Corps of Engineers, not applicants or their consultants, is responsible for determining whether or not a wetland is a *water of the U.S.* and thus regulated under the federal Clean Water Act (CWA). If the Corps determines that a wetland is not subject to regulation under the CWA, applicants should be aware that these wetlands may still be subject to regulation by Ecology as well as by local jurisdictions.

Refer to Appendix H for a checklist of what information should be included in a wetland delineation report as well as a sample outline for a report.

3.1.2 Assessing Impacts

After the area of wetland to be lost or degraded (the impact site) has been delineated, the unavoidable impacts of the development project should be assessed. The wetland should be characterized regarding the type, area, and functions that will be directly and indirectly affected. It is important to adequately assess the impact site prior to any further planning or construction associated with the development project, to determine the relative importance of the site and its role in the region or *watershed*. This information can also help justify modifying construction plans to further avoid and/or minimize impacts to wetland functions. Refer to Part 1, Sections 3.5 and 3.6 for a discussion of mitigation *sequencing* (e.g., avoidance, minimization, compensation) and different types of impacts.

The information gathered during an impact assessment will dictate the requirements for compensation and help in selecting and designing a site that adequately compensates for the proposed impacts.

A compensatory mitigation project should normally strive to replace both the wetland area and wetland functions lost or degraded by both likely direct and indirect impacts of the proposed work (see Part 1, Section 3.6 for a description of direct and indirect impacts).

3.1.2.1 Characterizing Wetlands and the Functions They Provide

During an impact assessment the wetland should be characterized using the:

- U.S. Fish and Wildlife Service classification (Cowardin et al. 1979). It can be found on-line at http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm.
- Hydrogeomorphic (HGM) classification for Washington State. The *hydrogeomorphic classificatio*n (HGM) groups wetlands into those that function in similar ways, depending on the hydrologic and geomorphic conditions. The highest classification (i.e., classes) for wetlands in a region are defined nationally. A key to identify these classes in Washington is available in the rating system described below.
- Subclasses for each of the classes are defined regionally by experts within the area. Currently, the HGM classification has been refined only for two regions in Washington: the Lowlands of Western Washington and the Columbia Basin. For details refer to the *Methods for Assessing Wetlands Functions* (Hruby et al. 1999 and 2000). They can be found on-line at http://www.ecy.wa.gov/programs/sea/wfap/index.html.
- The rating system for eastern or western Washington (Hruby 2004a and 2004b). The rating systems can be found on-line at http://www.ecy.wa.gov/programs/sea/wetlan.html.

Wetland Functions

Wetland functions are the physical, chemical, and biological processes that wetlands perform. Many of these functions provide important benefits to society and are therefore valued. Impacts to a wetland may result in a loss or degradation of wetland functions. Compensatory mitigation is required to replace functions lost or degraded due to impacts or, in some cases, provide different functions that are also important.

Wetlands provide functions to varying degrees. For example, a *slope wetland* will perform sediment retention, but not as well as a *depressional wetland*. However, not all wetlands provide all functions. For instance, a wetland without organic or clay soils may not retain heavy metals or toxic organic chemicals. For a more detailed description of functions commonly provided by wetlands in Washington refer to Appendix I, *List and Description of Wetland Functions.*

At a minimum, the functions provided by the lost or degraded wetland should be described by a qualified wetland professional (see Appendix G, *Hiring a Qualified Wetland Professional*) using best professional judgment (BPJ) or using the 2004 revised wetland rating systems for either eastern or western Washington (Hruby 2004a and 2004b). A detailed *function assessment* may, however, be needed to determine the functions impacted. This will depend on the size of the development project and the size and character of the wetland being altered. One such detailed assessment, mentioned above, is the *Methods for Assessing Wetland Functions* (also known as the Washington State function assessment methods or WFAM [Hruby 1999 and 2000]). Also refer to Part 1, Appendix G, *Analyzing the Functions of Wetlands: An Overview of Methods*.

A similar characterization of functions should be completed at the proposed compensation site. The characterization should be done both for existing conditions and for the conditions that are expected as a result of the mitigation project. This is particularly important if enhancement or rehabilitation of existing wetlands is proposed as compensation. A comparison of functions before and after the mitigation project will help determine whether the impacts will be adequately compensated. Pre-construction assessment can also provide a baseline from which an increase or change in functions can be determined ("functional lift").

Three Assessments Are Typically Needed

1. How the functions at the impact site will be affected.

2. Functions of the wetland site used for mitigation prior to its construction, particularly if enhancing or rehabilitating.

3. Functions of the wetland site used for mitigation that will result from the conditions proposed in the mitigation plan (how will the wetland function by the end of the monitoring period based on the proposed mitigation actions?).

3.2 Identifying Project-Specific Goals

Before a mitigation site is selected and designed, it is necessary to identify the goals of a compensatory mitigation project. A goal identifies what the project is trying to accomplish – what the end product will be. *The overall goal of a mitigation project is to provide adequate compensation for losses and degradation to wetland area and function that occurred at the impact site.*

Appropriate goals can be developed for the mitigation project using information from the wetland delineation report and impact assessment. Goals provide the basis for selecting an appropriate site and dictating what the particular design of the site will be. Specific functions may be targeted (target functions) as goals of the project based on the impacts.

Additional, site-specific goals, objectives, and performance standards should be developed after a site for mitigation has been chosen. Even when the mitigation site location is predetermined, the goals for the project should be identified according to what is appropriate, sustainable, and achievable given the strengths and constraints of that site. See Section 3.4.2, for a discussion of site-specific goals, objectives, and performance standards.

3.3 Selecting a Compensatory Mitigation Site

Once general goals are identified, based on the nature and extent of wetland impacts, the applicant must find and propose a location capable of achieving those goals (see Section 3.2). Selecting the site is as important as the design of the site in assuring the success of a project. A good design can not provide effective compensation if the site is inappropriate and the necessary functions and area cannot be achieved. Also, the physical characteristics of the potential site determine which type (e.g., creation, restoration, enhancement, preservation) of compensation and design are appropriate (see Section 3.4, *Designing a Compensatory Mitigation Project*).

A checklist of things to consider when selecting a site is provided in Appendix J.

In the past, agencies preferred on-site compensatory mitigation regardless of the suitability of the site. On-site means the compensation wetland is located on or very near the site of the development project where the impacts occur. However, a 2001 report, *Compensating for Wetland Losses Under the Clean Water Act* (National Research Council 2001), recommended that compensatory mitigation be considered in a *watershed* context and recognizes that locating sites for compensation at or near the site where the impacts occurred may not necessarily be desirable. Ultimately the most appropriate site is the one that makes the most ecological sense.

Selecting sites using a landscape-based approach

A landscape-based approach to mitigation means evaluating proposed impacts as well as selecting compensatory mitigation sites in the context of the larger landscape. It involves determining the relative importance of a wetland or aquatic system in relationship to other wetlands, habitats, and processes occurring in the landscape. In order to do this the perspective has to change from a narrow site-based focus to a wider focus that takes in the surrounding landscape and the environmental processes.

There are a variety of tools available for landscape analysis. One method that Ecology has recently developed provides guidance for Puget Sound planners, resource managers, and consultants on how to better protect aquatic ecosystems, such as lakes, rivers, wetlands, and estuaries, by including information about watershed processes in resource management plans and regulatory actions. The document, entitled *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes*, can be found on-line at http://www.ecy.wa.gov/programs/sea/landscape.

Applicants should also investigate and consider other approaches to compensatory mitigation such as agency-approved *mitigation banks* and *in-lieu fee programs* serving the area where the proposed impacts would occur (refer to Part 1, Chapter 4, *Approaches to Compensatory Mitigation*). For example, on-site compensatory mitigation could be inappropriate if the habitat developed would be isolated, of small acreage, or would experience substantial changes in hydrologic processes over the long term. In such a case, buying credits from an approved mitigation bank may be more practicable and environmentally beneficial because the suitability of that bank has already been demonstrated to the agencies. The use of banks and in-lieu fee programs may actually enhance the *aquatic resources* in the region or *watershed*. However, the agencies make the final decision whether to accept purchase of credits or in-lieu fee programs after examining all relevant issues, including landscape-scale issues such as wildlife corridors and water quality. These approaches should be discussed with the agencies during the conceptual planning stage (see Section 2.1.1, *Conceptual Mitigation Plan*).

Selecting an appropriate site helps ensure the compensatory mitigation project will provide the desired functions and be ecologically effective over the long term. A site should be selected where mitigation actions can provide enough increase in functions to compensate for the functions lost to wetland impacts and it should also be sustainable over the long term. This means avoiding *hydroperiods* and sources of water that require a lot of engineering or long term maintenance, such as water control structures. In addition, the existing and proposed land uses and landscape position of the site should be considered because these affect its sustainability and its ecological effectiveness.

3.3.1 Environmental Factors for Selecting a Site

Wetlands are dynamic systems whose existence depends on a variety of environmental factors (physical, chemical, and biological factors) that are limited to specific locations in the landscape. This section discusses the environmental factors that should be considered when selecting an appropriate site for compensatory mitigation. The success of a wetland mitigation project may also depend on non-environmental factors such as long-term

maintenance and site protection. If an applicant already owns a property, the agencies will use these same factors to determine if the property is capable of providing effective wetland compensatory mitigation.

Some environmental factors that need to be considered in choosing a site are:

- Source of water and the resulting water regime at the proposed site.
- Type and condition of soil on the site.
- Position of the property in the landscape and the *hydrogeomorphic (HGM) class/subclass* proposed for the compensation site.
- Land uses (historic, current, and future) of the site and adjacent areas.
- Presence of undisturbed corridors to wildlife habitats that are protected (existing wetlands, natural areas, or other aquatic sites).
- Existing or potential vegetated buffers.
- Extent of invasive species on the site as well as seed sources that might be nearby or upstream.
- Existing seed bank on the site (native and non-native species).
- Presence of endangered species.

All of these factors influence the performance of functions at the site. Each of these factors is discussed in more detail in the following subsections.

3.3.1.1 Source of Water

Water is the most critical environmental factor in selecting a wetland compensatory mitigation site. Failure to have an adequate and self-sustaining source of water is a major cause of failure for compensatory mitigation projects. Establishing the correct water regime is perhaps the most important factor in a successful project.

A proposed mitigation site must have a natural source of water (e.g., over bank flooding, precipitation, ground water) sufficient to support the wetland and the target functions in dry years as well as wet ones. The source of water must also be sustainable and relatively predictable. In some cases a water right permit may be needed.

> Droughts are not predictable and are always possible. A mitigation site with an adequate source of water, however, should still show wetland characteristics by the end of the monitoring period despite a year or two of drought.

Modification of the water regime at a site should be kept to a minimum. The goal is to have a self-sustaining water regime at the site that requires little or no long-term maintenance. It may be more difficult to establish an appropriate water regime at an upland site than one that was historically wetland, or one that is adjacent to existing aquatic resources (streams, lakes, or ponds). Re-establishing a source of water may include plugging ditches or removing drain tiles, a berm, dike, or flood gate. (See Part 1, Section 5.2 for information on what types of wetland compensation activities are preferred.)

Artificial structures and mechanisms to maintain water levels, such as weirs, should only be used temporarily, if it all. These structures need to be maintained and monitored, particularly after large storm events, and therefore, are not sustainable over the long term. In general, properly designed and sited wetland mitigation projects have no need for water control devices and artificial structures.

The agencies strongly discourage the use of long-term (i.e., longer than three years) irrigation as the main source of water. Sites primarily supported by such artificial water sources are not self-sustaining, and the functions at the site cannot be supported over a long period of time. Short-term irrigation sufficient to establish plant roots however is not discouraged and is, in some cases, essential.

In order to approve a proposed mitigation plan, the agencies will often require some form of hydrologic monitoring to document that the proposed source of water and predicted *hydroperiod* are attainable and appropriate for the site (see Section 3.4.1.1, for more information about the source of water and potential water regimes). The methods used to monitor the water regime will be determined case by case, based on local conditions. (Refer to the *Guidelines for Conducting and Reporting Hydrologic Assessments of Potential Wetland Sites* [Warne and Wakeley 2000].) An analysis of hydrologic conditions will usually include: examination of the groundwater/water table fluctuations; frequency, depth, duration, and timing of surface inundation (flooding); precipitation and surface runoff data; the area contributing surface water to the wetland (contributing basin); and soil type. If available, data on historic hydrologic conditions of the site, such as aerial photographs, can also help in the analysis. In addition, potential future changes to the water regime due to human activities (e.g., changes in land use), should also be considered (see Section 3.3.1.4, *Land Use*).

For enhancement or rehabilitation, it is important to show that the source of water maintaining the existing wetland will be adequate for the proposed improvements. For re-establishment, it is important to demonstrate that the original source of water is still available and can be returned to the wetland. For creation, it is important to demonstrate that the source of water is adequate to meet the hydrologic criterion for an area to be considered a wetland. This may mean collecting information about adjacent stream levels or surface runoff. If the proposed site is adjacent and/or connected to an existing wetland, it is important to verify that the hydroperiod of the existing wetland will not be affected and that the source of water will be sufficient to support both wetlands.

3.3.1.2 Type and Condition of Soil

Soil is another critical factor that affects wetland functions and is therefore important in selecting a site for compensatory mitigation. Soil affects a site's ability to retain water, support plant communities, and to provide certain functions (e.g., nutrient transformation and trapping pollutants).

The type of soil present will affect what functions the site will be able to provide and thus how it should be designed. For example, if a site contains deep sandy soil, water may drain so rapidly that establishing the necessary wetland hydroperiod would be difficult or impossible without engineered solutions requiring long-term maintenance. Refer to the respective county's soil survey or contact the appropriate Natural Resources Conservation

Service (NRCS) office in Washington for site-specific soil information. (Contact information for NRCS offices can be found on-line at: www.wa.nrcs.usda.gov/contact/fieldoffices.html.) Examining existing wetland reference sites nearby may also provide important information on the development of suitable soils at mitigation sites (see Section 3.4.3, *Using Reference Wetlands for the Design of a Mitigation Site*).

Soils at a potential mitigation site should be analyzed to answer the following questions:

1. Does the soil have hydric indicators? The presence of hydric soils on an upland site is an indication that at one time a suitable water regime for wetlands existed on the site. It also provides evidence that the site may be a good candidate for re-establishment. The NRCS, Field Indicators of Hydric Soils in the United States, can be found on-line at: http://soils.usda.gov/use/hydric/.

2. What are the levels of organic matter and nutrients in the soil? These characteristics influence the success of plantings and provide certain functions associated with improving water quality. Analysis of organic matter and nutrients should be done, especially if the site has previously been in agricultural production. A soil analysis can also aid in identifying appropriate soil amendments.

3. Is there any toxic contamination of the soil? If so, can remedial actions be implemented? Soils contaminated with toxic metals and organic compounds are generally not suitable for compensatory mitigation. However, a site downstream from a contaminated site may still provide important water quality improvement functions, if that is a goal for the compensatory mitigation project. The Washington Facility/Site Atlas lists locations of state and federal clean-up sites and may help identify the location of some of the areas known to contain contaminated soils. The Washington Facility/Site Atlas can be found on-line at http://apps.ecy.wa.gov/website/facsite/viewer.htm.

4. Is the soil compacted? Soils that are very compacted act as impervious layers and could limit the infiltration and sub-surface flow of water. This results in increased surface water run-off. Compacted soils may also hinder root growth in plantings and delay their establishment. However, compacted soils can be "ripped" (also referred to as subsoiling or deep chiseling) and amended to correct the problem.

Often, the most costly part of a compensatory project is grading and earthwork. If the soils at a potential site require extensive modification, it may be worthwhile to look for another site. For additional discussion about soils related to designing a mitigation project, refer to Section 3.4.1.2.

3.3.1.3 Position on the Landscape

When selecting a site it is important to consider its position on the landscape. One way to determine the position on the landscape is to classify it using the *hydrogeomorphic (HGM) classification* system for Washington (refer to Section 3.1.2.1, *Characterizing Wetlands and the Functions They Provide*).

Wetlands can be classified based on their position in the landscape and resulting source and hydroperiod of water. Freshwater wetlands form where:

- The shape of the land allows water to pool at or near the surface of the ground *(depressional wetlands)*.
- Water flows laterally between different soil layers near the surface due to differences in permeability *(slope or depressional wetlands)*.
- Breaks in the topography and subsurface flows are exposed *(slope wetlands)*.
- Surface waters regularly flood in valleys (riverine wetlands).
- Large bodies of water are shallow enough to allow light penetration to the bottom (wetlands along the shores of lakes, also called lacustrine fringe wetlands).

Providing compensatory mitigation of the same HGM class (e.g., depressional) or subclass (e.g., depressional closed or depressional outflow) as the affected wetlands means that the mitigation wetlands are more likely to be functionally equivalent to those lost or degraded. In some cases, an applicant may provide compensatory mitigation with a different class of wetland provided it is not an atypical HGM class or subclass (see shaded box below for a definition). Applicants should ensure that a site will have an HGM class/subclass appropriate for its position on the landscape regardless of whether the affected wetland has the same HGM class/subclass.

Defining atypical wetlands

Compensatory mitigation should not result in the creation, restoration, or enhancement of an atypical wetland. An *atypical wetland* is defined as a wetland whose "design" does not match the type of wetland that would normally be found in the geomorphic setting of the proposed site (i.e., the water source and *hydroperiod* proposed for the mitigation site are not typical for the geomorphic setting). In addition, any designs that provide exaggerated morphology or require a berm or other engineered structures to hold back water would also be considered atypical.

Creating a *depressional wetland* by excavating a depression in a riverine overflow channel or creating a depression in an existing slope wetland using an engineered berm to hold water, would both produce atypical wetlands. These would be considered atypical HGM locations for depressional wetlands and, as such, they would be less likely to provide the same functions. Excavating a permanently inundated pond in an existing seasonally saturated or inundated wetland would also result in an atypical wetland.

Note: This is different than the "atypical wetland" defined in the Corps 1987 wetland delineation manual.

In addition, applicants should consider the location of a potential site in relation to environmental processes occurring on the landscape, other wetlands, and habitats. For example, are there wetlands or other habitat areas in proximity to the potential site? If not, the potential site may not provide habitat for wildlife because wildlife cannot move to and

from the wetland to other habitats. Refer to the following sections on land uses and habitat connectivity for more discussion.

Finally, when selecting a site, consider whether its location is consistent with local and regional watershed plans, sub-area management plans, habitat management plans, and resource inventories. In other words, has the site been identified in a local watershed plan and will it contribute to the needs for aquatic resources of the impacted watershed? Local and regional watershed plans should be consulted when selecting mitigation sites.

3.3.1.4 Land Use

Current, future, and historic land uses affect the suitability of sites for mitigation. It is important to characterize all of these to determine how they will affect the site (e.g., will changes in land use reduce the functions in the wetland?). In order to sustain functions in the long-term, a potential mitigation site should not conflict with the existing and expected land uses. The mitigation project should also be consistent with existing land-use plans and zoning codes.

A site adjacent to an airport, for example, may have restrictions preventing the establishment of bird habitat (see Section 3.3.2.3, *Location near an airpor*t). In addition, airports produce continual disturbance from noise and light. Likewise, sites adjacent to residential or high density development may be subject to a variety of direct and indirect disturbances. Excessive human and pet intrusion as well as indirect impacts of noise, light, lawn runoff, and other pollutants can all greatly reduce the suitability of the wetland as wildlife habitat.

A mitigation site may also be adversely affected by the increasing amount of *impervious surface* as development increases in an area. This is an important factor affecting the *hydroperiod* of surface and groundwater flows in a *watershed*. Increased impervious surface normally results in a "flashier" flow (i.e., greater and more frequent water level fluctuations). High flows can scour a stream channel, causing an ever deepening channel that disconnects the stream from its floodplain, and possibly de-water adjacent *riverine wetlands*. Fluctuating water levels will affect the ability of some plant and animal species to survive, either drowning them or, when levels drop, stranding amphibian egg masses above the waterline. Impervious surface also affects a number of water quality factors including temperature, contaminants, and nutrients.

Existing industrial areas may leach pollutants into surface or subsurface water, thereby diminishing water quality in adjacent wetlands. However, a mitigation site situated downstream of industrial development will have an excellent opportunity to improve water quality.

Very small sites surrounded by buildings and roads are not likely to provide good wildlife habitat, but they may still provide very good water quality functions. In large urban areas, however, a small site may become more significant for certain wildlife if it is the only wetland in the area.

Land uses may also affect the width of buffer needed to protect mitigation sites and their functions (refer to Part 1, Section 6.6, *Determining Adequate Buffers*). Existing undeveloped areas adjacent to a site, such as pasture and timber lands, can further protect

the wetland mitigation site and increase its ability to provide wildlife habitat in conjunction with the designated buffer. Unfortunately, unless these areas are designated parks, wildlife areas, or are protected with a *deed restriction* or *conservation easement* (see Section 3.3.2.2, *Site Ownership and Legal Mechanisms for Long-term Protection*) they may not remain undeveloped.

Alternatively, a mitigation project may affect adjacent properties. For example, the removal of dikes along a river may restore acres of agricultural land to wetlands but it also may impact other adjacent land uses along the river by causing periodic flooding. Elements of the landscape are functionally connected, and land uses on one site (the mitigation site itself or adjacent sites) often influence *landscape processes* in surrounding locations.

Historic land use

Understanding past land uses can help identify both the constraints and opportunities of a potential mitigation site. For example, previous agricultural activities may have altered the flow of water (e.g., ditches and drainage tiles) which could influence the water source for a compensation wetland. This could be either an obstacle or an advantage allowing opportunities for re-establishing or rehabilitating hydrologic processes.

Some historic land uses have long-term consequences that may reduce a project's success. For example, land previously used as a chemical dump or landfill will likely be contaminated. Even after expensive cleanup, a site may never be suitable for wildlife habitat. Or soils on a site previously seeded with invasive pasture grasses may retain the seeds of these species that makes future control of invasive species difficult or impossible (see Section 3.3.1.8, *Seed Banks*). Therefore, it is important to obtain as much information as possible on the past history of potential sites as well as knowledge about current and future on-site and adjacent land uses.

It is also important to coordinate with local tribal governments (including the *Tribal Historic Preservation Office [THPO]*, and the *State Historic Preservation Office [SHPO]*) to determine if there are any *cultural resources* present.

THPO can be found on-line at http://www.cr.nps.gov/hps/tribal/tribaloffices.htm.

SHPO can be found on-line at http://www.achp.gov/shpo.html.

3.3.1.5 Habitat Connectivity

If a goal of a compensatory mitigation project is to provide wildlife habitat, where possible, a site should be selected that is connected to other aquatic systems or habitats. Landscape *connectivity* may be critical for the persistence of some native species. As a result, a compensatory mitigation proposal may include purchasing and protecting an undeveloped corridor, or removing a barrier that hinders the movement of wildlife in a disturbed corridor. Small sites may become more important for wildlife and may augment functions of other aquatic areas nearby if they are connected by vegetated corridors. Be aware, however, that removing barriers and/or establishing new connections to other aquatic habitats may also allow entrance of new invasive species such as bullfrogs.

The use of spatial analytical tools (e.g., *Geographic Information Systems [GIS]*) on a regional basis could provide valuable assistance in the choice of suitable locations for compensatory mitigation sites. Such tools can be used to analyze land uses in a *watershed* as well as habitat connectivity and other factors. Check with local planning agencies (and in some cases, state agencies) to see if any spatial analysis has been completed or digital data available for areas of interest.

3.3.1.6 Buffers

Buffers play an important role in supporting and maintaining wetland functions (refer to Part 1, Section 6.6). The width and characteristics of a buffer needed to protect a wetland mitigation site depend to a great extent on the functions the site is expected to provide and on the current and future condition (i.e., land uses) of the surrounding landscape. For example, if wildlife habitat is a project goal, the required buffer width may amount to a significant acreage. Applicants are therefore encouraged to consider the size and characteristics of the buffer needed to protect a proposed mitigation site and its proposed functions.

3.3.1.7 Invasive species

In most cases, the potential mitigation site should provide a good opportunity for establishment of vegetation appropriate for the *ecoregion* (see shaded box for definition) in which the project is located. This means that invasive species are of special concern. Choosing a site dominated by invasive species can present challenges. Restoration of such a site can, if done correctly, provide many ecological benefits. If such a site is chosen, however, there may be a need for extensive management and monitoring to ensure that the invasive species are eradicated or significantly reduced. Invasive species out compete native species reducing the diversity of plant and animal communities and affect functions such as wildlife habitat.

The importance of avoiding invasive species at a specific site depends in some measure on the functions desired on the site. Invasive species exert a significant stress on ecosystems, and the inability to control invasive species such as reed canary grass (*Phalaris arundinacea*) is a major cause of failure to achieve desired levels of wildlife habitat.

The ability to control invasive species at a site will be limited if the site itself or its surrounding areas are heavily infested with invasive species. In this case, intensive and long-term maintenance will be required to control the unwanted species at a minimum.

In the Pacific Northwest reed canary grass (*Phalaris arundinacea*) is one of the most difficult species to eradicate. If only water quality and hydrologic functions are being considered for a compensatory mitigation project, then it may not be worth spending resources on an effort to remove it. However, a site that can perform a variety of habitat functions as well is preferable. See also Section 3.4.1.4.

Definitions of ecoregion and invasive species

Ecoregions. A system of classifying areas with similar ecosystems and types, quality, and quantity of environmental resources. The classification is hierarchical and Level III ecoregion subdivisions currently mapped for Washington are: Coast Range, Puget Lowland, Cascades, Eastern Cascades Slopes and Foothills, North Cascades, Columbia Plateau, Blue Mountains, and Northern Rockies. The U.S. Environmental Protection Agency maintains updated maps of ecoregions that are available at http://www.epa.gov/naaujydh/pages/models/ecoregions.htm.

Invasive species. Are defined by the National Invasive Species Council (NISC) as 1) "a non-native (alien) to the ecosystem under consideration and 2) a species whose introduction is likely to cause economic or environmental harm, or harm to human health" (Executive Order 13112). Not all invasive species are of non-U.S. origin. Species that contribute positively to one ecosystem or area of the U.S., can pose significant ecological problems when transported elsewhere where the traditional predators and other mechanisms that would normally keep them in check are absent. Cordgrass (*Spartina spp.*) and the American bullfrog (*Rana catesbiana*) now found in Washington, are just two examples of East Coast organisms now severely affecting ecosystems on the West Coast. A list of noxious weed species, identified by the Washington State Noxious Weed Board, is provided in Appendix K.

The federal "gateway" for invasive species can be found on-line at http://www.invasivespecies.gov. It provides additional information and links to important invasive species sites, including the National Invasive Species Council.

A brief description of Executive Order 13112 can be found in Part 1, Appendix E. It can be found on-line at http://www.archives.gov/federal_register/executive_orders/1999.html.

3.3.1.8 Seed banks

The presence of seeds, both desirable and undesirable, on a site is another factor to consider when looking for a suitable mitigation site. Many seeds can remain dormant but viable in the soil for years or decades, awaiting the proper conditions to germinate. Therefore, knowing the past history of your site will give you an idea of what types of seeds you may expect in the site's seed bank (see Section 3.3.1.4, for information on historic land use).

However, it may be difficult to predict what plants will develop from existing seed banks. If the seeds of native wetland plants still remain at the site all that may be needed for them to germinate is to re-establish the correct *hydroperiod*. However, if the seeds are present in a pasture that had been dominated by an aggressive invasive species like reed canary grass (*Phalaris arundinacea*), it will be difficult to establish a diversity of native plants and achieve the desired plant richness because of the competitive advantage of the reed canary grass.

3.3.1.9 Presence of Endangered Species

The presence of species listed in the Endangered Species Act (ESA) on a site may make a site a priority for protection. This may, however, make the site inappropriate for some types of mitigation or may create too many limitations for mitigation activities, depending on the habitat requirements of the endangered species. An ESA consultation with the appropriate federal agencies may be required for mitigation activities (e.g., excavation) even if the development project had no effect on endangered species.

3.3.2 Non-environmental Factors

Some non-environmental factors should also be considered when selecting a site. These include:

- Long-term maintenance of the site.
- Site ownership, site management, and deed restrictions.
- Other practical considerations.

3.3.2.1 Long-Term Maintenance

When selecting a site you should also consider what potential long-term maintenance may be needed. One of the most common maintenance activities for mitigation projects is controlling invasive species. As mentioned previously, the ability to control invasive species on the site may be limited if the site itself and the surrounding landscape, are heavily infested with invasive species. Also, the site will likely require intensive and long-term maintenance to control unwanted species.

Selecting a site that will require extensive hydrologic modifications and/or engineered structures to provide an adequate water regime may also have long-term maintenance requirements and costs (see Section 3.6.4, *Maintenance and Contingency Plans*). Potential sources of damage that may require maintenance include vandalism and use by recreational vehicles (e.g., ATV and off-road vehicles).

3.3.2.2 Site Ownership and Legal Mechanisms for Long-term Protection

Controlling the ownership of a site or the "development rights" of a site is an important factor to consider when selecting a compensatory mitigation site since the site must be legally protected over the long term. Direct ownership of the property and/or its underlying land and water rights by the proponent or a conservation group can help ensure long-term protection. Leased properties, where certainty of future protection cannot be provided, are not acceptable sites for wetland compensation. Certainty of future protection can best be provided by restrictions on the deed for the property.

Restrictions on the deed provide assurance that the site will remain protected consistent with the goals and objectives of the project. Restrictions can be applied to a property through conservation easements or straight deed restrictions. All restrictions are attached to the title of the property.

A *conservation easement* is a legal agreement between a landowner and another entity such as a *land trust* or government agency that permanently limits uses of the land (e.g., development rights) in order to protect its values for conservation. Conservation easements have a long history of protecting lands, and they have a solid standing in court cases for enforcement purposes. A conservation easement is therefore more legally binding than a straight deed restriction. In addition, an enforcement entity, the "easement holder," is responsible for making sure the easement's terms are followed.

The holder of an easement, usually an organization, such as a land trust, or an agency involved in land conservation, ensures the protection of the site. The holder monitors the property on a regular basis to determine that the property remains in the condition agreed to in the easement. The holder may or may not accept responsibility for management of the site (i.e., implementing any necessary maintenance or corrective actions), depending on the original agreement. Easement holders usually receive an "endowment fee" for their services. This fee is banked and accrues interest for the purpose of providing long-term stewardship of the land and covers any legal fees or court costs, should the owner or other party violate terms of the easement.

Straight *deed restrictions* are similar to conservation easements in that the terms are placed on a property's deed as conditions of management. They differ from conservation easements in that they do not usually have an identified enforcement entity to oversee the terms, they lack an endowment, and their longevity is usually much shorter. Conservation easements most often are for perpetuity, whereas a straight deed restriction could potentially be removed from the property at some undetermined date.

However, not all land trusts, or public agencies, have the resources or the interest in overseeing the long-term protection of a compensatory mitigation project after it is constructed. If the compensatory mitigation site is a highly disturbed and/or a low functioning system, it may be difficult to recruit an appropriate entity to assume responsibility. For a relatively undisturbed and/or high functioning wetland the likelihood of securing an easement holder should be somewhat easier, and is certainly the preferred option.

If a willing conservation easement holder cannot be found, a straight deed restriction on the property may be acceptable, providing it clearly describes the required conservation and management activities. Implementing and abiding by an agency-approved deed restriction also becomes a permit condition, which provides regulatory agencies enforcement authority over the deed restriction (see Section 3.6.6, *Compliance and Enforcement*).

Authorization is needed to use state-owned aquatic lands

If the compensatory mitigation site is proposed on state-owned aquatic lands, authorization to use the lands for compensatory mitigation must be issued from the Washington State Department of Natural Resources.

3.3.2.3 Other Considerations

The following factors should also be considered when selecting a site. A complete checklist of factors to consider for site selection is presented in Appendix J:

- Presence of cultural resources. It is important to coordinate with local tribal governments (including the *Tribal Historic Preservation Office*) and the *State Historic Preservation Office* to determine if there are any cultural resources present at the potential mitigation site.
- Location near an airport. Will the site be located on or near an airport? Compensatory mitigation projects that might attract waterfowl and other bird species that pose a threat to aircraft need to be sited consistent with current Federal Aviation Administration (FAA) guidance. A 1997 Memorandum or Agreement (MOA) and Advisory Circular (AC), FAA AC 150/5200-33, provides guidance on locating certain land uses and landscape features, including wetlands, having the potential to attract hazardous wildlife to or in the vicinity of public airports. "Conservation/mitigation habitats" are one of the three activities of most concern. Design constraints, including limiting wildlife habitat and use of the site may apply if you choose a site that is affected by FAA rules. The MOA can be found on-line at http://wildlife-mitigation.tc.faa.gov/public_html/moa.pdf.
- Costs of site development. What are the potential costs associated with the site? The cost of land acquisition, activities such as earthwork, disposal of excavated materials, etc. can vary greatly among sites and should be considered in site selection.
- Meeting regulatory requirements. Does the site meet the regulatory requirements? It is important to coordinate with the appropriate agencies (Corps, Ecology, local governments) to make sure the site selected will meet the regulatory requirements for compensatory mitigation, such as where it should be located (see Part 1, particularly Chapter 6, including the section on choosing a location).

3.4 Designing a Compensatory Mitigation Project

An appropriate site design is equally as important as selecting the proper site though the two are dependent on each other. Once a site and conceptual plan are selected, a detailed mitigation plan should be designed around the constraints and strengths of that site. Conversely, a concept for site design may be proposed before a site is selected as a part of identifying project-specific goals (see Section 3.2, *Identifying Project-Specific Goals*). The initial concept could target specific functions that will be lost or degraded at the development site and that should be replaced. A site must then be found to accommodate this concept. In such a case, the design concept may still need adjustment to accommodate the characteristics of the site once it is chosen.

An appropriate site design is equally as important as selecting the proper site though the two are dependent on each other.

The site should be designed to compensate for the lost and degraded wetland area and functions. For example, if a project goal is to provide amphibian breeding habitat, then the

design should not include off-channel fish habitat. The design conflicts with the goal since fish prey upon amphibians.

Also, the design of the site may depend upon the type of wetland mitigation (e.g., creation, enhancement) being proposed. Obviously, if re-establishment is desired, the design must use an upland site that was previously wetland. Likewise, if rehabilitation or enhancement are desired the site design would focus on a currently degraded wetland. It is important to remember that an applicant proposing to rehabilitate a site must design the mitigation project to improve hydrologic processes, whereas improving vegetation structure would be enhancement (see Part 1, Section 5.1.1, *The Difference between Rehabilitation and Enhancement*).

Overall, the compensatory mitigation should be designed so that it will use *environmental processes* and, as previously mentioned, require minimal long-term maintenance. In addition, the design should be flexible to allow adjustments for unforeseen problems (see Section 3.6.5, *Adaptive Management*).

3.4.1 Environmental Factors in Designing a Mitigation Project

The following sections focus on some important environmental factors that should be considered when designing a site:

- Water - The source and the potential hydroperiod.
- Soils.
- Vegetation.
- Invasive species.
- Target functions.

These topics are followed by a discussion about site-specific goals, objectives, and performance standards as well as using reference sites during design of the project.

Additionally, there has been some concern expressed that wetlands create breeding areas for mosquitoes that potentially spread human diseases. Understanding the habitat requirements of different types of mosquitoes may help when designing wetland mitigation sites. See Appendix L for more discussion.

3.4.1.1 Water

Water is the most critical environmental factor in the design of a compensatory mitigation site. Its source, timing, frequency, and the duration of inundation or saturation determine the form and function of a wetland. Without sufficient water the site will not be a wetland or specific functions or improvement of functions may not be possible. Sufficient water is defined in wetland delineation manuals as having soils saturated or inundated to the surface for a minimum of 5% of the *growing season*. However, designing the hydroperiod to meet only this absolute minimum criterion, particularly for establishment or re-establishment of a wetland, will generally not be accepted by agency staff reviewing the mitigation plan. Instead, sites should be designed to have inundation or soil saturation to the surface for at least 10% of the growing season.

The growing season for much of the low elevations of Western WA is considered to be March 1st to October 31st, and inundation or saturation to the surface would be required for about 24 days. The growing season in the rest of the state is highly variable because of the climatic differences between eastern and western Washington. The growing season can range from 100 days in the mountains to close to 300 days on the Pacific coast. The growing season for specific areas can be estimated using the climate data found in most Natural Resources Conservation Service (NRCS) county soil surveys. Contact the local Washington NRCS office or Conservation District for site specific information (see below for on-line resources).

On-line resources

Some county soil surveys are on-line at http://www.wa.nrcs.usda.gov/technical/soils/soil_survey.html.

Local NRCS offices can be found on-line at http://www.wa.nrcs.usda.gov/contact/fieldoffices.html.

Local Conservation Districts can be found on-line at http://www.scc.wa.gov/districts/list/.

Designing an appropriate *hydroperiod* for a wetland is difficult. Designing for minimum saturation or inundation may result in a site that resembles upland and has more problems with invasive species. On the other hand, designing a site to ensure that there is plenty of water may result in a wetland with permanent inundation and deep ponding. This may not be appropriate compensation for lost or degraded hydrologic functions, depending on the characteristics of the wetland being affected by the development project. A wetland with an atypical HGM class may be the result of an inappropriate design for the hydroperiod (see Section 3.3.1.3 for a definition of wetlands with atypical HGM classifications).

A compensation wetland that relies solely on an artificial source of water is generally not acceptable.

The mitigation design should not only ensure there are sufficient amounts of water but also that the hydroperiod is appropriate. The presence of water may produce a wetland, but it is the hydoperiod of a site that affects the functions that will be provided.

The hydroperiod should support the goals, objectives, and functions that have been targeted. The design, however, should avoid a rapid and widely fluctuating depth of inundation, since this is detrimental to many functions. For example, if amphibian habitat is a target function then the hydroperiod should provide shallow ponding for long enough duration to allow native amphibian tadpoles to develop, but should avoid fluctuations that are greater than 20 cm in any one month.

The environmental conditions at a site, as well as the project-specific goals, should influence how the project, including its hydroperiod, is designed. However, the goals, objectives, target functions, and hydroperiod also need to be addressed to accommodate the

environmental conditions rather than try to engineer new ones on the site. For example, a site contains a stream channel and wetlands that are separated from the floodplain of a larger river except in extreme storm events. A hydroperiod involving yearly flooding of the stream channel and impounding of water in the wetlands could be established along with the associated functions (e.g., salmon rearing; retaining sediment, nutrients and contaminants; reducing downstream erosion). This could be accomplished through reconnecting the channel/wetlands to the floodplain of the river. The site, however, should not be designed to provide a hydroperiod suitable for amphibian breeding since that function is not appropriate in this location.

Applicants should avoid a site design that will require extensive engineering to produce the desired hydroperiod. The designed hydroperiod should also not create a wetland that would become an atypical HGM class (e.g., using an engineered dike to hold water in excavated depressions in an existing wetland on a slope). In general, compensation actions should restore hydrologic processes that previously occurred on the site and are appropriate for the landscape, rather than modifying water flow through the construction of weirs, deep basins, and berms that will result in atypical HGM classifications and require long-term maintenance. Also, slopes and shoreline edges should be constructed to mimic natural systems. Slopes should generally be gradual and shoreline edges should reflect the local conditions (e.g. sinuous in wide floodplains, circular in kettleholes etc.).

It is recommended that the hydroperiod at a site be monitored before and after construction. For example, observing the duration and extent of ponding and saturation for a year (or at least one wet season) after construction and before planting vegetation can identify problems that need to be corrected to assure the survival of the plants. Planting zones can be based on actual water levels rather than the approximation of where water should be. This can result in plants that establish faster and are healthier. It is recommended that a native, non-invasive, annual seed mix be applied to the bare soil during the observation period to prevent erosion and limit infestation of invasive species.

Including an observation period in the design combined with a phased approach to implementation may also be beneficial for other reasons. For example, if the reconfiguration of a stream channel is part of the design of a compensatory mitigation project, it may be best to re-introduce water to the new channel slowly and observe how the system responds. Allowing the stream flow to return over the course of a couple years gives vegetation time to develop, thereby helping prevent erosion damage, which otherwise could affect the success of the project or result in costly re-construction.

3.4.1.2 Soil

As mentioned in the discussion of site selection (Section 3.3.1.2), soil performs a number of important functions in a wetland. Soils are thus an important part of the design of compensatory mitigation projects. The following functions provided by soils should be considered when designing a wetland mitigation project.

- Rooting medium. Soil serves as a rooting medium for plants, providing the physical support for above-ground plant structures.
- Germination medium. Seed germination often requires more specialized conditions than those required to sustain mature rooted plants. Germination of

annuals, for example, is often promoted by a moist, temporarily exposed soil that is free of detritus.

- Seed bank. Seeds and rhizomes retained in the soil may remain viable for months to years. It is important to know whether the seed bank at the site contains native species, non-native species, or both.
- Source of water and nutrients for plants. Soil is the primary site of the uptake of water and nutrients for rooted plants, even rooted plants that are submerged. Nitrogen mineralization, which takes place in soil, releases forms of nitrogen that are available to plants thereby providing a constant source of nutrition to wetland plants. The soil pH can also be important. For example, if it is too acidic the uptake of some minerals can be impeded.
- Habitat for mycorrhizae and symbiotic bacteria. Roots have complex relationships with soil fungi (*mycorrhizae*) and bacteria that enable and enhance nutrient uptake. Examples include nitrogen-fixing bacteria living symbiotically in root nodules of legumes and *Alnus* (alder) species and vesicular-arbuscular mycorrhizae that associate with *Salix* (willow) species. Some plants require the presence of specific mycorrhizal species for survival.
- Water quality functions. Soil is the location of most of the physical, chemical, and biological processes that enable wetlands to improve water quality. The chemical composition of the soil, such as the presence of iron and aluminum hydroxides, affects its ability to absorb phosphorus. Denitrifying bacteria dwell in the soil and depend on soil carbon as an energy source to support denitrification (reducing nitrogen or nitrogen compounds to nitrogen-containing gases).
- Habitat for soil macrofauna. Soil-dwelling fauna sustain wading birds that probe the sediments of mudflats and sandflats with their long beaks. The role of soil-dwelling fauna in other types of wetlands is less well known.
- Conduit for groundwater. The permeability of the soil affects its ability to convey water. Dense, low-permeability soils may serve as aquacludes (i.e., barriers), causing water in wetlands to be perched above the regional water table. More permeable soils, such as entisols, have higher hydraulic conductivities, allowing wetlands to have greater interaction with groundwater.

Designs that require excavation often remove the part of the soil that contains the most organic material, seeds, nutrients, and beneficial microbes. The underlying subsoil usually has a different texture, structure, chemistry, and biota than the top soil. Often subsoil is nearly devoid of organic matter, deficient in nitrogen, and lacks mycorrhizal and microbial populations important to the establishment of plants and the water quality functions. The plants that can successfully reproduce in such material may not be the desired ones, and this material cannot provide the same functions as an intact wetland soil. When excavation or re-contouring is a necessary part of a design, the following options are recommended to improve soil conditions.

Salvaging Soil

The best option is to salvage the hydric topsoil from the impact area and apply it to the wetland mitigation site (vegetation can be salvaged too, refer to Section 3.4.1.3 on vegetation for more discussion). Salvaging the hydric topsoil is not recommended,

however, if reed canary grass (*Phalaris arundinaceae*) or other invasive species dominate the vegetation and seed sources at the wetland impact site (see Appendix K, *2005 Washington State Noxious Weed List*).

Salvaged soils should normally not be stockpiled. If they are, beneficial microbes, seeds, and rhizomes could be destroyed since the soil will heat up as it begins to compost. If hydric topsoil has to be salvaged from the impact site, the mitigation site should be constructed at the same time as the development occurs. If short-term stockpiling is necessary the soil should be covered with plastic to seal in moisture and keep the soils in an anaerobic, weed-free condition. Covering the stockpile may not be appropriate if the salvaged topsoil is being used to introduce mycorrhizal fungi. Covering the stockpile may kill the roots that they live on. In this case it may be better to seed the stockpile with a cover crop to prevent invasive species.

Organic Amendments

The second option is to augment the subsoils left after grading with organic amendments (plant or animal material that has been composted). Many studies have focused on the importance of organic matter in wetland soils. Low concentrations of organic matter in the soil are associated with poor establishment and growth of vegetation, poor sources of food for invertebrates and fish (food-chain support), and altered nutrient cycling. Some kind of augmentation with organic matter is therefore recommended.

The type of organic amendment that should be used will depend on the characteristics of the site and the functions being proposed. A soil sample from a nearby *reference wetland* (i.e., of the same Cowardin and HGM classifications as the proposed compensatory mitigation wetland) may serve as a model to establish the type of soil needed. Soil amendments incorporated into the subsoil should try to duplicate the texture, bulk density, and organic matter content of the reference wetland (see Section 3.4.3, *Using Reference Wetlands for the Design of a Mitigation Site*). To minimize the introduction of plant pathogens and invasive species, sterile and weed-free organic soil amendments (i.e., have been properly composted to kill weed seeds) should be used.

Introduction of Mycorrhizal Fungi

The introduction of native mycorrhizal fungi is another way to improve soils at a wetland mitigation site. In disturbed and/or freshly graded sites, native mycorrhizal fungi are often destroyed or missing. Though the results are mixed, more and more research is being done on the use of mycorrhizae, particularly for the recovery and rehabilitation of marginal land (i.e., very large and bare areas that have sterile soils or subsoil). Some benefits may include improved plant survival, resistance to root disease, building of soil structure by the network of mycorrhizal fungi, increased plant diversity (by allowing survival of seedlings), and resistance to the invasion of weeds (most weeds do not need mycorrhiza and therefore outcompete native species if they are absent).

Salvaged topsoils can be used to introduce mycorrhizal fungi, or they can be added by inoculating the existing subsoils. The mycorrhizae used for the inoculation should be from a local source and be suitable for the soil type and climate of the site. For example, introducing mycorrhizae in areas that are inundated for extended periods of time may not be effective.

Compacted Soils

It is also important to reduce or eliminate compacted soils. Use of heavy machinery during construction activities or previous land uses can compact soils. Saturated or moist soils are more easily compacted than dry soils. Compaction of soil can diminish soil permeability and pore space and severely limit root growth and the establishment of desirable plants. Plant species that tolerate compacted soils are usually not those desired at a mitigation site since they are often weedy and invasive.

To loosen and aerate the soil a chisel or ripper shank should be pulled to the depth of compaction, usually about 18 inches. The depth of compaction may be shallow and should be checked in the field and ripped to that level and a little below. Care should be taken to not rip too deep as you wouldn't want to needlessly disturb subsoil or penetrate an aquatard. The most effective time to rip is when the soil is dry. Ripping through moist soil does little to relieve compaction and may cause further compaction.

Grading and Contours

It is also important to establish topographic variations when excavating or re-grading. Minor differences in the topography (microtopography) can result in different hydrological regimes. Thus, re-contouring should be done carefully. Nearby or adjacent *reference wetland*s may aid in planning the elevations that are appropriate for the mitigation site.

3.4.1.3 Vegetation

Vegetation is an essential structural part of a wetland that contributes to the performance of functions such as:

- Supporting the food chain. Vegetation has a fundamental role in the food chain as the primary energy producer.
- Providing wildlife habitat. Increased richness in plant species helps increase the suitability of a wetland as wildlife habitat. Many animal species depend on specific plant species, and if these are not present the animal also cannot be present.
- Improving water quality. Vegetation influences a wetland's ability to improve water quality by removing nutrients, metals, and other contaminants from surface or groundwater. Plants also help improve water quality by trapping sediment (and any associated pollutants) and by reducing the amount of erosion that would cause pollution from sediments further downstream.
- Altering flood events and water regimes. Vegetation influences water flow by slowing currents and desynchronizing peak flows.
- Contributes organic debris to the ecosystem.
- Affects soil composition. Needle and leaf litter can change pH as well as the amount of organic matter.

Given the importance of plants to wetland functions, it is crucial that mitigation sites establish vegetative cover capable of providing the functions planned for the site.

Plants for the wetland mitigation project should be those that tolerate and thrive in the hydroperiod and soils targeted for the site. Although all hydrophytic vegetation is adapted

to growing in relatively wet, anaerobic conditions, their growth requirements vary. For example, many of Washington's wetland ecosystems experience dry periods during the *growing season*, and plants that tolerate this type of water regime should be targeted for a wetland site with such dry periods.

There are several considerations for designing the site and its planting plan that should improve the effectiveness and success of the compensatory mitigation wetland. One of the most important is what species to plant and how much diversity is desired. Recent scientific findings have questioned the value of planting compensation sites. Frequently, the vegetation that becomes established at a compensation site is not what was planted, but rather comes from the soil seed bank or from the surrounding landscape. It is very important, therefore, to determine what the local source of seeds would be in a mitigation site when planning what the vegetation at the future site will be.

In addition, the literature suggests that predictions of future vegetation structure based on what is planted are generally wrong (review in Klotzli and Grootjans 2001). Furthermore, specific trajectories for colonization by plants at a restoration site cannot be predicted with any accuracy.

That said, there are reasons why planting with "desired" species makes sense. One reason is to attempt to reduce the potential for invasive species colonizing the site. Another is to attempt to foster greater species diversity and reduce the likelihood that a monoculture will become established. When forested wetlands are the goal, "jump-starting" the site by planting deciduous tree species, followed by an underplanting of conifers in later years should help.

Thus, a mitigation site should be planted with seeds or nursery-grown seedlings if you have data indicating that there is no local source of seeds or an existing seed bank in the soil, or if there is a need to "jump-start" the plants to meet specific objectives.

By including a diversity of species in the planting plan, rather than a monoculture, those plants that are best suited for the conditions of the compensation site will thrive. As mentioned, each species has its own tolerances, so what might be too wet or too high a pH for one species may be ideal for another.

Diversity is important even if one vegetation type or cover class (e.g., emergent or herbaceous vs. forested) is proposed. For example, if an emergent wetland is proposed, a number of different emergent species should be planted. The same applies to scrub-shrub or forested types. Therefore, planting a diversity of species in each proposed community or cover class can help to ensure that an adequate number and diversity of species will survive and become established. Furthermore, a diversity of species generally fosters a diversity of the organisms for which they provide habitat, thereby improving overall wildlife diversity.

Source of Plant Material/Salvaging Vegetation

If a mitigation site is to be planted it is important to consider the source of the vegetation. Plant material can be obtained from many sources and come in many forms. Local nurseries, some of which specialize in hydrophytic plants and wetland mitigation, sell plants in containers, as cuttings, and as bare root. Alternatively, roots, rhizomes, tubers, or mature plants can be transplanted or salvaged from the wetland site that will be lost or

degraded. Also, seeds can be obtained commercially or from other sites and broadcast over the compensation site.

Soil (substrate) and the seed bank it contains can also be imported from the impact site; this is referred to as natural re-vegetation (i.e., relying on an existing bank of seeds in the soil). If natural re-vegetation is used, the soil should be evaluated for the species and viability of the seeds.

In addition, if conditions are appropriate, some species will often appear on their own. This is referred to as passive recruitment. For example, some species (e.g., red alder [*Alnus rubra*]) may not need to be planted or salvaged if a nearby seed source exists. Where feasible, passive recruitment of vegetation can be used and should be encouraged.

In some cases, salvaging (i.e., transplanting) trees and shrubs with a root ball from the impact site may be a good way to increase species richness and incorporate important nutrients and fauna that are in the hydric soil in the root ball (see Section 3.4.1.2 for a discussion of salvaging soils). Even if the plant itself does not survive, it will contribute a snag or woody debris. In addition, seeds, roots, and rhizomes from that plant or other species may be introduced, thereby adding diversity. Emergent species can also be salvaged by taking a mat of plants, roots, and rhizomes, similar to grass sod.

If salvaging plants or topsoil it is recommended that the material be moved quickly from the impact site to the mitigation site to increase the success of the transplant. If salvaged plants need to be stored it is necessary to keep the roots moist. For short periods of time the salvaged plants can be "heeled-in" to an organic medium. For longer periods of time the salvaged plants should be potted and placed in capillary beds[2]. It is also important to consider the weather when salvaging plants. Generally, plant salvage is most successful when done on wet, cloudy days during the dormant season rather than on hot, dry, sunny days during the growing season.

Salvaged plants should not be used if the source was dominated by non-native or invasive species (see Section 3.4.1.4, *Invasive Species* and Appendix K, *2005 Washington State Noxious Weed List*). Seeds, roots, or rhizomes of invasive and non-native species can unknowingly be introduced to the wetland mitigation site through the soil attached to the roots, and this could lead to unnecessary maintenance that may compromise the success of the site.

Some believe that cattail (*Typha latifolia*) and soft rush (*Juncus effusus*), though native species, should not be planted or salvaged. Both of these species can be rapid colonizers that create monocultures. The final choice, however, should depend on the functions that need to be attained at the site. Cattails, for example, can be very effective at trapping sediments and removing toxic compounds if these are the functions desired.

2 Capillary beds are short, four-walled structures usually lined with plastic and filled with a fine-grained medium such as sand or mulch. Water is delivered through drip irrigation or some other method to the bottom of the bed and water travels via capillary action up through the medium to the roots of the plants.

Ultimately, what is included in the design and planting plan should be based on the goals and objectives of the wetland mitigation project. For example, if one of the goals is to shade out and compete with non-native invasive species, a fast growing and early-succession tree like red alder (*Alnus rubra*) could be planted to provide cover even where a nearby seed source exists. However, in order to prevent a monoculture, consider under-planting with species that will diversify the tree canopy over time.

When and Where to Plant

When to plant depends on the timing of the project as well as the type of plants (e.g., containerized plants, cuttings, bare root) and when they are available. As mentioned previously, planting should generally be delayed by one year, or at least one wet season, if excavation or grading is needed at the site. This will allow time to monitor water levels, modify site elevations, and identify appropriate locations for each species. Survival of plantings can be increased significantly if each species is placed in areas that match its preferred hydroperiod. If it is inappropriate or impractical to wait, a species could be planted over a range of elevations. This will help ensure that some plants survive if the water levels are not as predicted. It is recommended that a native, non-invasive, annual seed mix be applied to the bare soil during the observation period to prevent erosion and limit infestation of invasive species.

Bare root plant material should generally be planted when the vegetation is dormant. It is good to check with local nurseries that supply bare root plants to determine when they are usually available. For example, in western Washington, a nursery may start digging plants in December and have the plants available in January. In eastern Washington, however, plants may not be dug until mid-March or April due to frozen ground. Container plants should generally be planted between November and March west of the Cascades and Mid-October to the end of November east of the Cascades. Local nurseries and landscape contractors with experience in restoration and compensatory mitigation can provide more specific information on planting specifications for particular species.

If planting, it may be appropriate to complete it in phases. Many later-succession species, such as Western red cedar (*Thuja plicata*) do not tolerate being planted in full sun and newly graded soil. Time and money could be wasted by replacing dead plants or waiting for struggling plants to establish and provide the required aerial cover. Instead applicants should plant early-succession species first, such as willow (*Salix sp.*), cottonwood (*Populus balsamifera ssp. trichocarpa*), shore pine (*Pinus contorta*), and red alder (*Alnus rubra*) (if there is no existing seed source of red alder nearby). When these have become established (i.e., provide aerial cover and shade), the later-succession, shade-tolerant species can be under-planted with a higher likelihood of success.

Maintaining areas of existing native upland trees and shrubs in the project design can also provide some shading for new plants in the wetland mitigation site. This can provide other benefits; habitats that are mosaics of wetland and upland can provide important habitat functions that wetlands alone cannot provide.

Improving the Survival of Planted Vegetation

The planting plan should also specify a maintenance program to improve the survival of planted species. For example, vegetation may need additional water during the dry summer

season for the first year or two after planting. However, a self-sustaining wetland mitigation site should not require long-term irrigation to assure plant survival.

If irrigation is needed, the following factors should be considered:

- Source of water.
- Need for water rights.
- Costs associated with the irrigation.
- Site constraints that would limit the use of irrigation.
- Alternative methods if the site is remote (e.g., hand watering or drip irrigation).

Limiting herbivory by waterfowl, deer, rodents, and beaver can also greatly improve plant survival. Enclosures can include mesh or netting over emergent plants to keep geese and other waterfowl from browsing. Open-ended containers (tubes) can be installed around saplings and shrubs to prevent rodents from girdling the bark. Rodents may also be deterred by using other methods. One site manager, for example, had success by painting the lower stem of trees and shrubs with a mix of paraffin wax and cayenne pepper.

Enclosures to protect plants from geese, deer, and rodents, however, should not be permanent. Wetland plants are the primary producer of energy in the ecosystem and provide food and cover for wildlife. The purpose of an enclosure is to keep herbivores out temporarily so that emergent or shrub species can establish a sufficient root system that will tolerate browsing later.

Finally, remove unwanted grasses and weeds in the immediate vicinity of newly planted trees. This can be accomplished by mowing, cutting, raking, or knocking them down in order to reduce competition for the first couple of years or until plantings are well established.

3.4.1.4 Invasive Species

Managing invasive species is another key factor to consider when designing a wetland mitigation project (see Section 3.3.1.7 for a definition of invasive species). The lack of adequate control is considered a major cause of failure at mitigation sites. As a result, projects involving enhancement of vegetation in heavily infested areas often have a low success rate. Generally speaking, the result of an invasion by these species is a reduction in the functions provided, especially wildlife habitat. This will ultimately affect the usefulness of the compensatory mitigation project in replacing the functions lost. Refer to Part 1, Section 7.2 for agency policies on invasive species.

Invasive species may affect a site in a variety of ways, depending on the species involved and their distribution on the site. Some general characteristics of invasive species that account for their adverse effects include:

- Invasive species can act as “ecosystem engineers.” Ecosystem engineers modify the wetland ecosystem by changing major processes such as water flow, nutrient cycling, food webs, and the chemical and physical properties of the soil and water (e.g., nutria [*Myocaster coypus*], knotweed *[Polygonum spp.]).*

- Invasive species may form monocultures that suppress or prevent the growth of native plants (e.g., reed canary grass *[Phalaris arundinacea*], purple loosestrife [*Lythrum salicaria*]).
- Invasive species often form dense thickets that shade many of the native species.
- Invasive species may be toxic to wildlife, such as tansy ragwort (*Senicio jacobaea*).
- Invasive species that contain oils may burn hotter and more frequently, changing the fire regime and, over time, inhibit re-establishment of native vegetation (e.g., cheat grass [*Bromus tectorum*]).
- Invasive species change soil salinity and draw down water tables below the root zones of native species, such as salt cedar (*Tamarix ramosissima*).
- Non-native animal species such as nutria may also cause problems when they eat young plants, reducing the survival of the newly planted stock.

Washington State and County Noxious Weed Lists

Each state has its own noxious weed laws and list. Noxious weeds are non-native plants introduced to Washington and other states through human actions. Because of their aggressive growth and lack of natural enemies in the state, these species can be highly destructive, competitive, or difficult to control. Noxious weeds are a subset of invasive species that have been classified according to the seriousness of the threat they pose. And counties and landowners are required to control them. Refer to Appendix K for the Washington State's list of noxious weeds.

All counties (except Douglas County) maintain their own noxious weed lists, which must include species listed on the state list, but which may also require control of additional species or control in additional areas. Many invasive, terrestrial weed species (and a few aquatic species) can be found on the noxious weeds lists maintained by each county. It is important to obtain a copy of the county weed list, including annual updates, that corresponds to the location of the mitigation project and know under which class the invasive weeds at the mitigation site are listed. In some cases, listing may require the property owner to remove or eradicate the species or receive a fine.

Washington's County Weed Boards and Weed Districts can be found on-line at: http://www.nwcb.wa.gov/county_bds/county_bd_home.html.

Because invasive species can have such a negative impact on a site, it is important to consider the following factors and answer key questions for each factor while designing a mitigation project:

- Presence of invasive species.
- Quantity of invasive species present.
- Acceptable numbers and levels of invasive species.
- Presence of invasive species adjacent to the site.
- Introduction of invasive species through mitigation activities.

Presence of Invasive Species

Are invasive species already present on the site? If so, which species, and what are their characteristics? Each species has its own growth characteristics, habitat requirements, patterns of establishment, and reproductive mechanisms. As a result, each will interact differently with other species on the site, and there may be unique ways to control or eradicate it. Knowing the species and their characteristics will help predict how they might interact with the existing native species and those you plant. This information can also help predict how they may impact the functions you expect to develop on the site.

For example, reed canary grass (*Phalaris arundinacea*) is an invasive species often present in wetlands. It is a perennial that spreads by both seeds and rhizomes and creates dense, tall monocultures that crowd out low-growing species. Thus a plan that calls for taller shrubs and trees, in comparison to groundcovers, will be more successful at competing with and/or eventually shading out the reed canary grass. The site design and maintenance plan will need to include control of the reed canary grass to enable woody plants to become established since reed canary grass is a strong competitor for water and nutrients. Finally, a strategy for control must be timed before seed-set. Some types of control such as occasional mowing are not suitable for this species because the population is not likely to be reduced due to its rhizomatous growth pattern. If you cannot control reed canary grass the wildlife habitat functions on the site could be severely impacted.

The agencies sometimes recommend hydroseeding a mix of water foxtail (*Alopecurus geniculatus*), bent grass (*Agrostis stolonifera* or *A. oregonensis*), and red fescue (*Festuca rubra*) to help control reed canary grass in western Washington. This mix has been observed to suppress the invasion of some reed canary grass on several projects. This mix, or others consisting of native, non-aggressive annuals, can also help control erosion if planting will not be done for several seasons. A possible negative outcome when using grass mixes, however, is that it provides habitat for rodents who may girdle trees. One solution is placing bark or mulch in a three foot-wide circle around trees and shrubs since rodents do not like areas without cover.

Numbers of Invasive Species Present

What is the number of invasive species present? Because each species has its own growth characteristics and may require a separate approach for its control, knowing the population size (i.e., percent cover) for each species is an important factor in establishing an adequate plan for monitoring and control. The control effort and cost rise geometrically as a population expands. When possible, eradication is preferable to long-term control. While invasive species may be impossible to totally eradicate on some sites, they should be controlled. Long-term maintenance of a site to control invasives may become a heavy burden.

When an invasive species appears, it should be eliminated as soon as discovered. Some species, such as knotweed (e.g., Japanese knotweed or *Polygonum cuspidatum*) or kudzu (*Pueraria Montana var. lobata*) can severely impact wetlands very quickly. Regardless of a mitigation plan's performance standards, such species should be eradicated at once.

Acceptable Numbers and Levels of Invasive Species

How many invasive species and/or what level of infestation is acceptable? Ideally, the answer to that question is zero, but this is often unrealistic and impractical. In general, applicants should strive to restrict the percent cover of invasive species on the site. But to some extent the acceptable percent cover depends upon the species in question, how it affects the functions the site is intended to provide, and the improvement in the functions desired. Some species may not significantly affect the functions, in which case a larger number may be tolerable. For example, if improving water quality is the only function targeted for the site, dense reed canary grass can make a very efficient filter, and its presence on site may be less important than in areas where wildlife habitat is the focus. See Part 1, Section 7.2 for a discussion of the agencies' policies on invasive species.

Presence of Invasive Species Adjacent to the Site

Are there invasive species present in areas immediately adjacent to the site? This question is important if the mitigation site is disturbed by grading and other earth-moving activities. Bare ground provides an opportunity for invasion by invasive species (see the discussion below). Invasive species favor disturbed areas. The opportunity for invasion of mitigation sites is high if they are found in the surrounding landscape, even if they are not currently present at the site. In such cases, long-term monitoring and periodic control will usually be necessary.

Introduction of Invasive Species through Mitigation Activities

Mitigation activities can be vectors for invasive species. These vectors should be identified and reduced as part of the mitigation plan. Equipment tires, boots, boat trailers, and similar items are common mechanisms for the spread of seeds or vegetation fragments. If the equipment to be used in site construction has operated in areas where invasive species are a problem, it is quite possible it may introduce invasive species. Equipment needs to be cleaned effectively before use on other sites. Therefore, the site design and construction plan should include checking equipment before entry onto a site and planning for control measures if needed.

Timing construction activities to reduce the opportunity for invasive species to spread is also an important consideration. Mitigation sites are especially vulnerable when grading activities occur during the time invasive species are reproducing ("setting seed").

3.4.1.5 Target Functions

The functions being targeted for a wetland mitigation project should also be considered when designing a site. The factors discussed in the preceding sections are also relevant to this section since all of them influence the performance of functions at the mitigation site.

An applicant must identify the functions that will be created, restored, or enhanced (target functions) at the mitigation site. Analyzing functions at the impact site will provide information on what functions will be lost or degraded and will need to be replaced (see Section 3.1.2.1, *Characterizing Wetlands and the Functions They Provide* and Appendix I, *List and Description of Wetland Functions*). In many cases replacement of the lost functions will be required, and these will become the target functions in the mitigation plan.

(See Part 1, Section 6.3, for guidance on "in-kind" compensatory mitigation.) Some target functions will be different if specific functions have been identified in the basin or watershed as being of greater importance than those lost. In the end, target functions should tie directly into the goals, objectives, and performance standards for a mitigation project (see Section 3.4.2, *Site-Specific Goals, Objectives, Performance Standards*).

For example, if a wetland that provides water-quality functions (retention of sediments and removal of nutrients, metals, and toxic organic compounds) is impacted, one of the goals of the wetland mitigation project should normally be to provide water-quality functions. Improving water quality would be a target function and the project should be designed accordingly.

The following characteristics are important for wetlands that improve water quality, and should be considered when designing the project:

- Landscape Position. The wetland mitigation site should be located in a depression either without an outlet (closed) or with an outlet that is constricted enough to reduce the volume and velocity of water leaving the wetland. This will increase the amount of time water is retained in the wetland, thereby allowing suspended sediments, many with adsorbed nutrients and metals, to settle out. Another location suitable for improving water quality is an active floodplain that is frequently flooded by streams or rivers with a heavy sediment load.
- Vegetation. The wetland mitigation site should have dense cover of emergent vegetation, which can filter sediments and transform or neutralize toxic compounds.
- Hydroperiod in depressional wetlands. Water should pond in the wetland mitigation site during part of the growing season (to foster denitrification) and then should dry out (to foster nitrification), thus transforming nitrogen into an atmospheric gas.
- Soils. The soils of the site should have either a high clay content or high organic content to provide an acceptable surface for the adsorption of toxic metals and organic compounds.

Although only the water-quality functions were used in the example above, a site should usually be designed to provide several types of wetland functions (improving water quality, hydrologic functions and/or habitat functions). In these cases it is important to ensure that the functions targeted are compatible with one another. Designing a wetland that provides a suite of functions may be challenging, and it may not be possible to combine all of the desired characteristics into one wetland. For example, fish habitat and amphibian habitat are typically not compatible because fish will prey upon amphibians. Also, if you want to maximize the potential of a site to perform certain functions (e.g., water quality and quantity) other functions may not be possible at a maximum level (e.g., habitat functions).

Activities that are undertaken to provide target functions should be specifically identified in the plan for the mitigation project, and whenever possible they should be measurable and included as performance standards. (See Section 3.4.2, *Identifying Site-Specific Goals, Objectives, and Performance Standards*.)

The *Methods for Assessing Wetland Functions* (also known as the Washington Function Assessment Methods orWFAM) (Hruby et al. 1999 and 2000) provide a list of indicators for each wetland function, which can aid in selecting design features for specific targeted functions. These indicators however, should not be used as the sole source of performance standards for the site.

The WFAM can be found on-line at:
http://www.ecy.wa.gov/programs/sea/wfap/index.html.

3.4.2 Identifying Site-Specific Goals, Objectives, and Performance Standards

As mentioned in Section 3.2, *Identifying Project-Specific Goals*, a goal identifies what the project is trying to accomplish – what the end product will be. And the overall goal of a mitigation project is to provide adequate compensation for losses to and the degradation of wetland area and function. Once a site is selected and the environmental factors of the site are considered, site-specific goals, objectives and performance standards can be developed following some of the guidance provided in Sections 3.3 an 3.4.

Objectives identify specific elements that are undertaken to meet the goals of the project. They provide more detail on how each goal will be achieved. One goal may have several objectives, but each objective is tied to a particular goal.

It is important to identify site-specific goals and objectives early and let them guide the planning and design of the project, rather than design a site and try to devise the goals and objectives that conform to the design. Begin with what the compensation site is to achieve, both holistically and in terms of particular functions, environmental processes and structural elements. Then identify how to measure or determine what has been achieved through performance standards that reflect what is to be achieved.

The following steps, adapted from the Washington State Department of Transportation publication, *Developing Performance Criteria for Wetland Mitigation Projects: A Guideline* (Ossinger 1999), offer a sequential process for planning a project, from picking target functions/goals to identifying objectives and performance standards (see Section 3.4.1.5 for more on target functions).

1. What functions do I want the site to perform?
2. Of those, which functions will the site have the opportunity to perform?
3. Of those, which functions can be achieved given my design constraints?
4. Of those, which functions are critical to the overall success of the compensatory project?
5. Of those, which functions can be evaluated through a known monitoring method that I am capable of implementing (considering time and budget constraints)?

6. Of those, which can I define with a performance standard that is both:
    - A meaningful and measurable benchmark of success, and
    - Achievable on my site within my designated monitoring period?
7. Of those, which functions could I expect to achieve after implementing maintenance and contingency plans if the monitoring shows that the performance standard is not being met? (See Section 3.6.4, *Maintenance and Contingency Plans.*)

Identifying goals, objectives, and performance standards can be an iterative process. Goals and objectives may need to be refined as the mitigation project is developed from a conceptual plan to a final plan. Performance standards should be developed after the goals and objectives have been clarified and should be clearly linked to them.

Performance Standards

Goals and objectives guide site design. Performance standards are measurable criteria for determining if the goals and objectives are being achieved. Performance standards document a desired state, threshold value, or amount of change necessary to indicate that a particular function is being performed or structure has been established as specified in the design (Elzinga et al. 2001). In other words, performance standards should be used to measure an attribute that indicates whether a particular function is being performed.

Performance standards are directly related to monitoring because they help determine the parameters to be monitored and data to be collected during monitoring. Data collection efforts should focus on determining whether performance standards are being met.

Performance standards are also called performance criteria, success criteria, success measures, standards of success, and success standards. All of these terms refer to regulatory conditions used to establish whether a compensatory mitigation project is achieving its goals and objectives, and therefore, regulatory requirements.

Because regulatory requirements must be enforceable, performance standards need to be meaningful, measurable, and achievable by the methods and in the timeframe identified in the mitigation monitoring plan (see Section 3.6.3 on monitoring). Performance standards should contain the following components to ensure they are complete and clearly written (Elzinga et al. 2001):

- Indicator. They identify what will be monitored, such as woody vegetation, invasive species (e.g., reed canary grass - *Phalaris arundinacea*), wetland area, or water regimes.
- Attributes. They identify what aspect of the indicator will be monitored, such as percent cover (of vegetation), density (of stems of surviving vegetation), size (of wetland area), or percent area (of a water regime).
- Actions. They identify the "verb" of the attribute, such as will not exceed X percent cover (of invasive species), establish X acres (of wetland area), maintain number (of surviving vegetation), or will have X-X% area (of a water regime).

- Quantities/Status. They identify the amount of change or the desired level the attribute should reach, such as achieving X% total aerial cover of trees and shrubs, establishing X acres of wetland., or having X-X% area of a water regime.
- Time Frame. They identify when the quantity/status should be achieved or at what time the effectiveness of management of the site should be evaluated. For example, having X-X% area of a water regime each year of monitoring, achieving X acres of wetland by the end of the monitoring period, or achieving X% total aerial cover of trees and shrubs by year X. Performance standards should be included for interim years, not just the end of the monitoring period.
- Location. They identify the geographical area where the indicator will be monitored, such as a particular wetland mitigation site or a specific habitat type within a compensatory wetland. For example, the "Blue Wetlands Inc." compensatory mitigation wetland in Olympia will achieve X acres of wetland by the end of the monitoring period.

See Table 1 for examples of performance standards that contain the above 6 components.

Guidance on Performance Standards

The Federal Interagency Mitigation Workgroup is drafting guidance on the use of performance standards in compensatory mitigation in the Clean Water Act Section 404 regulatory program. It is part of the National Wetlands Mitigation Action Plan. The guidance will be available on-line at http://www.mitigationactionplan.gov/performancestandardsguidance.htm.

Developing Performance Criteria for Wetland Mitigation Projects: A Guideline (Ossinger 1999) provides guidance on developing standards of success for wetland mitigation projects. The document can be found on-line at: http://www.wsdot.wa.gov/environment/biology/docs/success_guidelines.pdf.

The Washington State Department of Transportation, Wetland Mitigation Technical Group, has developed a number of white papers that provide guidance on specific performance standards. They can be found on-line at: http://www.wsdot.wa.gov/environment/biology/wet_mitigation.htm.

Table 1. Examples of performance standards (that contain the 6 components to ensure they are complete and clearly written).

Performance standard	Additional information
County-listed Class A noxious weeds and Himalayan blackberry (*Rubus armeniacus*), cutleaf blackberry (*Rubus laciniatus*), reed canarygrass (*Phalaris arundinacea*), and purple loosestrife (*Lythrum salicaria*) will not exceed *X*% aerial cover in the wetland during all monitoring years.	1) Target plant species are identified using both common and scientific names so that there is no ambiguity. 2) County-listed Class A noxious weeds should be included. Law requires eradication of these species. 3) Targets for invasive species cover should be based on surrounding and existing site conditions, county-specific regulatory requirements, and an assessment of threats to the mitigation project.
After five growing seasons, there will be at least *X*% total aerial cover for all trees and shrubs at the mitigation site.	This identifies that total aerial cover will be measured. It is important to specify whether you want to measure aerial cover, areal cover, cumulative cover, or relative cover. Aerial cover is the percent of the ground surface covered by vegetation of a particular species (or suite of species) when viewed from above (Elzinga et al. 2001).
By year *X*, enhancement of wetland area B will result in an increase from *X* to at least *X* in the WFAM function assessment scores for sediment removal.	Caution: WFAM (Hruby et al. 1999 and 2000) is not recommended for detecting small changes in functions.
After *X* years, the palustrine emergent wetland (PEM, as defined by Cowardin et al. 1979) will have at least *X* FACW or OBL emergent species (excluding reed canary grass [*Phalaris arundinacea*]) each of which will have greater than X% aerial cover."	Alternatively, to be more clear the performance standard could be divided in to two separate ones: 1) After 3 years, the palustrine emergent wetland (PEM, as defined by Cowardin et al. 1979) will have at least *X* FACW or OBL emergent species (excluding reed canary grass [*Phalaris arundinacea*]). 2) After 3 years, X species (same as X in #1) will each have greater than X% aerial cover in the compensatory mitigation wetland.

Important note on the examples in this section

The sample performance standards presented in this section are intended to be used only as examples. They should not be copied directly into draft mitigation plans unless they are clearly tied to the site-specific goals and objectives of the mitigation plan. Below is an example goal and possible objectives and performance standards that could be tied to it.

Example Goal 1. Improve downstream water quality.

Objective 1a. Increase the removal of nitrogen by re-establishing a seasonally inundated wetland.

Performance Standard 1a1. The compensatory mitigation site [location] will have [action] at least X acres [quantity] of wetland [indicator] area [attribute], as demonstrated by wetland delineation in the final year of monitoring [timeframe].

Performance Standard 1a3. The compensatory mitigation site [location] will have [action] X-X% [quantity] area [attribute] that is seasonally inundated (surface water present for > 1 month, but no more than 6 months) [indicator] each year of monitoring [timeframe].

Objective 1b. Increase sediment filtration by establishing X acres of palustrine emergent wetland (PEM, as defined by Cowardin et al. 1979).

Performance Standard 1b1. Aerial cover [attribute] of native emergent vegetation (facultative or wetter) [indicator] will be [action] at least X percent [quantity] in the wetland [location] at the end of the monitoring period [timeframe].

Objective 1c. Increase sediment retention/storage by constricting the outlet at the wetland mitigation site.

Performance Standard 1c1. Water [indicator] depth [attribute] will be [action] at least *X* cm [quantity] above the bottom of the outlet of the mitigation site [location] during all storm events that have a recurrence interval less frequent than Y [time frame] (Note: Y is often measured in months or years. A storm with a 3 month recurrence interval means the amount of rainfall during that event occurs, on the average, only once every three months.)

In addition to containing the 6 components of a clear and complete standard, performance standards need to be tailored to each specific project: it's goals and objectives and site-specific conditions. However, standards for most projects should, at a minimum, address the following:

- Area of Wetland. This documents the amount of wetland acreage that is intended to result from mitigation activities (re-establish, create, rehabilitate, or enhance). A standard for wetland area will be necessary for most, if not all, wetland mitigation projects. For example:
  - The compensatory mitigation site [location] will have [action] at least X acres [quantity] of wetland [indicator] area [attribute], as demonstrated by wetland delineation in the final year of monitoring [timeframe].
- Water and Hydroperiod. A minimum performance standard for wetlands should state, "The soils [indicator] of the compensatory mitigation site [location] will remain [action] inundated or saturated to the surface [attribute] for a minimum of 30 [quantity] consecutive days [attribute] during the *growing season* for each monitoring year [time frame]." Applicants believing that a different minimum, performance standard for hydroperiod is warranted for their sites are responsible for proposing a different hydrologic standard. They should submit the necessary information to support the rationale for using a different hydrologic standard. For example, a hydrologic standard could also be tied to a *reference wetland* to address local climactic conditions (e.g., the area inundated and/or saturated in the compensation wetland will not be less than that found in "reference wetland x" for the first 5 years of the project). This would help reduce the potential problems during years of drought.
- Hydroperiod Associated with Target Functions. A performance standard may also be needed to ascertain if the desired hydroperiod (e.g., permanently ponded, seasonally inundated, seasonally saturated, or a mixture of these) was achieved for the specific functions targeted in the mitigation. It should be used if site-specific goals and objectives of the mitigation plan make it appropriate. For example, if water quality is a goal/target function, a performance standard for hydroperiod might include the following:
  - The compensatory mitigation site [location] will have [action] X-X% [quantity] area [attribute] that is seasonally inundated (surface water present for > 1 month, but no more than 6 months) [indicator] each year of monitoring [timeframe].

  [This is important for water quality, since areas with seasonal inundation are where sediment retention is expected to place, where nitrification/denitrification occurs, and where removal of toxic chemicals takes place.]
- Area of Hydrogeomorpic (HGM) Classes/Subclasses and Cowardin Classes. Agencies are often required to report on the area of HGM classes and Cowardin classes provided through compensatory mitigation. And this information is often compared to permitted losses of those classes to determine what types of tradeoffs are occurring through compensatory mitigation. Therefore, it is necessary to quantify the area of HGM and Cowardin classes. In some cases, if tied to the goals and objectives, performance standards may need to identify the area (specific acreage or a range) of each wetland class. For example:

- The compensatory mitigation wetland [location] will have [action] a minimum of X acres [quantity] of palustrine *emergent wetland* (PEM, as defined by Cowardin et al. 1979) [indicator] area [attribute] by the end of the monitoring period [timeframe].

In some cases it may be more appropriate to have a goal or objective that addresses the amount of each class/subclass (HGM and Cowardin) that is intended to be achieved. For example, it may be a goal of a project to establish a particular HGM subclass (e.g., a depressional closed wetland). A performance standard should then be identified to show that the mitigation actions resulted in establishment of that subclass.

Ranges can be useful because they allow some flexibility, yet they still provide a measurable, enforceable benchmark to determine success. In the above example a range could be added if a maximum threshold for emergent wetland is desired; "The compensatory mitigation wetland will have X.X – X.X acres of palustrine emergent (PEM, as defined by Cowardin et al. 1979) wetland area by the end of the monitoring period."

- Species Richness and Abundance. Species richness and abundance is often used in relation to vegetation. Such a performance standard is needed if the goal of the project is to establish wildlife habitat for a guild that relies on specific plant species, such as song birds, or if the goal is to prevent unintended monocultures of vegetation. If the planting plan calls for a variety of species of vegetation to be planted, then a performance standard for level of richness at the end of monitoring should be developed. For example:
  - A minimum of X [quantity] (number of) species [attribute] of native shrubs or trees [indicator] will be present [action] in the wetland [location] by the end of the monitoring period [timeframe].
  - X species (same as X above) [indicator] will each provide [action] at least X% [quantity] aerial cover [attribute] in the compensatory mitigation wetland [location] by the end of the monitoring period [timeframe]."

  Performance standards also need to be meaningful and achievable. Information from reference wetlands under similar regimes of disturbance as the mitigation wetland may be used to set the upper and lower limits for richness and abundance.

- Maximum Percent Cover of Invasive Vegetation Species. Nearly every mitigation plan should identify limits on cover, composition, frequency, or density of invasive and/or non-native plant species. Invasive species lists in performance standards should be based on site location, county-specific regulatory requirements, and an assessment of threats to the mitigation project. Performance standards for invasive species, however, also need to be realistic and based on existing conditions at or surrounding the site. Setting unrealistically low standards will usually increase costs by requiring extensive control efforts after the site is established.

An example performance standard could be:

> – County-listed Class A noxious weeds and reed canarygrass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), poison hemlock (*Conium maculatum*), climbing nightshade (*Solanum dulcamara*), and non-native knotweeds (*Polygonum cuspitadum, P. polystachyum, P. sachalinense, and P. bohemicum*) [indicators] will not exceed [action] X% [quantity] aerial cover [attribute] in the wetland [location] during all monitoring years [time frame].

A direct link from the invasive species standard to the goals and objectives of the mitigation plan should be evident. If a direct connection does not exist, targets for invasive species control could be included in the contingency plan instead.

- Target Functions. *The Methods for Assessing Wetland Functions* (also known as the Washington Function Assessment Methods or WFAM) (Hruby et al. 1999 and 2000) and the Washington State Rating Systems for eastern and western Washington (Hruby 2004a,b) provide lists of indicators for some wetland functions, which can aid in selecting design features for specific targeted functions.

  For example, if the site is intended to reduce peak flows the site will need to have certain characteristics, based on its HGM class, that indicate it has the potential to reduce peak flows. In addition, the site will also need to have the opportunity to provide that function (i.e., it will need to be situated upstream of areas that would be affected by peak flows). Key indicators of this function in depressional wetlands, include depth of live storage and constriction of the outlet (if it is designed to have one). Therefore, an example of a performance standard for this function could include:

  > – Water [indicator] depth [attribute] will be [action] at least X cm [quantity] above the bottom of the outlet of the mitigation site [location] during all storm events that have a recurrence interval less frequent than Y [time frame] (Note: Y is often measured in months or years. A storm with a 3 month recurrence interval means the amount of rainfall during that event occurs, on the average, only once every three months.)

In some cases, wetland mitigation sites that have already matured and successfully achieved their goals can be used to help develop performance standards. The specific benchmarks for performance could be based on the monitoring information from these projects. This is also a way to generate performance standards that are achievable (see Section 3.4.3 on reference wetlands).

When identifying goals, objectives, and performance standards, applicants should <u>avoid</u> the following pitfalls:

- Complex and conflicting performance standards. As discussed above, performance standards are generally necessary for: area of wetland, water and hydroperiod, hydroperiod associated with target functions, area of HGM classes/subclasses and Cowardin classes, species richness and abundance, maximum percent cover of invasive species, and target functions. While developing performance standards for each it is important to make sure that they are clearly tied to the project goals and objectives and that they are compatible with each other. It is also important to determine the amount of effort that will be necessary to effectively monitor and

manage the site when developing the standards. Complex standards may add significant monitoring effort to the project with out significant benefits.

- Objectives stating, "the wetland mitigation site will provide wildlife habitat." This statement is too broad. A landfill provides wildlife habitat, but hopefully that is not what is intended. Instead, objectives should specify a particular wildlife group such as amphibians or, in rare cases, a specific species such as coho salmon. Though establishing meaningful and achievable performance standards to address wildlife objectives for particular species can be difficult. Changes observed in wildlife communities on a wetland mitigation site may have more to do with activities off-site and out of the applicant's control than changes that are actually occurring on the mitigation site. Often, physical attributes or attributes of the vegetative community are used as surrogates for direct observations of wildlife. Here are some examples:

  Performance Standard (Year 1) [Habitat Structures]

  > In Year 1, wildlife habitat structures including *X* snags and *X* large woody debris piles will be installed in the wetland.

  Performance Standard (Year 5) [Vertical Structure]

  > After 5 years, habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature in the scrub-shrub wetland.

  Performance Standard (Year 5) [Wetland Classes Present]

  > After 5 years, areas of emergent, scrub-shrub, and forested wetland will be present on the mitigation site.

- Performance standards that are too general or "easy to attain." For example, "the compensatory wetland will provide habitat for two species of passerine birds." This standard is not indicative of meaningful ecological development. It does not require wetland conditions at a site, and it can be met by observing two non-native passerine species (e.g., starling and house sparrow) that are highly adapted to disturbed conditions.
- Standards that are not measurable and, therefore, cannot be used to evaluate the success or compliance of projects.
- Standards that contain confusing or ambiguous language.
- A lack of performance standards for each objective. Performance standards must be clearly tied to the site-specific goals and objectives of the mitigation plan.
- Performance standards that are unachievable, such as excessively low cover values for invasive species, extremely high richness that it is not represented of conditions found in Washington, and excessively high requirements for woody cover.

Table 2. Examples of performance standards to avoid, the rationale, and an alternate standard.

Performance Standard	Rationale	Alternate Standard
By the end of the fifth year, there will be X-X% coverage.	This standard does not specify what type of coverage (cumulative, aerial, or relative), or what should be providing the cover (it could be non-native Scot's broom or Canada thistle). Also missing from the standard is the location (where the cover should be).	An alternate standard would be: After 5 years, native wetland (FAC or wetter) species will provide X% aerial cover in the wetland."
X-X acres will be dominated by native forested wetland vegetation in the *Alnus rubra*/*Rubus spectabilis*, *Alnus rubra*/*Lysichitum americanum*, and *Fraxinus latifolia*/*Carex obnupta* community types.	This standard provides a range for acreage, which is good. However, specifying the exact plants that need to dominate these areas could be setting this site up for failure by not allowing natural colonization and site conditions to influence plant community composition. Also missing from this standard is a time frame, an exact location, and a clear description of the action. Multiple interpretations of the word "dominated" are possible.	Several standards may be needed. For example: 1) A minimum of X (number of) species of native shrubs or trees will be present in the wetland by the end of the monitoring period. 2) A minimum of X (number of) native, herbaceous species will be present in the wetland by the end of the monitoring period. 3) X species (same as X above) [indicator] will each provide [action] at least X% [quantity] aerial cover [attribute] in the compensatory mitigation wetland [location] by the end of the monitoring period [timeframe].
Within 5 years vegetation will provide adequate food and habitat to support populations of species found in natural areas of compatible size.	This standard is not useful for regulatory purposes. It is not measurable. It does not identify an attribute of vegetation that would be measured, nor does it provide a quantity/status that should be reached. Also missing from this standard is a location. The time frame and action are ambiguous.	Several standards may be needed. For example: By year 5 there will be X-X acres of native, palustrine emergent wetland (PEM, as defined by Cowardin et al. 1979) at the wetland mitigation site. By year 5 there will be X-X acres of native, palustrine scrub-shrub wetland (PSS, as defined by Cowardin et al. 1979) at the wetland mitigation site.
In the first year of monitoring, X% of the planted species or appropriate volunteers must be present and viable.	This standard is confusing and may be hard to measure or enforce. Words like "viable" have multiple interpretations. The words "appropriate volunteers" may be subject to interpretation, also.	An alternate standard would be: Native woody species (planted or volunteer) will maintain an average stem density of X in the scrub-shrub wetland in all monitoring years.

In year 3, survival of planted vegetation will be X%.	This is ambiguous, immeasurable, and unachievable. Standards should distinguish between woody and herbaceous plantings. The survival rate of planted herbaceous species is difficult to measure (dead herbaceous planting can disappear quickly, and living individuals are difficult to distinguish for many plants). For woody plantings, measuring survival at year 3 can also be difficult and does not provide a good depiction of what is on-site: natural recruitment of woody species may have occurred. It would be better to measure stem density and then aerial cover in later years.	Alternate standards for the establishment of woody vegetation could be: In year 1, survival of planted woody vegetation at the mitigation site will be 100%. If all dead plantings are replaced, the standard will be considered met. In year 3, woody vegetation at the mitigation site will have a stem density of at least X stems/acre. In year 10, woody vegetation at the mitigation site will achieve at least X% aerial cover.

3.4.3 Using Reference Wetlands for the Design of a Mitigation Site

A reference site, or *reference wetland*, can provide a source of information and a model for the design and performance of a wetland mitigation site. Reference sites may be existing wetlands where the topographic and hydrologic conditions are similar to those proposed for the compensatory mitigation site. In some cases the impacted wetland, in a pre-impact state, may serve as a reference for designing the mitigation site. Alternatively, the selection of a reference wetland may be based on information about the historic condition of environmental processes at the mitigation site. However, a reference site based on historic conditions may not be appropriate in areas where the movement of water and sediment has been substantially altered.

In addition, a reference wetland could potentially be another compensatory wetland that has matured and is considered ecologically successful. In most cases, the success of a compensatory mitigation project is determined when the site is still relatively immature. Therefore, if a mitigation project is scheduled to be evaluated for success within five to twenty years, the evaluation could include a comparison to other successful compensatory mitigation projects that are similar in regard to goals, objectives, including HGM classification and the target functions and ecological processes.

When a reference site is used for designing or measuring the performance of the ecological processes of a wetland mitigation site, the reference site should correspond with the proposed site in the following ways:

- Same HGM classification.
- Same type of water source.
- Same position in the landscape.
- Same or similar soil types and substrates.
- Susceptible to the same or similar land-use activities and potential disturbances.

Assuming that a reference site meets all or most of the listed criteria, it can serve as examples for site elevations, topography, soils, and water regimes, and benchmarks of

performance. It may be useful for setting performance standards for the wetland mitigation site, particularly for standards involving water level fluctuations and water regimes. As mentioned previously, the use of wetland mitigation sites that have been evaluated as compliant and ecologically successful as reference sites can be helpful in developing performance standards for a new project. This is a way to generate performance standards that are meaningful, measurable, and achievable (see Section 3.4.2 for a discussion of performance standards).

For example, a performance standard may require the following: "The wetland will have at least X inches of inundation (at sampling point A) during the months of March, April, May, and June, or water levels will be the same as observed in reference wetland A (sampling point X)." Thus, a compensatory wetland would still meet its performance standard if there is a drought that affects the region and water levels in the reference wetland also drop. By setting the standard to a reference wetland in the same area, unexpected environmental conditions that impact the entire region can be accommodated.

Similarly, wetlands designed for compensatory mitigation in urban areas should rely on reference wetlands found in urban areas. The urban environment imposes particular conditions that influence the development and function of wetlands and relatively undisturbed reference wetlands in outlying areas are not representative of the actual conditions. This may especially be useful when setting performance standards for invasive species. If a reference wetland in an urban area is acknowledged as performing functions relatively well, but it has a certain percent cover of invasive species, then a wetland designed for compensatory mitigation in the same area should not be expected to have a lower cover of invasive species.

3.5 Implementing a Compensatory Mitigation Project

Implementing a mitigation project often involves construction activities. Although construction activities should not occur until the final mitigation plan and appropriate permits for the project have been approved, it is important to consider a number of construction related issues before too much planning has occurred. These issues include the following:

- Selection of qualified construction personnel.
- Oversight of the construction.
- Protection of sensitive areas and control of erosion.
- Timing, including phased construction.

Construction efforts will vary depending on the size of the site, the type of compensation (e.g., creation, re-establishment), the amount of earthwork required, and the complexity of the plan. Thus, the guidance that follows is not intended to provide plans for actual site construction. It does, however, identify important factors to consider when constructing a site.

Once the final compensatory mitigation plan is approved and all relevant permits are obtained implementation should follow the approved specifications for site design and construction. Most permits have conditions that require notifying appropriate agencies when construction begins and when it ends. In addition, a copy of the approved plans, specifications, permits, and agency approvals should be available on site whenever construction is in progress and should remain on site until the project is completed.

3.5.1 Selecting Qualified Construction Personnel

Selecting the right construction personnel to carry out a project is an important part of the mitigation process. In most cases, one or more construction personnel (licensed surveyor, landscape contractor, clearing/grading contractor, and/or general contractor) will be hired and will be responsible for fully implementing the final compensatory mitigation plan and for meeting the specifications set out in the construction plan. The type of personnel needed depends on what is included in the compensatory mitigation plan. A construction contractor however is almost always needed unless the project involves preservation only. It is recommended that all personnel hired have previous experience successfully completing wetland compensatory mitigation projects. You should request information about past projects from any one you interview to carry out your project.

In general, construction work should not begin until there is a meeting between the applicant and/or their agent, a qualified wetland professional, and the contractor. The plans and specifications approved by the agencies should be reviewed so all parties involved understand the intent and the specific details related to the construction, specifications, and site constraints.

Examples of tasks for which a construction contractor may be responsible include the following:

1. General
    a. Perform construction in accordance with agency standards, codes, permit conditions, and other applicable ordinances and policies.
    b. Notify the applicant, their agent, and/or the qualified wetland professional immediately if any modifications to the plans may be necessary.
    c. Verify the location of utilities, both from existing records and from field checks, and insure these are avoided during construction.
2. Grading/Clearing
    a. Survey and identify the limits of clearing/grading.
    b. Verify that topographic elevations at the site match those in the plan prior to grading.

c. Resolve any discrepancies between the site conditions and the approved grading plan prior to start of construction.

d. Verify actual locations of any existing vegetation to be salvaged and request modifications to the grading plan as necessary to avoid all vegetation to be left at the site that is depicted on the plan.

e. Excavate the compensatory mitigation area according to the approved grading plan and make minor field adjustments to ensure proper functioning of the area, with prior approval by the applicant, their agent, and/or qualified wetland professional.

f. Avoid disturbance to existing vegetation located outside the limits of clearing/grading.

g. Implement a "Temporary Erosion and Sediment Control Plan" (see Section 3.5.3, *Protecting Sensitive Areas and Controlling Erosion*).

h. Install silt fences and implement other *Best Management Practices* (BMPs) prior to any disturbance within sensitive areas.

i. After completion of excavation, review and verify that subgrades were done according to plan.

j. Finish grading, including placement of topsoil (in some cases stockpiled) and organic material.

k. Verify the finished grade and conduct an "as-built" survey (see Section 3.6.1, *Submitting As-built Reports*).

3. Planting

a. Follow the approved planting specifications, including hydro-seeding (if required).

b. Locate, stake, and verify planting areas as well as approve the locations prior to planting.

c. Remove non-native and invasive species prior to planting.

d. Add soil amendments, moisture retention agents, fertilizers, and/or mulch (if required in the plan).

e. Provide "as-built" drawings of planted material with actual locations and quantities of plantings within the compensatory mitigation area (see Section 3.6.1, *Submitting As-built Reports*).

4. Installing Temporary Irrigation

5. Installing Habitat Features

6. Maintaining the Site (usually for one year after construction)

Boundaries of the construction area should be clearly marked

As with most construction projects, the boundaries of the construction area should be clearly marked using temporary construction fencing. Buffers and wetland limits should be clearly flagged.

3.5.2 Overseeing Construction of the Project

The compensatory mitigation plan should include provisions for oversight of the project to help ensure that all aspects of the plan are completed without incident. Project oversight includes on-site management of construction personnel by one or more of the applicant's representatives, such as a wetland consultant. The representative should have complete knowledge of the compensatory mitigation (and monitoring) plan and some understanding of soil science, hydrology, botany, horticulture, or plant ecology.

One of the concerns frequently raised by wetland consultants who develop compensatory mitigation plans is the lack of oversight by qualified wetland professionals. As a result, construction at a site often fails to address environmental and design problems that arise. In many cases, the consultant who designs a compensatory mitigation plan is not involved further, and the construction crews are not aware of the goals for the project and may not be able to adapt to conditions that are different than predicted. Therefore, the applicant should retain a qualified wetland professional to be on site during construction to ensure the intent of the project is carried out. If possible, this should be the same person involved with the design of the project.

The person overseeing the construction of the project should be responsible for:

- Ensuring the actual environmental/wetland conditions at the site match those used in the design.
- Guaranteeing that the approved plan is followed.
- Overseeing grading and soil preparation.
- Ensuring that delivered or salvaged plants are as specified and are alive upon installation.
- Authorizing deviation from the compensatory mitigation plan if specifically allowed in permit documents.
- Coordinating with agency staff on any alterations to the plan.
- Documenting and justifying any alterations to the plan in an as-built report.

As part of the *Washington State Wetland Mitigation Evaluation Study* (Johnson et al. 2000 and 2002), consultants provided comments regarding the value of having someone qualified on site to oversee the construction of the project. Some of the comments are listed below:

- Inspection of grading and planting prevented installation of unspecified and poor quality plants.

- Oversight of the grading contractor was critical because wetland work/grading is very different from traditional grading work; e.g., finish grades in planting areas were left very rough and scarified to provide «niche habitat» and prevent compaction.
- Woody debris found during excavation was incorporated into the project.
- Certain field decisions need to be made on a daily basis, e.g., as to how weather conditions affect what kind of work is to be done, or what equipment/manpower is needed to do a particular task.
- Questions/solutions for possible drainage problems can be handled on site.
- The correct layout and spacing of plant materials can be ensured.
- An interface between the applicant and three different project contractors was essential.
- Construction oversight allowed minor adjustments to be made, such that excavation was routed around several large willow trees, thus preserving the trees – a benefit not specified in the plan. (Note: Any changes to the plan must be described or illustrated in an as-built report or drawing. See shaded box, *Documenting Unforeseen Changes to the Plan* and Section 3.6.1, *Submitting As-Built Reports*).

In addition to having a qualified wetland professional on site, it is recommended that a representative of the State or Tribal Historic Preservation Office be present if there is reason to believe that *cultural resources* may exist within the project boundaries.

In most cases, permits require a permittee to provide evidence that the compensatory mitigation site has been field inspected by a qualified wetland professional (see Appendix G, *Hiring a Qualified Wetlands Professional*) during grading and planting operations and after the planting has been completed.

Documenting Unforeseen Changes to the Plan

Any significant change to the approved mitigation plan should be identified during construction and must be approved by the appropriate agencies before they are implemented whenever possible. In addition, changes to the plan should be documented and justified in an as-built report and/or drawings (see Section 3.6.1, *Submitting As-Built Reports*, and Section 3.6.5, *Adaptive Management*).

3.5.3 Protecting Sensitive Areas and Controlling Erosion

Sensitive areas at a compensatory mitigation site should be protected and erosion controlled to the extent possible during construction. If heavy equipment will be used in the construction of the site, care must be taken to ensure that the equipment stays within the project boundaries. Sensitive or critical areas (e.g., vegetative buffers, wetlands, steep slopes, floodplains, geologic hazard areas, streams) should be staked or flagged to preclude unauthorized impacts from the construction. *Best Management Practices (BMPs)* must be implemented prior to any disturbances within sensitive areas and to control erosion.

There are a great variety of BMPs that can and should be implemented for specific construction activities. Detailed descriptions of all of the different BMPs are beyond the scope of this guidance. However, see the box below for some BMPs that may apply to construction activities associated with wetland compensatory mitigation projects.

Best Management Practices (BMPs)

BMPs are commonly used to control *stormwater* and are defined in the stormwater manuals for eastern and western Washington as "schedules of activities, prohibitions of practices, maintenance procedures, managerial practices, or structural features that prevent or reduce adverse impacts to waters of Washington State. BMPs are divided into those for short-term control of stormwater from construction sites and those addressing long-term management of stormwater at developed sites."

Example BMPs include the proper installation of contiguous silt fence (BMP C233 in the 2005 stormwater manual for western WA), that can be removed; typically after vegetation covers at least 75% of the bare soil. Application of a seed mix is also recommended to prevent erosion (BMP C120). Refer to the stormwater management manuals for eastern and western Washington for standards and specifications for BMPs for construction site activities. For western WA refer to Volume 2, Chapter 4.1 (Source Control BMPs) and Volume 4, Chapter 2.2 (BMPs for Landscaping and Lawn/Vegetation Management). For eastern WA refer to Chapters 7.3.1 (Source Control BMPs) and 8.3.2 (BMPs for Landscaping and Lawn/Vegetation Management).

The Stormwater Management Manual for Eastern Washington can be found on-line at http://www.ecy.wa.gov/programs/wq/stormwater/eastern_manual/index.html or http://www.ecy.wa.gov/biblio/0410076.html.

The Stormwater Management Manual for Western Washington (Ecology 2005) can be found on-line at http://www.ecy.wa.gov/programs/wq/stormwater/manual.html.

Volume 2 can be found directly at http://www.ecy.wa.gov/biblio/0510030.html.

Volume 4 can be found directly at http://www.ecy.wa.gov/biblio/0510032.html.

Permits for constructing a compensatory mitigation site will often have a list of conditions to ensure that sensitive areas are protected and that erosion is controlled. Conditions for approval of a project might include the following:

- All construction debris shall be properly disposed of on land so that it cannot enter the waterway or degrade water quality in state waters.
- All excess excavated material shall be disposed of above the 100-year floodplain and shall be contained to prevent its re-entry into waters of the state.
- Wash water containing oils, grease, or other hazardous materials resulting from wash down of equipment or working areas shall not be discharged into state waters except as authorized by an National Pollutant Discharge Elimination System (NPDES) or state waste discharge permit.

- Devices to control erosion (e.g., silt fence, straw bales, and brush barriers) that will prevent exceeding state water quality standards shall be in place before starting project construction and shall be maintained throughout construction.
- At the completion of construction, hydroseeding may be used to stabilize slopes and soils until other required planting is completed. Hydroseed mix should consist of native, non-invasive annual plant species only.

The following table lists problems that have occurred during construction of some of the compensatory mitigation sites that were evaluated as part of the *Washington State Wetland Mitigation Evaluation Study* (Johnson et al. 2000 and 2002). This is not meant to be a comprehensive list but rather to provide some real-life examples. Many of these problems could have been prevented or reduced if they had been considered during the selection, design, and construction of the site.

Table 3. Examples of possible solutions to common problems during construction of compensatory mitigation.

Possible Problems During Project Implementation	Possible Solutions (all of the below must be approved by the appropriate regulatory agencies)
Desired plants not available.	Make appropriate plant substitutions.
Plan does not fit the actual on–the-ground conditions (e.g., creation in the designed area would require felling some large existing conifers).	Revise the plan and construct the project around the large existing trees.
Site too wet to implement grading according to plan.	Make changes to the plan (reconfigure). Wait until the site is drier.
Unanticipated water inputs made the site wetter than planned (i.e., site too wet to plant vegetation according to plan).	Wait one year prior to planting to evaluate the water regime of the site. Adapt the planting plan accordingly.
arGrading done incorrectly (inexperienced heavy machinery operator did not implement the approved plan).	Know who you are hiring and provide construction oversight. Have the contractor correct the grading and implement the approved plan (request a qualified construction personnel).
Toxic organic contamination encountered during excavation activities.	When selecting a site determine the history of the site and if the site contains toxic substances. Stop excavation and contact the agencies to determine next steps.
Site design too intricate for accurate implementation.	Make appropriate adjustments in the field at the recommendation of the on-site wetland professional.
Soils are heavily compacted.	Rip and amend the soil.

3.5.4 Timing Issues

The timing of construction activities is also important to consider when developing a compensatory mitigation project. Issues of timing include: when the mitigation site is constructed in relation to the development project and associated wetland impacts; the time of year that construction, including planting, occurs, and; if the construction process occurs in phased steps to reflect environmental conditions. In most cases the agencies require that the compensatory mitigation site be constructed prior to, or concurrent with, the development activities that impact wetlands.

Phased construction may help ensure the success of a compensation project. Increasingly, agency staff suggest that applicants wait a year (or at least one wet season) after grading, excavating, or filling to observe the hydroperiod before planting. As mentioned in Section 3.4.1.1, monitoring the duration and extent of ponding and saturation for a year can identify problems with the water regime that can then be corrected before planting. Also, the planting zones can be based on actual water levels rather than the levels hypothesized in the plan. The likelihood that plantings will be successful increases when plants are located in the correct hydrologic regime. In the interim, the agencies recommend planting a seed mix, containing native, non-invasive, annual species, to prevent erosion and limit the spread of invasive species.

It is generally recommended that grading occur when it is dry. Earthwork should be completed prior to the winter rains in western Washington and, as mentioned previously, water levels monitored throughout at least one wet season. In eastern Washington, however, construction should be limited to the times when the ground is not frozen.

As already discussed in Section 3.4.1.3, *Vegetation*, when to plant is often ultimately dependent on the source and availability of plant material (e.g., container plants, cuttings, bare root). If invasive species are a concern it is also important to consider when these species will be reproducing. Disturbing the soil during an invasive species reproductive period will only facilitate its spread. On the other hand, disturbing the soil when native species like cottonwood (*Populus trichocarpa*) are producing seed can provide an opportunity for their establishment, if desired.

Other factors may influence the timing of construction activities at the site. If a Hydraulic Project Approval (HPA) or Biological Opinion (BO) is required for the project, construction activities must be performed within the permitted "work window" (i.e., timeframe). For example, timing of construction activities may be affected by the presence of endangered species (e.g., salmon spawning habitat, or breeding and nesting habitat of certain bird species should not be disturbed during certain seasons).

3.6 Managing the Site After Implementation

Managing a compensatory mitigation site immediately following construction is crucial to its success since many mitigation sites do not develop as expected. Rarely, if ever, does a site exactly follow the ecological trajectory that is predicted for it initially (see reviews in Zedler and Callaway 1999, Stanturf et al. 2001, Klotzli and Grootjans 2001). Management includes monitoring the site; reporting on progress; and implementing maintenance plans, *contingency plans*, and *adaptive management* if problems arise. Changes in water regime, soils, the presence of invasive plant species, browsing by wildlife, and other problems can occur on newly established compensatory mitigation sites. Without comprehensive management, minor problems may develop into signficant ones whereas major problems may become unmanageable and threaten the success of the project.

Important tasks involved in managing a site after construction, include:

- Submitting as-built reports.
- Protecting the site.
- Monitoring the site.
- Implementing maintenance and contingency plans.
- Employing adaptive management.
- Dealing with compliance and enforcement actions.

3.6.1 Submitting As-Built Reports

Once the construction has been completed, agencies require that an as-built report and/or drawings be delivered by certified mail (provides proof of submittal). The time frame for submittal of an as-built report is usually specified in the permit for the project.

An "as-built" report provides documentation of what actually occurred onsite during construction and serves as a baseline from which to manage and monitor the site. This report identifies the date on which construction at the compensatory mitigation site was completed and if there were any changes from the plan approved by the agencies. Although these changes may improve the project, it may appear as if the project is out of compliance with the original approved plan if the changes aren't documented in the report. An "as-built" should be developed with the assistance of a qualified wetland professional (see Section 2.3, *Level of Expertise Needed to Develop a Mitigation Plan*) or other party that was on-site during construction.

An as-built report may look like a final mitigation plan but changes from the approved construction plan will be highlighted. An as-built report should include the following:

The responsible parties (designer, construction contractors, planting contractor) and whether a qualified wetland professional or other qualified personnel was on-site during construction.

- Dates of implementation (including completion date).
- Description of any changes to the original plan.
- Description of any problems encountered during construction and what was done to correct them.
- A list of any follow-up actions needed, with a schedule.
- Plan sheets/drawings showing the as-built conditions.
- Photos to document baseline conditions.

Major changes to the approved mitigation plan require an amendment to the mitigation plan and approval by the agencies. Changes should be noted on the original construction plans so that they are easy to verify.

3.6.3 Protecting the Site

The protection of a wetland mitigation site over time is as important as design and construction. Applicants need to consider how the site will be protected over the long term and who will be responsible for its protection.

Protection encompasses ownership, legal mechanisms to prevent future development, and buffers that serve to maintain the wetland functions that develop. As discussed previously, site ownership, deed restrictions, and conservation easements are examples of legal mechanisms. Legal means are the best ways to protect sites from future development (see Section 3.3.2.2, *Site Ownership and Legal Mechanisms for Long-term Protection*).

Buffers, also discussed previously (see Section 3.3.1.6, *Buffers*), provide protection by reducing indirect impacts from adjacent properties. When planning and designing a mitigation project, the width of buffer necessary to protect and maintain the target functions is determined (see Part 1, Section 6.6 for guidance on recommended widths of buffers).

Buffers however can be reduced over time by the activities of adjacent landowners, particularly in urban areas (e.g., lawns are extended, shrubs and trees are thinned, pets are allowed to wander through the wetland). An inadequate or diminishing buffer width may affect wetland functions by not protecting them adequately, thereby preventing a mitigation site from being fully successful. To help protect buffers, their boundaries should be clearly marked with signs. Fencing should be considered on a case-by-case basis. Any fence used should be unobtrusive and should not block wildlife migration if that is one of the goals of the compensatory mitigation plan (see Part 1, Section 3.9.6 for further discussion of fences).

3.6.3 Monitoring

Monitoring the compensatory mitigation project after it is completed is also important to its success. The plan for monitoring is part of the mitigation plan and includes the methods, duration, and frequency of data collection and reporting. The goals, objectives, and performance standards are the basis for the monitoring plan and are the measure against which compliance and success are determined (see Section 3.6.3.1, *Use of Monitoring Data*, below and Section 3.4.2 on *Identifying Site-Specific Goals, Objectives, and Performance Standards*). The monitoring can also identify any unforseen problems that occur. Therefore, a well-conceived and executed monitoring plan is essential to determine the progress of a site and whether implementation of contingency plans is needed.

The information gathered during monitoring is documented in reports submitted to the appropriate agencies. In most cases, monitoring reports are required as a condition of permits authorizing impacts that necessitate construction of a compensatory mitigation site (e.g., grading, planting). Failure to submit completed monitoring reports in a timely manner could result in suspension of the permit or requirements for additional compensatory mitigation (see Section 3.6.6, *Compliance and Enforcement*).

3.6.3.1 Use of Monitoring Data

The information collected through monitoring should address the established goals, objectives, and performance standards. This information will be used to determine if the

project is achieving ecological success within the predicted timeframe. Regular monitoring reports also provide an opportunity for agency staff to help identify the extent of any problems and any necessary remedial measures. For example, a performance standard may require less than 20% areal cover by invasive vegetation by the end of the five-year monitoring period. The site, however, has 25% cover of invasive vegetation at the end of the third year. Evidence from previous monitoring reports indicates that the 25% invasive cover is an improvement over the 60% invasive cover present in the first year of monitoring. This documentation of the progress of the site could illustrate to the agencies that the site has significantly improved and that 20% invasive cover is likely to be achieved by year 5.

Identifying and fixing problems early on can improve the success of compensatory mitigation projects and their compliance with the conditions of the permit.

Monitoring data is important for the permittee as well as the agencies because they can reveal conditions that are unfavorable for attaining final performance standards. By implementing contingency plans (e.g., replanting dead or dying vegetation or re-grading parts of the wetland) based on this information, applicants can take corrective steps to ensure that the site is a success at the end of the monitoring period.

Finally, monitoring reports need to be as objective as possible. They can be used by the agencies, as a part of the official case file, to analyze and document permit compliance and the overall success of mitigation as compensation for wetland loss and degradation. Monitoring can also serve to increase our knowledge of the effects of specific actions.

3.6.3.2 Duration and Frequency of Monitoring

To help ensure the success of mitigation projects, the agencies recommend that monitoring continue for at least 5 years. In some cases, longer monitoring periods may be needed, particularly for projects establishing *forested wetlands*. Monitoring periods may also be extended if the performance standards are not being met.

Monitoring reports will generally be required annually or every other year. Agency staff, however, may request more frequent monitoring reports for specific projects. It is also recommended that, on average, sites be monitored two times per year, to track the seasonal variability of indicators used in the performance standards. For example, hydrologic indicators are best monitored in the early spring in western Washington, while indicators of vegetation are best monitored in late summer. In situations where monitoring periods longer than 5 years are required, monitoring of some parameters may be conducted less frequently. Frequency of monitoring however will depend on the performance standards and methods developed for ensuring that they are met.

3.6.3.3 Contents of the Monitoring Report

Appendix M provides an outline of information to provide in a typical monitoring report. The agencies recognize that there may be cases in which all of the information is not practical (e.g., very small projects) or that providing more information might be necessary (e.g., large or complex projects). This decision is made by agency staff working with the

applicant. In the majority of cases however the information in the checklist should be provided.

> Monitoring reports must accurately represent on-the-ground conditions of the entire compensatory mitigation site, not just the monitoring plots and/or transects.

3.6.4 Maintenance and Contingency Plans

Maintenance and *contingency plans* should be included in the overall plan for the compensatory mitigation project. Ideally, mitigation projects should be relatively maintenance free. However, mitigation sites often require maintenance to help ensure that performance standards are achieved. Maintenance plans outline the activities that are regularly scheduled, such as removal of unwanted plant species, upkeep of short-term irrigation systems, weeding trees and shrubs to the drip line, mulching, and removal of litter. If known, maintenance plans should also include contact information for the parties responsible for maintenance as well as identify the access points for ongoing maintenance.

Initially maintenance is done as frequently as once a month. For example, invasive plants may need to be removed monthly during the spring and early summer before they reproduce. A proactive maintenance program is necessary to prevent their spread.

One year of maintenance is generally part of most construction contracts. This usually includes 100% replacement of any dead or dying plants. However, experience shows that many sites may require maintenance for at least 3-5 years.

Contingency plans are initiated when problems are observed during monitoring that indicate the site is not going to meet one or more performance standards. There are many site-specific or landscape-scale factors that may influence wetlands and the functions they provide which were unpredicted. Droughts, floods, fires, grazing, and global warming are all factors that are not predictable. It is important to realize the dynamic nature of wetlands and streams, and, as with all systems in nature, some things are beyond control. Environmental processes change over time and over the landscape in response to internal and external forces. Well-crafted compensatory mitigation plans, however, recognize the likelihood of these events and attempt to plan for them, primarily through monitoring, contingency plans, and adaptive management (see Section 3.6.5 for more on adaptive management).

Contingency plans should outline actions that would be taken if monitoring revealed a problem that would prevent the site from attaining its stated goals, objectives, and performance standards. Contingency plans should both anticipate problems and identify specific maintenance activities or actions that would be implemented to rectify each problem. Actions may be identified for problems such as failed plantings, invasion of non-native species, damaged or missing structures, insufficient water supply or inappropriate water regime, or vandalism.

If a mitigation site is designed to restore or create the environmental processes that are appropriate for that landscape, maintenance and contingency efforts will hopefully be mimimal. For plantings, irrigation should only be used for the short term (no more than 3 years) during the dry summer months (May thru September). This approach forces (allows) the plantings to adapt to the water table and not to the irrigation. As long as hydrologic conditions are present and appropriate early succession species are planted, wetlands can potentially re-establish themselves over time, even if they are affected by unexpected events.

3.6.5 Adaptive Management

Adaptive management is a systematic process in which modifications to a compensatory mitigation plan, including monitoring, maintenance, and contingency plans, are made based on what has or has not been effective. Adaptive management is a feedback loop in which monitoring information is used to determine how site management may be adjusted if the project's performance standards are not being met. And it is most often implemented when unforeseen circumstances result in problems that a compensatory mitigation plan has not addressed. For example, adaptive management may be needed to revise a contingency plan that fails to rectify a problem.

Adaptive management involves the applicant and the agencies discussing the problems and possible solutions or alternative approaches. It may entail acknowledging that a particular site-design is not compatible with conditions at the compensatory mitigation site. In extreme cases, adaptive management may result in a change in project goals, objectives, or performance standards due to unanticipated conditions.

One proactive approach to adaptive management is to incorporate specific experiments into the compensatory mitigation plan when possible. These may include setting up experimental plots within a site that have different treatments, inputs, etc., to determine if specific activities are meeting the desired goals. Experimental sampling design however requires a high-level of monitoring expertise and can be costly in terms of time, staff, and resources. Unless experiments are rigorously controlled, results may not be statistically valid.

3.6.6 Compliance and Enforcement

The agencies are responsible for ensuring that permittees comply with the terms and conditions of their permits, including the successful implementation of any required compensatory mitigation plan. The goal is for the applicant and the agencies to work collaboratively to ensure that the compensatory mitigation project is successful and complies with the conditions of the permit. Non-compliance, however, may necessitate a compliance or enforcement action by the agencies, which could result in additional compensatory mitigation requirements (see Part 1, Section 3.9.8, *Compliance and Enforcement*).

3.6.7 Completion of Compensatory Mitigation Requirements

Lastly, permittees are required to notify the agencies when the monitoring period has ended. Notification might take the form of a letter or final monitoring report documenting that all performance standards have been met. Also when applicable, permittees should submit a formal jurisdictional delineation of wetlands created or re-established for compensatory mitigation. Following receipt of the final report, the agencies will contact the permittee to schedule a site visit to confirm the completion of the compensatory mitigation project and review any jurisdictional delineation. The compensatory mitigation is not considered complete without an on-site inspection by agency staff and written confirmation that the approved criteria for success have been achieved.

Glossary

Adaptive management. A systematic process for improving management policies and practices by learning from the outcomes of previous policies and practices. Related to compensatory mitigation, it involves the permittee and the agencies discussing the problems occurring on a compensation site and coming to agreement on possible solutions or alternative approaches necessary to bring the site into compliance.

Aquatic resources. Refers to ecological systems where the regular or occasional presence of water is the dominant factor in determining the characteristics of the site. Aquatic resources include wetlands, rivers, streams, and lakes and other deepwater habitats.

Atypical wetland. A wetland whose "design" does not match the type of wetland that would be normally be found in the geomorphic setting of the proposed site (i.e., the water source and hydroperiod proposed for the mitigation site are not typical for the geomorphic setting). Designs that provide exaggerated morphology or require a berm or other engineered structures to hold back water would also be considered atypical.

Avoidance. The first step of *mitigation sequencing*.

Best management practices (BMPs). Schedules of activities, prohibitions of practices, maintenance procedures, managerial practices, or structural features that prevent or reduce adverse impacts to waters of Washington State.

Buffers or buffer areas. Vegetated areas adjacent to wetlands, or other aquatic resources, that can reduce impacts from adjacent land uses through various physical, chemical, and/or biological processes.

Class. A grouping based on shared characteristics in a classification scheme. In the *Cowardin classification* (Cowardin et al. 1979) of wetlands a class is the third level in the 'taxonomy' of wetlands whereas in the *hydrogeomorphic classification* (Brinson 1993) it is the highest taxonomic unit.

Compensatory mitigation. The stage of the mitigation sequence, where impacts to wetland functions are offset (i.e., compensated for) through creation (establishment), restoration (re-establishment, rehabilitation), or enhancement of other wetlands. Because regulatory requirements and policies tend to focus on compensatory mitigation, the term "mitigation" is often used to refer to compensation, which is just one part of the overall mitigation sequence. See *mitigation sequencing*.

Connectivity. The degree to which structures found across the landscape facilitate movement of living organisms between patches or their habitat. The movement can occur either within the lifetime of an organism or over a period of generations. The purpose of facilitating movement is to maintain viable populations that allow species and communities of species to persist in time. Connectivity can be achieved via a continuous and linear habitat feature (as in a *corridor*) or discrete habitat patches comprised but not limited to individual forests, wetlands, shrub lands, and shorelines.

Conservation easement. A legal restriction placed on a piece of property to protect the resources (natural or man-made) associated with the parcel. It restricts the type and

amount of activities that can take place on a parcel of land. Easements are recorded on the property deed and are held in trust by a conservation easement "holder" such as a land trust or government agency. The holder polices the terms of the easement for the duration of its existence, which is usually into perpetuity. Compare to *deed restriction*.

Construction. As used in this document includes all activities used to create (establish), restore (re-establish and rehabilitate), enhance, and preserve a site for use as compensation for unavoidable wetland impacts. Construction associated with a wetland mitigation site includes activities such as moving earth, building weirs, plugging ditches, breaking drain tiles, removing dikes, planting vegetation, removing cattle.

Contingency plan. A plan outlining actions that would be taken if monitoring revealed a problem that would prevent the site from attaining its performance standards. Contingency plans should both anticipate problems and identify specific actions that would be implemented to rectify each problem.

Corridor. Areas that contain relatively undisturbed habitat and/or vegetation that maintain connections for wildlife throughout the landscape. Corridors usually represent linear habitats with the range of environmental functions necessary to permit the movement of animals between larger and more fully functioning habitats. Corridors can include but are not limited to, annual or seasonal migration corridors that connect wintering and breeding habitat, or intra-seasonal corridors that connect foraging and nesting habitat or breeding and dispersal habitat. See *connectivity*.

Cowardin classification. The first commonly used classification system for wetlands. It was developed in 1979 by the U.S. Fish and Wildlife Service. The Cowardin system classifies wetlands based on water flow, substrate types, vegetation types, and dominant plant species. See *class*.

Creation. See *establishment.*

Cultural resources. Any archaeological, historical, or cultural (e.g., religious significance) areas of concern. This term is a catch-all term that is not defined in any federal statute or regulation.

Deed restriction. Clauses in a deed limiting the future uses of the property. Deed restrictions may impose a vast variety of limitations and conditions, for example, for a compensatory mitigation site, they may limit the allowed activities on the site based on the goals and objectives of the site. If the site is primarily for wildlife habitat human access may be restricted. Compare to *conservation easement*.

Depressional wetland. A *class* of wetlands in the *hydrogeomorphic classification.* These are wetlands that occur in topographic depressions that exhibit closed contour interval on three sides and elevations that are lower than the surrounding landscape.

Development project. In the context of this document means any activity that will result in negative impacts to a wetland or other aquatic resource (e.g.,

constructing a residential subdivision, single-family residence, commercial facility, or roads; installing utility lines).

Ecoregion. Geographic regions where climatic conditions are similar and the ecosystems (including wetlands) are relatively homogeneous. Omernik and Gallant (1986) mapped the following ecoregions in Washington: Coast Range, Puget Lowland, Cascades, Eastern Cascades Slopes and Foothills, North Cascades, Columbia Plateau, Blue Mountains, and Northern Rockies.

Ecosystem. A loosely defined assemblage of co-occurring organisms and the geographic location which they inhabit. The term is an operational convenience defined by the user of the term for the convenience of description (Levin 2001). There is no basic geographic scale associated with the term ecosystem, and that also has to be defined by a user. For example, the term can be used to describe the micro-organisms co-occurring in a spoonful of soil (soil ecosystem) at one end of the scale to the ecosystem of the world that encompasses all organisms on the planet.

Emergent wetland. A wetland *class* under the *Cowardin classification* that is dominated by erect, rooted, herbaceous plants. Emergent wetlands include marshes and wet meadows.

Enhancement. The manipulation of the physical, chemical, or biological characteristics of a wetland site to heighten, intensify or improve specific function(s) or to change the growth stage or composition of the vegetation present. Enhancement is undertaken for specified purposes such as water quality improvement, flood water retention or wildlife habitat. Activities typically consist of planting vegetation, controlling non-native or invasive species, modifying site elevations or the proportion of open water to influence hydroperiods, or some combination of these. Enhancement results in a change in some wetland functions and can lead to a decline in other wetland functions, but does not result in a gain in wetland acres. Compare to *establishment* and *restoration* (*re-establishment* and *rehabilitation*).

Environmental Processes. Environmental factors that occur at larger geographic scales, such as basins, sub-basins, and watersheds. Processes are dynamic and usually represent the movement of a basic environmental characteristic, such as water, sediment, nutrients and chemicals, energy, or animals and plants. The interaction of landscape processes with the physical environment creates specific geographic locations where groundwater is recharged, flood waters are stored, stream water is oxygenated, pollutants are removed, and wetlands are created.

Establishment (creation). The manipulation of the physical, chemical, or biological characteristics present to develop a wetland on an upland or deepwater site, where a wetland did not previously exist. Establishment results in a gain in wetland acreage [and function]. (Note: The U.S. Army Corps of Engineers' Regulatory Guidance Letter 02-02 uses the term "establishment" rather than the previously accepted term "creation." Federal agencies, as well as the Department of Ecology, have started using the term "establishment.") Compare to *enhancement* and *restoration*.

Forested wetland. A wetland *class* in the *Cowardin classification* where woody plants taller than 20 feet form the dominant cover (> 30% aerial cover). Shrubs often form a second layer beneath the forest canopy, with a layer of herbaceous plants growing beneath the shrubs.

Fragmentation. The breaking up of ecosystems into patches of habitat that are separated by areas altered by human land uses. Fragmentation always consists of both the reduction in the area of the original habitat and a change in spatial configuration of what remains.

Functions. The physical, biological, chemical, and geologic interactions among different components of the environment. See *wetland functions.*

Function assessment. The process by which the capacity (i.e., potential) of a wetland to perform a function is measured or characterized. This approach analyzes the capacity to perform a function often using a numeric model. Assessments are methods that generate a number that represents an estimate of the performance of a wetland function. The number generated is relative to a predetermined standard (e.g., level of function provided by reference wetlands). Numbers do not reflect an actual level of function performance (Hruby 1999). Examples include the Washington State methods for assessing wetland functions (also known as WFAM) (Hruby et al. 1999 and 2000) and a Hydrogeomorphic wetland function assessment method (Brinson et al. 1995). See *functions*.

Geographic Information System (GIS). A system of spatially referenced information, including computer programs that acquire, store, manipulate, analyze, and display spatial data.

Growing season. The portion of the year when soil temperatures at 19.7 inches below the soil surface are higher than biologic zero (5° C) (US Department of Agriculture – Soil Conservation Service 1985). For ease of determination this period can be approximated by the number of frost free days (US Department of the Interior 1970-National Atlas of the United States pp 110-111).

Hydrogeomorphic (HGM) classification. A system used to classify wetlands based on the position of the wetland in the landscape (geomorphic setting), the water source for the wetland, and the flow and fluctuation of the water once in the wetland. An HGM wetland class is the highest level in the hydrogeomorphic classification of wetlands. There are six basic hydrogeomorphic wetland classes including depressional, tidal fringe, slope, riverine, lake fringe, and flat. See *class*.

Hydroperiod (or water regime). The pattern of water level fluctuations in a wetland. Includes the depth, frequency, duration, and timing of inundation or flooding. Patterns can be daily, monthly, seasonal, annual or longer term.

Impact site. For the purposes of this document, the area of wetland that is being indirectly or directly affected by the *development project*.

Impervious surface. A hard surface area which either prevents or retards the entry of water into the soil relative to conditions prior to development; and/or a hard

surface area which causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development.

In-lieu fees (ILFs). An approach to compensatory mitigation that allows permit applicants to pay a fee to a third party such as a government agency or conservation organization. The fees are then used to restore, create, enhance, or preserve wetlands. Generally, in-lieu fee contributions are collected in advance of wetland losses. These funds are accumulated until they are sufficient to design and implement a wetland compensation project.

Invasive Species. Defined by the National Invasive Species Council (NISC) as "(1) a non-native (alien) to the ecosystem under consideration and (2) a species whose introduction is likely to cause economic or environmental harm, or harm to human health"(Executive Order 13112).

Lacustrine (lake) fringe wetlands. A wetland *class* under the *hydrogeomorphic classification*. These are wetlands that occur at the margins of topographic depressions in which surface water is greater than 8 hectares (20 acres) and greater than 2 meters deep in western Washington and 3 meters in eastern Washington.

Land trust. A non-profit organization, with 501-c-3 status under federal tax law, whose purpose is to conserve natural lands through acquisition and ownership. Land trusts are usually locally-based citizen run grass-roots organizations working to protect a range of different critical ecosystem features within their communities.

Large woody debris (LWD). Large pieces of downed wood such as logs, rootwads, and limbs that are in or near a body of water. LWD provides habitat structure for fish and other aquatic organisms.

Minimization. The second step of mitigation sequencing, in which actions are taken to reduce the extent of wetland impacts (e.g., a project is redesigned to lessen wetland alteration). It does not however eliminate the direct or indirect loss of area and/or functions. See *mitigation sequencing*.

Mitigation banking. As defined by the 1995 federal guidance on wetland mitigation banking and state law (Chapter 90.84 RCW), mitigation banking is "wetland restoration, creation, enhancement, and in exceptional circumstances, preservation undertaken expressly for the purpose of compensating for unavoidable wetland losses in advance of development actions, when such compensation cannot be achieved at the development site or would not be as environmentally beneficial."

Mitigation sequencing. A prescribed order of steps taken to reduce the impacts of activities on wetlands. Mitigation sequencing involves: 1. Avoiding the impact altogether by not taking a certain action or parts of an action; 2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps, such as project

redesign, relocation, or timing, to avoid or reduce impacts; 3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; 5. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments; and 6. Monitoring the impact and taking appropriate corrective measures (Chapter 197.11.768 WAC). See *compensatory mitigation*.

Monitoring. The repetitive measurement of some aspect of a natural resource and/or human activity using ecological indicators as the basis for identifying changes to that resource.

Mycorrhizae (mycorrhizal fungi). The combination of root and beneficial fungi in a mutually advantageous living arrangement in the soil.

Performance standards. Observable or measurable attributes used to determine whether a compensatory mitigation project meets its objectives. Standards are written in a mitigation plan and are enforceable conditions.

Preservation. See *protection/maintenance.*

Protection/maintenance (preservation). Removing a threat to, or preventing the decline of, wetland conditions by an action in or near a wetland. This includes the purchase of land or easements, repairing water control structures or fences, or structural protection such as repairing a barrier island. This term also includes activities commonly associated with the term preservation (in a regulatory context). Under regulatory actions preservation does not result in a gain of wetland acres, but may result in a gain in functions over the long term, and is used only in exceptional circumstances.

Re-establishment. The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former wetland. Activities could include removing fill material, plugging ditches or breaking drain tiles. Re-establishment results in a gain in wetland acres and functions. Compare to *rehabilitation. S*ee also *restoration*.

Reference wetland. In the context of compensatory mitigation, a wetland chosen to represent the functions and characteristics that are being created, restored, or enhanced at the "mitigation" site. A reference wetland can be used for monitoring the success of the mitigation project. Reference wetlands, in the context of methods for assessing wetland functions, mean the sites chosen to represent the full range of functioning in a region or hydrogeomorphic class. Data collected at these sites are used to calibrate the methods.

Rehabilitation. The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions and processes of a degraded wetland. Activities could involve breaching a dike to reconnect wetlands to a floodplain, restoring tidal influence to a wetland, or breaking drain tiles and plugging drainage ditches. Rehabilitation results in a gain

in wetland function but does not result in a gain in wetland acres. Compare to e*stablishment (creation), re-establishment* and *enhancement*. See also *restoration*.

Restoration. The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural or historic functions to a former or degraded wetland. For the purpose of tracking net gains in wetland acres, restoration is divided into *re-establishment* and *rehabilitation*. Re-establishment represents a net gain in acres while rehabilitation does not.

Richness. The number of different species of organisms present in a community.

Riverine wetlands. A *class* of wetlands in the *hydrogeomorphic classification*. Wetlands that occur in floodplains and riparian corridors in association with stream or river channels where there is frequent overbank flooding.

Slope wetlands. A *class* of wetlands in the *hydrogeomorphic classification*. These are wetlands that occur on the slopes of hills or valleys. The principal water source is usually seepage from groundwater.

Species richness. See *richness*.

State Historic Preservation Officer (SHPO). Administers the national historic preservation program at the State level, reviews National Register of Historic Places nominations, maintains data on historic properties that have been identified but not yet nominated, and consults with Federal agencies during Section 106 review. SHPOs are designated by the governor of their respective State or territory. Federal agencies seek the views of the appropriate SHPO when identifying historic properties and assessing effects of an undertaking on historic properties. SHPO work for the Washington State Office of Archaeology and Historic Preservation.

Stormwater. Stormwater is the water coming from rain or snow that runs off surfaces such as rooftops, paved streets, highways, and parking lots. It can also come from hard grassy surfaces like lawns, play fields, and from graveled roads and parking lots.

Tribal Historic Preservation Officer (THPO). A representative of a tribe that assumes any or all of the functions of a State Historic Preservation Officer (see above) with respect to tribal land. The decision to participate or not participate in the program rests with the tribe. In Washington there are currently 5 tribes with a THPO: the Makah Tribe; the Skokomish Indian Tribe; the Confederated Tribes of the Colville; the Squaxin Island Tribe; and the Spokane Tribe.

Tribal lands. All lands within the boundaries of an Indian Reservation, whether they are tribally or independently owned.

Values. See *wetland values*.

Waters of the United States. Generally include navigable waters, tributaries of navigable waters, interstate waters, and all other waters such as intrastate lakes, rivers, streams, and wetlands. See 33 CFR 328.3 for a detailed definition.

Watershed. A geographic area of land bounded by topographic high points in which water drains to a common destination.

Wetland functions. The physical, biological, chemical, and geologic interactions among different components of the environment that occur within a wetland. Wetlands perform many valuable functions and these can be grouped into three categories: functions that improve water quality, functions that change the water regime in a watershed such as flood storage, and functions that provide habitat for plants and animals. See *functions*.

Wetland rating. Also called a wetland rating system, is a tool for dividing or grouping wetlands into groups that have similar needs for protection. One method used in Washington is the Washington State wetland rating systems (Hruby 2004a,b), which places wetlands in categories based on their rarity, sensitivity, our inability to replace them, and their functions.

Wetland values. Wetland processes, characteristics, or attributes that are considered to benefit society.

Wetlands. As defined by the *Washington State Wetlands Delineation Manual* (Ecology 1997), "The Corps of Engineers (CE) (Federal Register 1982), the Environmental Protection Agency (EPA) (Federal Register 1985), Washington's Water Quality Standards, the Shoreline Management Act (SMA) and the Growth Management Act (GMA) all define wetlands as: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. In addition, Washington's Water Quality Standards, the SMA and GMA definitions add: "Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas to mitigate the conversion of wetlands."

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Tools and On-line Resources

Government Sites

Code of Federal Regulations (CFR) http://www.gpoaccess.gov/cfr/index.html.

Federal Register http://www.gpoaccess.gov/fr/.

Federal Aviation Administration (FAA) guidance on locating certain land uses and landscape features, including wetlands, having the potential to attract hazardous wildlife to or in the vicinity of public airports
http://wildlife-mitigation.tc.faa.gov/public_html/moa.pdf.

National Invasive Species Council http://www.invasivespecies.gov. Executive Order 13112, on Invasive Species
http://www.archives.gov/federal_register/executive_orders/1999.html.

National Wetlands Mitigation Action Plan (NWMAP)
http://www.mitigationactionplan.gov. Includes guidance on performance standards and other aspects of mitigation.
http://www.mitigationactionplan.gov/performancestandardsguidance.htm.

Revised Code of Washington (RCW) http://www.leg.wa.gov/rcw/index.cfm.

State Historic Preservation Office (SHPO), Washington Office of Archaeology & Historic Preservation http://www.achp.gov/shpo.html.

State Historic Preservation Office http://www.oahp.wa.gov/.

Tribal Historic Preservation Office (THPO)
http://www.cr.nps.gov/hps/tribal/tribaloffices.htm.

United States Army Corps of Engineers - Seattle District (go to "Regulatory" then "Waters & Wetland Information") http://www.nws.usace.army.mil/.

U.S. Environmental Protection Agency Headquarters Wetlands Page
http://www.epa.gov/owow/wetlands/.

U.S. Environmental Protection Agency Region 10 Wetlands Page
http://yosemite.epa.gov/R10/ECOCOMM.NSF/Wetlands/Wetlands.

U.S. Environmental Protection Agency Watershed Academy (online training courses on wetlands, invasive species, watersheds, etc)
http://www.epa.gov/OWOW/watershed/wacademy/acad2000/.

U.S. Environmental Protection Agency's Wetlands Helpline
http://www.epa.gov/OWW/wetlands/wetline.html.

Washington Administrative Codes (WAC's) http://www.leg.wa.gov/wac/.

Washington Department of Natural Resources http://www.dnr.wa.gov.

Washington Natural Resources Conservation Service (NRCS) Field Offices http://www.wa.nrcs.usda.gov/contact/fieldoffices.html. Go directly to Soil Survey Reports: http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html.

Washington State Department of Ecology http://www.ecy.wa.gov.

Washington State Department of Ecology's "best available science for wetlands" project http://www.ecy.wa.gov/programs/sea/bas_wetlands/index.html.

WA State Department of Ecology Facility/Site Identification System http://www.ecy.wa.gov/services/as/iss/fsweb/fshome.html, or Facility/Site Atlas http://apps.ecy.wa.gov/website/facsite/viewer.htm.

Washington State Department of Ecology on-line public events calendar http://apps.ecy.wa.gov/pubcalendar/calendar.asp.

Washington State Department of Ecology's wetland function assessment project http://www.ecy.wa.gov/programs/sea/wfap/index.html.

Washington State Department of Ecology's wetland mitigation banking home page http://www.ecy.wa.gov/laws-rules/activity/wac173700.html. You can also find a link to the Draft State Wetland Banking Rule (WAC 173-700). Although it has not be adopted at this time, it lays out clear criteria and requirements for wetland mitigation banks. Ecology will use the draft rule as guidance during review of bank proposals. It can be accessed directly at http://www.ecy.wa.gov/programs/sea/wetmitig/index.html.

Washington State Department of Ecology's wetlands home page http://www.ecy.wa.gov/programs/sea/wetlan.html.

Washington State Department of Transportation Environmental Services http://www.wsdot.wa.gov/environment/default.htm.

Washington State Department of Transportation, Wetland Mitigation Technical Group, guidance on mitigation, including a number of white papers on developing standards of success for wetland mitigation projects. http://www.wsdot.wa.gov/environment/biology/wet_mitigation.htm.

Washington State Noxious Weed Control Board (includes information on County Weed Boards)http://www.nwcb.wa.gov/index.htm.

Washington State Office of Regulatory Assistance http://www.ecy.wa.gov/programs/sea/pac/.

Delineation

U.S. Army Corps of Engineers Wetland Delineation Manual (U.S. Army Corps of Engineers 1987) can be found on-line at: http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/87_Manual.pdf, or http://www.wes.army.mil/el/wetlands/pdfs/wlman87.pdf. 1994 Regional Guidance for Washington is at http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/WASHINGTON_REGIONAL_GUIDANCE_on_87_manual.pdf.

Washington State Identification and Delineation Manual (Ecology 1997) can be found on-line at: http://www.ecy.wa.gov/biblio/9694.html.

The Routine Wetland Determination Data Forms can be found at: http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/Data_Sheets_for_Wet_Delineations.pdf.

A list of helpful resources can be found on the Corps Seattle Districts' regulatory home page at: http://www.nws.usace.army.mil/reg.html (Wetland and Water Resources).

The Field Guide for Wetland Delineation prepared by the Wetland Training Institute is available on-line at http://www.wetlandtraining.com/books.html.

Vegetation

For a list of plants that occur in Washington's wetlands refer to:

> Reed, P.B., Jr. 1988. *National List of plant species that occur in wetlands: Northwest (Region 9).* U.S. Fish and Wildlife Service, Biological Report 88 (26.9).
>
> Reed, P.B., Jr. 1993. 1993 Supplement to list of plant species that occur in wetlands: Northwest (Region 9). U.S. Fish and Wildlife Service, Supplement to Biological Report 88 (26.9).
>
> Both of the above are available on-line at: http://www.nwi.fws.gov/bha/

You can also go to the USDA Natural Resources Conservation Service PLANTS Database to Display USFWS wetland indicator status for vascular plants, by genus, family, and/or wetland region. http://plants.usda.gov/cgi_bin/topics.cgi?earl=wetland.html.

Soils

Hydric soil lists are available on the USDA Natural Resources Conservation Service internet site, for Washington lists by county go to: http://www.wa.nrcs.usda.gov/technical/soils/county_hydric_lists.html

The National Resource Conservation Service's (NRCS) *Field Indicators of Hydric Soils in the United States* http://soils.usda.gov/use/hydric/.

Some county soil surveys are on-line at http://www.wa.nrcs.usda.gov/technical/soils/soil_survey.html.

Local NRCS offices can be found on-line at http://www.wa.nrcs.usda.gov/contact/fieldoffices.html.

Local Conservation Districts can be found on-line at http://www.scc.wa.gov/districts/list/.

Wetland Classification and Characterization

U.S. Fish and Wildlife Service classification (Cowardin classification) http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm.

Hydrogeomorphic classifications for Washington can be found in the *Methods for Assessing Wetland Functions* (Hruby et al. 1999 and 2000).
http://www.ecy.wa.gov/programs/sea/wfap/index.html.

The rating systems for eastern or western Washington (Hruby 2004a and 2004b)
http://www.ecy.wa.gov/programs/sea/wetlan.html.

Other Resources

Developing Performance Criteria for Wetland Mitigation Projects: A Guideline (Ossinger 1999) http://www.wsdot.wa.gov/environment/biology/docs/success_guidelines.pdf.

Ecoregions - U.S. States Environmental Protection Agency description and definition
http://www.epa.gov/naaujydh/pages/models/ecoregions.htm.

Society of Wetland Scientists Professional Certification Program
http://www.wetlandcert.org

Stormwater Manual for Eastern Washington
http://ww.ecy.wa.gov/programs/wq/stormwater/eastern_manual/index.html or
http://www.ecy.wa.gov/biblio/0410076.html.

Stormwater Manual for Western Washington
http://www.ecy.wa.gov/programs/wq/stormwater/manual.html.

Appendix A - Reviewers of Part 2

Individuals and organizations that provided written comments, suggestions, and materials during the public review period (Name and affiliation at time of comment):

Bill Null, Washington State Department of Transportation

Bob Zeigler, Washington Department of Fish and Wildlife

Bonneville Power Administration (BPA), Fish and Wildlife Program

Environmental Restoration, LLC

Port of Seattle, Aviation Environmental Programs

Washington Department of Natural Resources (WDNR), Aquatic Resources Division

Washington State Department of Transportation (WSDOT), Environmental Services

Individuals and organizations that provided written input during pre-draft focus group meetings, using the on-line comment form, etc. (Name and affiliation at time of comment):

Brian Johnston, Snohomish County

Emily Teachout, U.S. Fish and Wildlife Service

Glenn Scholten, City of Cheney

Jeff Dixon, City of Auburn Planning Department

Jim Wiggins, ATSI

Karen Walter, Muckleshoot Indian Tribe Fisheries Division

Kristen Andersen, David Evans and Associates

Kristie Dunkin, Parametrix

Lyn Morgan-Hill, Whatcom County Planning & Development

Michael Muscari, Pentec Environmental

Washington State Department of Ecology Wetland Technical Advisory Group

Washington State Department of Transportation Wetland Mitigation Technical Group

Appendix B - Agency Contacts

U.S. Army Corps of Engineers (Corps) - Seattle District

The Seattle District administers the Corps' Regulatory Program throughout the state of Washington except that the activities of Ports located on the Washington side of the Lower Columbia River are regulated by the Portland District.

Within the Corps, staff responsibility is generally divided up by county, but the county responsibilities sometimes shift. Staff are also assigned to special topics (e.g., endangered species, transportation projects, etc.). For information contact the headquarters or regional offices (see below). Also, check the following website for the most current list of staff: http://www.nws.usace.army.mil/reg.html ("Contact Our Staff").

Seattle District Headquarters and Regional Contacts

Mailing address	Agency staff	Counties
Seattle District Headquarters Seattle District Corps of Engineers Regulatory Branch, CENWS-OD-RG ATTN: "person's name/file number" Post Office Box 3755 Seattle, Washington 98124-3755 Telephone: (206)764-3495 Fax: (206)764-6602 **Physical Address** Federal Center South 4735 E. Marginal Way South Seattle, Washington	Please contact the Seattle District Headquarters for current county staff assignments. There are also staff assigned to special topics (e.g., endangered species, mitigation banking, etc.). Check the regulatory web page for a list of special topics and associated staff assignments: http://www.nws.usace.army.mil/reg.html	Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish, Thurston, Whatcom
Eastern Washington Field Office U.S. Army Corps of Engineers Eastern Washington Field Office Post Office Box 273 Chattaroy, Washington 99003-0273	**Tim Erkel** tim.r.erkel@nws02.usace.army.mil (509)238-4570 Fax: (509)238-4561	Adams, Asotin, Benton, Columbia, Ferry, Franklin, Garfield, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, and Whitman
Southwest Washington Field Office U.S. Army Corps of Engineers Southwest Washington Field Office 2108 Grand Boulevard Vancouver, WA 98661-4624 Fax: (360)750-9307	**Ron Klump** ron.klump@nws02.usace.army.mil (360)750-9046 Vacant (360)694-1171 **Brad Murphy** bradley.j.murphy@nws02.usace.army.mil (360)906-7274	Clark, Cowlitz, Klickitat, Pacific (enforcement only), Skamania, and Wahkiakum

Mailing address	Agency staff	Counties
Central Washington Field Office U.S. Army Corps of Engineers Central Washington Field Office Post Office Box 2829 Chelan, Washington 98816	**Debbie Knaub** deborah.j.knaub@nws02.usace.army.mil (509)682-7010 Fax: (509)682-7710	Chelan, Douglas, Grant, and Okanogan
Seattle District Corps of Engineers Regulatory Branch, CENWS-OD-RG ATTN: Jason Lehto Post Office Box 3755 Seattle, Washington 98124	**Jason Lehto** jason.a.lehto@nws02.usace.army.mil (206)764-3495 Fax: (206)764-6602	Kittitas and Yakima

U.S. Environmental Protection Agency (EPA) - Region 10

The EPA provides oversight of the Corps Regulatory Program and Clean Water Act Section 401 Water Quality Certifications for activities on *tribal lands* and in national parks. EPA Region 10 has a main office in Seattle, and small offices in Olympia WA; Portland, Eugene and La Grande OR; Boise, Prosser, and Pocatello ID; and Anchorage, Juneau, and Kenai AK. Within EPA, staff responsibility is generally divided up by county, but the county responsibilities sometimes shift. For information contact the Regional Office at:

U.S. EPA, Region 10
1200 Sixth Avenue
Seattle WA 98101
(206)553-1200 or 1-800-424-4EPA (toll free number)

The following table provides a list of staff that can answer questions regarding wetland mitigation proposals. For more general wetlands information you can contact the EPA Wetlands Helpline (see shaded box below).

EPA Region 10 Wetland Contacts

Agency staff	Contact information	Subject areas
Joan Cabreza	(206)553-7369 cabreza.joan@epa.gov	mitigation/restoration, mitigation banking, invasive species
Richard Clark	(206)553-6522 clark.richard@epa.gov	regulatory/permit processes, 401 certifications, enforcement
Krista Rave-Perkins	(206)553-6686 rave-perkins.krista@epa.gov	regulatory/permit processes, 401 certifications
Ralph Rogers	(206)553-4012 rogers.ralph@epa.gov	regional ecologist, mitigation/restoration, monitoring
Linda Storm	(206)553-6384 storm.linda@epa.gov	regulatory/permit processes, restoration, monitoring, cultural resources

EPA Wetlands Helpline

For more general wetlands information you can contact the EPA Wetlands Helpline. The helpline is a national resource and may be useful for obtaining national publications, federal registers, general wetland information, etc.

Who We Are

The EPA Wetlands Helpline is a contractor-operated information and referral service which handles requests for information on wetlands regulation, legislation and policy pursuant to Section 404 of the Clean Water Act, wetlands values and functions, and wetlands agricultural issues. The Helpline acts as a first point of contact for EPA's Wetlands Division, which is part of the Office of Wetlands, Oceans and Watersheds (OWOW). As of January 1, 2002, the Helpline has been co-located within the EPA's Water Resource Center allowing both Helpline and Resource Center customers access to the full spectrum of water-related public information available from EPA.

What We Do

The Helpline is staffed by librarians providing in-depth, EPA-approved information, documents, and referrals addressing Federal and State regulatory programs, wetlands science, and educational outreach. Librarians can respond to specialized research requests using the Helpline's extensive reference library, as well as other pertinent sources including the Internet. Librarians also maintain an extensive list of contacts at regulatory agencies and other organizations to provide the most appropriate and accurate referrals.

Our Documents

For more general wetlands information you can contact the EPA Wetlands Helpline, which is a contractor-operated information and referral service. The helpline is a national resource and may be useful for obtaining national publications, federal registers, general wetland information, etc. The Helpline acts as a first point of contact for EPA's Wetlands Division, which is part of the Office of Wetlands, Oceans and Watersheds (OWOW).

Contact Us

Hours: Monday through Friday, excluding Federal Holidays, 8:30am to 5:30pm Eastern Standard Time.
Telephone: 1-800-832-7828
Fax: (202)566-1736.
Email: wetlands.helpline@epa.gov
Website: http://www.epa.gov/OWOW/wetlands/wetline.html
Helpline Publications List: http://www.epa.gov/owow/wetlands/wetpubs.html

Watershed Academy (web-based interactive courses)

The EPA Office of Water also maintains a series of web-based interactive courses called the Watershed Academy. The Academy provides dozens of on-line courses on everything from wetlands and watersheds to invasive species, and includes courses from other federal agencies as well. To see a catalogue of courses go to http://www.epa.gov/owow/watershed/waacademy/catolog.html.

Washington State Department of Ecology

Wetland staff at the Washington State Department of Ecology are located at the headquarters office in Lacey, Washington and in four regional offices: Central region (Yakima), Eastern region (Spokane), Northwest region (Bellevue), and Southwest region (Lacey). Regional staff responsibility is divided by county, but the county responsibilities sometimes shift. For information contact the headquarters or regional offices (see below). Also, check the following website for the most current list of staff: http://www.ecy.wa.gov/programs/sea/wetlandcontacts.htm.

Mailing address	Agency staff	County or Subject Area
Ecology Headquarters PO Box 47600 Olympia, WA 98504 Telephone: (360)407-6000 Fax: (360) 407-6902 **Physical Address** 300 Desmond Drive SE Lacey, WA 98503	**Andy McMillan** (360) 407-7272, anmc461@ecy.wa.gov	Wetland Science & Policy Manager
	Lauren Driscoll (360)407-7045, ldri461@ecy.wa.gov	Wetland mitigation policy and mitigation banking
	Christina Merten @NWRO (425)649-7007, chme461@ecy.wa.gov	Wetland mitigation banking
	Dana L. Mock (360)407-6947, dmoc461@ecy.wa.gov	Various wetland projects, including mitigation guidance updates
	Donna Bunten (360)407-7172, dbun461@ecy.wa.gov	Critical area ordinance review coordinator and other projects
	Jeanne Koenings (360)407-7258, jkoe461@ecy.wa.gov	Wetland stewardship
	Patricia Johnson 360)407-6140, pjoh461@ecy.wa.gov	Forested wetland projects (WETSAG) and other projects
	Susan Grigsby (360)407-7546, sgri461@ecy.wa.gov	Landscape planning and geographic information systems (GIS)
	Stephen Stanley @NWRO (425)649-4210, ssta461@ecy.wa.gov	Restoration and landscape planning
	Teri Granger (360)407-6857, tgra461@ecy.wa.gov	Various wetland grant projects, including best available science
	Tom Hruby (360)407-7274, thru461@ecy.wa.gov	Senior Ecologist
Central regional office 15 West Yakima Avenue, Suite 200 Yakima, WA 98902-3401 Fax: (509)575-2809 	**Cathy Reed** (509) 575-2616, craj461@ecy.wa.gov	Benton, Kittitas, Klickitat and Yakima counties
	Gary Graff (509) 454-4260, gagr461@ecy.wa.gov	Chelan, Douglas and Okanogan counties

Eastern regional office N. 4601 Monroe Spokane, WA 99205-1295 	**Chris Merker** (509) 329-3528, cmer461@ecy.wa.gov	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, and Whitman counties
Northwest regional office Mail Stop NB-81 3190 – 160th Avenue SE Bellevue, WA 98008-5452 Fax: (206)649-7098 	**Erik Stockdale** (425)649-7061, esto461@ecy.wa.gov	Watershed planning and technical assistance
	Kim Harper (425)649-7004, khar461@ecy.wa.gov	Transportation projects, Multi-agency Permitting Team (MAPT)
	Laura Casey (425)649-7148, cala461@ecy.wa.gov	San Juan, Skagit, and Snohomish counties
	Richard Robohm (425) 649-4447, riro461@ecy.wa.gov	King and Kitsap counties
	Susan Meyer (425) 649-7168, sume461@ecy.wa.gov	Whatcom and Island counties
Southwest regional office P.O. Box 47775 Olympia, WA 98504-7775 Fax: (360)407-6305 	**Gretchen Lux** (360) 407-6221, glux461@ecy.wa.gov	Clallam, Jefferson, and Mason counties
	Mark Cline (360) 407-7273, mcli461@ecy.wa.gov	Wahkiakum, Skamania, Lewis, Clark, and Cowlitz counties
	Perry Lund (360) 407-7260, plun461@ecy.wa.gov	Unit Supervisor, Grays Harbor and Pacific counties
	Karen Rogers (360)407-6294, krog461@ecy.wa.gov	Pierce and Thurston counties

Office of Regulatory Assistance (ORA) - Help with environmental permitting

ORA staff provide information regarding environmental permits issued by the State departments of Ecology, Fish and Wildlife, Health, and Natural Resources, and the local air authorities. Regional staff are available to coordinate permit applications for large, complex projects, and to work with applicants, agencies and regulatory authorities to develop a plan for meeting environmental and land-use requirements.

The Office is located in the Ecology Building at 300 Desmond Dr. SE, Lacey, WA. Staff are available Monday through Friday from 9 a.m. to 4 p.m. Although you can drop in anytime during those hours, it is recommended that you make an appointment. You can call the Office at 360-407-7037 or 800-917-0043, or e-mail them at ecypac@ecy.wa.gov or go to the website at http://www.ecy.wa.gov/programs/sea/pac.

Local Governments

Most local governments (cites and counties) maintain web sites with current contact information. The Municipal Research & Services Center of Washington maintains a current list of local government web sites (for cities and towns go to http://www.mrsc.org/byndmrsc/cities.aspx and for counties go to http://www.mrsc.org/byndmrsc/counties.aspx). This information is also accessible on the Access Washington web site, which provides Washington State Government information and services http://access.wa.gov/). You can call the Municipal Research & Services Center of Washington to get the phone number for your local government planner at (206) 625-1300.

The state Department of Community, Trade and Economic Development's (CTED) Local Government Division provides technical assistance to local governments, including growth management services. Go to http://www.cted.wa.gov/growth/ or call (360) 725-3000 for general information and to get connected with the appropriate planner who can answer specific questions.

Appendix C - Recommended Outline for Draft and Final Mitigation Plans

The outline in this appendix is provided to assist applicants (and the qualified professionals they hire) in preparing a wetland mitigation plan. A wetland mitigation plan describes a proposed development project[3], how it will affect wetlands and other aquatic resources, and how the applicant proposes to mitigate for those impacts. It is usually submitted to the agencies for review as part of a permit application. This outline identifies the recommended information for a mitigation plan. The outline includes components that are considered essential by the reviewing agencies and some that may be needed based on special conditions at the development site or the mitigation site.

Detailed descriptions and site plans of the proposed mitigation project are crucial to the ultimate success of a project and should be developed by experienced professionals. Unlike the conceptual plan (see shaded box), the draft plan should be developed at the same level of detail intended for the final plan. The main difference is that the final plan should incorporate agency comments from the draft plan and other changes that the applicant finds necessary in final revisions of the plan (see Section 2.1, *Phases of Mitigation Plan Development*).

The outline in this appendix applies ro concurrent mitigation for individual projects. If using other approaches to mitigtion (i.e., mitigation banks, in-lieu jees), contact the agencies to determine what informatioi is needed (see Appendix B). Also see Part 1, Chapter 4.

The level of detail of the information in the mitigation plan will vary by project and should be commensurate with the impacts of the development project, the type of mitigation, and the type of wetlands involved (see Section 2.2, *Level of Detail Expected in a Mitigation Plan*). Not all information in the recommended outline is relevant to all projects. Items marked with an asterisk (*) usually apply only to complex projects, those with larger impacts, or those with more complex compensatory mitigation projects that may require additional information. Agency staff can provide guidance on a case-by-case basis regarding any additional information that may be needed for specific projects.

The outline also includes discussion on some of the items listed in a shaded box or provided in the appropriate bullet. In some cases, these notes include suggestions on methods that can be used to collect the data and analyze it. However, a variety of qualitative and quantitative methods are available, and their use depends on the specifics of the development and mitigation projects.

3 In the context of this document, *development project* means any activity that will result in negative impacts to a wetland (e.g., constructing a residential subdivision, single-family residence, commercial facility, roads, installing utility lines etc.).

Appendix D contains a checklist of the information provided in this outline. The order in which the information is presented and the format used in the outline are optional and is offered as an example. If, however, the pertinent information listed in the checklist is included in a mitigation plan, review of a project can be expedited.

Conceptual Mitigation Plans

This outline, and the detailed information it represents, is not applicable to conceptual mitigation plans. A conceptual plan for the mitigation site is used to discuss possible options and opportunities with the agencies in the early stages of developing the project, and it precedes the draft and final plans. It identifies the goals and objectives of the mitigation project and describes the possible mitigation strategies that will be used to achieve them. A brief description is needed of the methods, or processes, that will be used to meet each of the objectives proposed. At this stage, detailed engineering drawings are not needed, but schematic drawings are very important. See Section 2.1.1 for an outline of the contents of conceptual mitigation plans.

1.1 Cover / Title Page

A. Project name.

B. Reference numbers (e.g., Corps application numbers).

C. Date of publication.

D. Who it was prepared for / contact information.

E. Who it was prepared by / contact information.

1.2 Table of Contents

Provide a table contents at the beginning of the document. A table of contents allows easy access to information in the document, and assists with the efficient review of the proposals for development (development project) and mitigation (mitigation project).

1.3 List of Figures

Provide a list of the figures, which may be maps, presented in the document. The figures can be inserted throughout the body of the document or collected in an appendix. They should be used to display information concerning both the wetland to which impacts are proposed (the impact site) and the site considered for the mitigation project (mitigation site) unless otherwise noted.

Figures and maps should be on 8.5" x 11" pages with north at the top. If the development and/or mitigation project is large and will not fit on a standard page, include several pages, but be careful that the information can be read at the scale used. Provide match lines for adjacent pages.

For Corps instructions for preparing project drawings go to the Seattle District Regulatory web page at http://www.nws.usace.army.mil/(Regulatory, Permit and Applicant Information, Project Drawings).

Descriptions of recommended figures/maps are provided at the end of this outline.

1.4 List of Tables

Tables can be very useful for presenting data and summarizing information, and, if used effectively, can help to speed up the review process of mitigation plans. As with figures, tables can be inserted throughout the body of the document or collected in an appendix. Descriptions of the critical tables recommended are provided at the end of this outline.

1.5 Responsible Parties

Provide names, titles, addresses, phone numbers, and information regarding the professional experience (if applicable) for those involved in the development and mitigation projects. Provide the name of the company or agency and the individuals involved.

- Applicant(s).
- Applicant's representative/agent.
- Preparer(s) of the wetland delineation report if it is different from the firm responsible for the mitigation plan.
- Preparer(s) of the mitigation plan.
- Preparer(s) of mitigation construction plans and specifications if different from preparer(s) of the mitigation plan.
- Party(ies) responsible for monitoring, long-term maintenance, and contingency plans. If this information is not known at the time the mitigation report is submitted, it should be provided with the monitoring reports.

1.6 Executive Summary

An executive summary should be prepared and placed at the beginning of the plan. It should summarize the project, its impacts, and the proposed mitigation. This may be a 1/2 to 2-page summary of the plan contents, depending on the complexity of the project and the length of the plan. The executive summary can either be narrative or a data page as shown in Appendix F.

- Applicant name / address / phone number.
- Agent / consultant.
- Brief description of the proposed development project (e.g., residential subdivision etc.).
- Location of work (e.g., county, city, state, STR [section, township, and range], global positioning system [GPS] coordinates).
- Description of the measures taken to avoid and minimize impacts to the wetland and other aquatic resources (i.e., demonstrate that mitigation sequencing was followed).
- Description of unavoidable wetland impacts and the proposed compensatory mitigation (e.g., restoration, creation, enhancement, and/or preservation).
  - Size (acres).
  - Cowardin classification.
  - Hydrogeomorphic (HGM) classification.

  - Wetland rating (Washington state & local).
  - Functions (brief summary).
  - Mitigation ratios used.
- Description of unavoidable impacts to other aquatic resources (e.g., streams, lakes, estuaries).
- Other details about the proposed mitigation project.
  - Goals and objectives.
  - Proposed improvements to the functions and environmental processes of the larger watershed.
  - Proposed buffers for the compensatory mitigation site (minimum and maximum width and total area).
  - Monitoring period and frequency.

1.7 Proposed Development Project

1.7.1 Project Description

In one or two paragraphs, describe the development project (not just the wetland area that will be affected by the development project). In the context of this document, development project means any activity that will result in negative impacts to a wetland (e.g., constructing a residential subdivision, single-family residence, commercial facility, roads, installing utility lines, etc.).

A. Project location.

- County.
- Town.
- STR (section, township, and range).
- Water Resources Inventory Area (WRIA).
- River basin.
- Sub-basin.

Also include and reference a vicinity map (see list of recommended figures and maps).

B. Type of development (e.g., land use and type of construction).

C. Size (acres) of the development project.

D. Schedule (e.g., anticipated start date and time period for construction).

1.7.2 Description of the Development Site

The purpose of this section is to describe the existing conditions of the proposed development site (i.e., before any development activities have occurred). The development site is where the development project is occurring.

A. Historic and current land uses and zoning designations.

- Historic land uses and structures on the development site and adjacent properties (if known).
- Current land uses and structures on the development site.
- Current land uses and zoning designations of adjacent properties.
- A local area map showing land uses and zoning designations (see list of recommended figures and maps).

B. Existing wetlands on or adjacent to the development site.

Information on wetlands is often provided in a wetland delineation report for the property. In this case, to avoid redundancy, the existing wetland boundaries need only be summarized in the mitigation report with a reference to the delineation report.

- A topographic base map (scale 1 in. = 400 feet or smaller) outlining the boundaries of the wetlands that are under state, federal, or local jurisdiction (see list of recommended figures and maps).
- Name of the delineation manual used and the method used (i.e., routine, intermediate, problem, or disturbed).
  - Date field work was performed.
  - Field data sheets documenting the data collected on the three criteria (hydrology, vegetation, soils).
  - List of reference material used in delineation (e.g., which soil survey).

If a separate wetland delineation report was developed, that document should be referenced and may be attached.

- Provide the total area of wetlands on the development site. Also, identify the area (acres) of individual wetlands (e.g., Wetland A is 4.5 acres, Wetland B is 2.6 acres).

C. Other aquatic resources on or adjacent to the development site.

- Description of the other aquatic resources (e.g., streams, lakes, tidal waters) on the development site or adjacent properties. And note hydrologic connections among them and with existing wetlands.

- Include and/or reference a map showing the approximate location of all aquatic resources (see list of recommended figures and maps).
- Description of any flooding that affects the development site and the location of the development within the floodplain, where applicable. Indicate on a map whether the development project is located within a mapped 100-year floodplain (see list of recommended figures and maps).

D. Known historic or cultural resources on the development site.

If a separate report on cultural/historic resources was prepared, it can simply be referenced in the mitigation plan.

- List of structures listed or eligible for historic registers.
- Brief description of resources having archaeological or cultural significance (if presence of resources suspected, consult with the Tribal Historic Preservation Office or the State Historic Preservation Office).

E. Include and reference any maps related to the existing conditions of the development site, existing wetlands, and adjacent properties (see list of recommended figures and maps).

1.8 Assessment of the Impacts at the Development Site

The purpose of this section of the document is to describe how the development project will affect wetlands and other aquatic resources. A development project can have long-term temporary, short-term temporary, indirect, and direct impacts to wetlands and other aquatic resources. All types of impacts should be described in this section.

All wetland mitigation proposals should provide detailed documentation on how wetlands and other aquatic resources will be adversely affected at the proposed development site.

A. Area (acreage) of the wetland being affected by the development project.

- Provide the total area of wetlands that will be affected by the development project (wetland impacts). This includes temporary, temporal, indirect, and direct impacts (see Part 1, Section 3.6 for a description of the types of impacts).
- Identify the area of individual wetlands that will be affected (e.g., 2 acres of Wetland A, 1.2 acres of Wetland B). Compare to total area described in 1.7.2(b).
- Indicate these areas on the topographic map (see list of recommended figures and maps).

B. Description of the water regime that will be affected.

- Description of the source of water to the wetland being affected by the development project. If several sources are present, estimate the percentage

contribution from each (i.e., stream flow, surface runoff, direct precipitation, etc.).

- Description of hydrologic regime of the wetland being affected (i.e., rough, qualitative estimate of duration and frequency of inundation and/or saturation. Use generally accepted terms such as permanent open water, seasonally flooded, seasonally saturated, wet pasture, etc.).
- Map of the surface and groundwater flowing into the impacted area with the directions of water flow indicated.

C. Description of the soils of the wetland that will be affected.

- Description of the soil characteristics of the wetland being affected including; soil type and classification; and a description of texture, color, structure, permeability, and organic content.
- Soil survey map (indicate the source of the map).
- Map showing soil sampling locations (typically the location of the soil pits used for delineation).

D. Description of the vegetation of the wetland that will be affected.

- Qualitative descriptions of the different Cowardin (1979) classes at the wetland being affected (include subclass and water regime modifiers). If a forested class is present, also estimate the average age of the canopy species.
- Estimate of the relative abundance of dominant and subdominant plants within each Cowardin class (use information collected during routine delineation unless more detailed data are available).
- List of the wetland indicator status of dominant and subdominant species (e.g., obligate - OBL, facultative - FAC, facultative wet - FACW).
- Description of the prevalence and distribution of non-native and/or invasive species, if any are present at the wetland being affected.
- General description of upland plant communities within 330 ft (100m) of the wetland being affected, if any.
- List of rare plants and plant communities that are known to occur on the development project site or adjacent properties. If any of these species are observed on the site, include descriptions of the occurrence and any potential impacts to them.

The Washington Department of Natural Resources maintains a list of rare plants and high quality/rare ecological communities.

Rare Plants http://www.dnr.wa.gov/nhp/refdesk/plants.html

High Quality/Rare Ecological Communities
http://www.dnr.wa.gov/nhp/refdesk/communities.html

E. Description of fauna known to use the wetland that will be affected.

If a biological assessment was prepared for the project, the report can simply be referenced in the mitigation plan.

- Description of the animals (including amphibians) using the wetland being affected and their buffers. Especially note evidence of past or present beaver use. In most cases, a list of species likely to use the habitats on the site is sufficient, with brief descriptions of the existing habitats.
- Include a description of endangered, threatened, sensitive, and candidate animal species that are known to occur in the general area (distance depends on species) of the development site, as well as observations of such species. Also, include those listed as "Priority Species" or "Species of Concern" by the Washington Department of Fish and Wildlife (see shaded box below).

Washington Department of Fish and Wildlife, Priority Habitats and Species List can be found on-line at http://wdfw.wa.gov/hab/phspage.htm.

Species of Concern in Washington include all State Endangered, Threatened, Sensitive, and Candidate species. Species of Concern also include Federal Endangered, Threatened, and Candidate fish stocks. Species of Concern are also considered priority species. They can be found on-line at http://wdfw.wa.gov/wlm/diversty/soc/concern.htm.

F. Description of the landscape position and geomorphology of the wetland that will be affected.

- Class of the wetland being affected by the development project. Use the hydrogeomorphic classification (class and subclass) to describe its position in the watershed.
- Qualitative description of the functions performed by the wetland being affected relative to the position in the watershed. This may include its role in attenuating flooding, as a corridor for wildlife between different regions of the watershed, as part of a regional flyway, or in improving water quality regionally.

G. Description of the functions provided by the wetland that will be affected.

- Description of the functions provided by the wetland being affected and to what level they are performed (e.g., the site provides the function "Removing Sediment" at a high level, the score for "Removing Sediment" that results from applying [name the method] is X, with X being the highest score that can be achieved).

Wetlands perform many different functions. Not all wetlands, however, perform all functions to the same level, and the level of detail needed in the assessment for each function may vary. The type of information needed (qualitative vs. quantitative), and therefore the method used to assess functions, varies depending on the scale of the impact (size/type), the complexity of the wetland, etc. See Part 1, Appendix G for a description of the various methods for assessing wetland functions in Washington.

In order to compare the impact site with the mitigation site, it is imperative that the methods used for assessing each be the same. In addition, the same method should be used for monitoring the mitigation site.

- Qualitative or quantitative description of the characteristics that enable the wetland being affected to perform specific functions, depending on the method used. (For example, the site removes sediment effectively due to the dense, persistent vegetation that covers 80% of the site and 100% of the area that experience over-bank flooding from the stream. It also occurs in a depression with a restricted outlet thereby reducing the velocity of water flow allowing sediment to be deposited in the site.)
- Description of the sampling and assessment methods used.
- Documentation of the training of professionals assessing the functions.
- List of the references consulted.

H. Categorization of the wetland that will be affected (wetland rating).

The rating systems can be found on-line at http://www.ecy.wa.gov/programs/sea/wetlan.html.

- The category of the wetland being affected using the Washington State rating system for eastern Washington or western Washington (as revised, current versions are Hruby 2004a,b).
- Copies of the original data sheets used to rate the wetland.

I. Description of the existing buffers on the development site.

- Size (width) of the undeveloped upland buffer within 330 feet (100m) of the wetland being affected by the development project.
- Qualitative description of the dominant vegetation in the buffer and the physical structure of plants in it (e.g., deciduous forest, coniferous forest, and prevalence of snags and downed woody debris).
- Maps of the buffer areas and the vegetation types (see list of recommended figures and maps).

J. *Information on water quality, where applicable.

Record known or observable sources of sediment, nutrients, hydrocarbons, and other pollutants that affect wetlands and other aquatic resources on the development site.

Basic water quality parameters that should be considered include dissolved oxygen (DO), pH and alkalinity, temperature, turbidity/suspended solids/sediment accretion, nutrients, fecal coliform, and heavy metals. For projects with streams or lakes on site, consult the Washington State's water quality 303(d) list for information on existing water quality problems. It can be found on-line at http://www.ecy.wa.gov/programs/wq/links/impaired_wtrs.html.

- Description of any known water quality problems at the development site and whether they will continue after the development project is completed.
- Assessment of whether the development project is expected to worsen or improve existing water quality conditions.

1.9 Mitigation Approach

A. Mitigation sequencing.

The first step of any development project should be to avoid impacts to wetlands and other aquatic resources to the maximum extent practicable. An explanation of the steps taken to avoid and minimize wetland impacts must be provided. See Part 1, Section 3.5 for more details.

- Descriptions of the specific steps taken to avoid and minimize impacts to the maximum extent practicable. *Larger projects may need to include an Alternatives Analysis in an appendix.
- Description of the specific steps taken to minimize wetland impacts to the site or to reduce impacts over time (e.g., timing of project, redesign of project, orientation, and/or location). *Where applicable, note how proposed stormwater treatment facilities may reduce water quality impacts.
- Discussion of wetland rectification strategies. Where applicable note how temporary impacts, occurring during implementation of the development project, could be rectified through restoration and maintenance activities (e.g., removal of temporary fill for an access road, re-vegetation of wetland area).
- Notation of the size and type of compensation being proposed. Include a description of the mitigation ratios and why they are adequate to compensate for the lost or degraded area and functions. A table is recommended to summarize this information. A full description of the compensatory mitigation should be provided as described in the following sections.

B. Project-specific goals.

> Identify the goal or goals of the compensatory mitigation project (i.e., provide adequate compensation for losses and degradation to wetland area and function). Refer to Part 2, Section 3.2 for more details.

C. Mitigation strategy.

> Describe in general terms the strategies (actions) that will be used to achieve the goals.

1.10 Proposed Mitigation Site

> Describe the site or sites selected for mitigation and the rationale for the choice. See Part 2, Section 3.3 for more details on selecting a compensatory mitigation site.

A. Site Location. Include map showing the location of site in relation to the project impact site (see list of recommended figures and maps).

B. Site ownership[4].

C. Rationale for why the site was chosen for mitigation.

- Discuss how the site fits with the environmental needs in the watershed. If watershed or regional planning efforts exist for the area, explain how the selection of the compensation site is consistent with those plans.

D. Description of the constraints at the mitigation site, that could affect the success of the mitigation project, and strategies used to address each constraint. (Constraints may include factors outside of the control of the applicant such as a primary water source for the mitigation wetland originating offsite, the potential for other landowners to alter the source, etc.)

4 If the compensatory mitigation site is proposed on state-owned aquatic lands, authorization to use the lands for compensatory mitigation must be issued from the Washington State Department of Natural Resources.

1.11 Existing (Baseline) Conditions of the Mitigation Site

The purpose of this section is to document the existing (baseline) conditions of the site that will be used for compensatory mitigation (i.e., before any mitigation activities have occurred). The technical information provided should demonstrate that the chosen mitigation site or sites has the potential to meet the overall goals of the mitigation project (i.e., that it will adequately compensate for lost or degraded wetlands).

All mitigation plans should provide this type of documentation. It should be provided no matter what type of compensation is proposed (e.g., enhancement, creation). Assessing the existing environmental conditions helps to identify important features that may affect the mitigation design and the ultimate success of the site; to evaluate the type and extent of the improvement in function expected from the mitigation project; and to understand pre-existing conditions for tracking how similar sites progress and develop.

Without a detailed assessment of the proposed mitigation site, important features may otherwise be overlooked. The list of information needed for the mitigation site is similar, but not identical to, the list for the development site (see 1.7.2 and 1.8). The level of detail needed will vary with each site.

A. A summary of historic and current land uses and zoning designations on the mitigation site and adjacent properties.

- Historic land uses and structures on the mitigation site and adjacent properties (if known).
- Current land uses and structures on the mitigation site.
- Current land uses and zoning designations of adjacent properties.
- A local area map showing land uses and zoning designations (see list of recommended figures and maps).

B. A description of any known historic or cultural resources on the mitigation site.

If a separate report on cultural/historic resources was prepared, it can simply be referenced in the mitigation plan.

- List of structures listed or eligible for historic registers.
- Brief description of resources having archaeological or cultural significance (if presence of resources suspected, consult with the Tribal Historic Preservation Office or the State Historic Preservation Office).

C. A description of any existing wetlands on the mitigation site and adjacent properties.

> Information on wetlands is often provided in a wetland delineation report for the property. In this case, to avoid redundancy, the existing wetland boundaries need only be summarized in the mitigation report with a reference to the delineation report.

- A topographic base map (scale 1in. = 400 feet or smaller) outlining the boundaries of the wetlands that are under state, federal, or local jurisdiction (see list of recommended figures and maps).
- Name of the delineation manual used and the method used (i.e., routine, intermediate, problem, or disturbed).
  - Date field work was performed.
  - Field data sheets documenting the data collected on the three criteria (hydrology, vegetation, soils).
  - List of reference material used in delineation (e.g., which soil survey).

  If a separate wetland delineation report was developed, that document should be referenced and may be attached.
- Provide the total area of wetlands on the mitigation site. Also, identify the area (acres) of individual wetlands (e.g., Wetland A is 4.5 acres, Wetland B is 2.6 acres).

D. A description of other aquatic resources on the mitigation site and adjacent properties.

- Description of the other aquatic resources (e.g., streams, lakes, tidal waters) on the mitigation site and adjacent properties. And note hydrologic connections among them and with existing wetlands.
- Include and/or reference a map showing the approximate location of all aquatic resources (see list of recommended figures and maps).
- Description of any flooding that affects the mitigation site and the location of the development within the floodplain, where applicable (indicate on a map whether the development project is located within a mapped 100-year floodplain).

F. *Map showing current contours as surveyed. This is needed particularly when mitigation activities will alter ground elevations (see list of recommended figures and maps)

G. Description of the water regime of the mitigation site.

- Description of the source of water to the mitigation site. If several sources are present, estimate the percentage contribution from each (i.e., stream flow, surface runoff, direct precipitation, etc.).
- Description of the existing water regimes at the mitigation site (i.e., rough, qualitative estimate of duration and frequency of inundation and/or saturation.

Use generally accepted terms such as permanent open water, seasonally flooded, seasonally saturated, wet pasture, etc.).

- Map of the surface and groundwater flowing into the mitigation area with the directions of water flow indicated (see recommended list of figures and maps).
- *For more complex mitigation projects, quantitative information on the water regime may be required.

H. Description of the soils of the mitigation site.

- Description of the soil characteristics of the mitigation site including; soil type and classification; and a description of texture, color, structure, permeability, and organic content. Use soil surveys confirmed by representative soil samples.
- Soil survey map (indicate the source of the map).
- Map showing soil sampling locations (typically the location of the soil pits used for delineation).

I. Description of the vegetation of the mitigation site.

- Qualitative descriptions of the different Cowardin (1979) classes at the mitigation site (include subclass and water regime modifiers). If a forested class is present, also estimate the average age of the canopy species.
- Estimate of the relative abundance of dominant and subdominant plants within each Cowardin class (use information collected during routine delineation unless more detailed data are available).
- List of the wetland indicator status of dominant and subdominant species (e.g., obligate - OBL, facultative - FAC, facultative wet - FACW).
- Description of the prevalence and distribution of non-native and/or invasive species, if any are present.
- General description of upland plant communities within 330 ft (100m) of the mitigation site, if any.
- List of rare plants and plant communities that are known to occur on the mitigation site or adjacent properties. If any of these species are observed on the site, include descriptions of the occurrence and any potential impacts to them.

The Washington Department of Natural Resources maintains a list of rare plants and high quality/rare ecological communities: Rare Plants http://www.dnr.wa.gov/nhp/refdesk/plants.html, High Quality/Rare Ecological Communities http://www.dnr.wa.gov/nhp/refdesk/communities.html.

J. Description of fauna known to use the mitigation site.

If a biological assessment was prepared for the project, the report can simply be referenced in the mitigation plan.

- Description of the animals (including amphibians) using the mitigation site. Especially note evidence of past or present beaver use. In most cases, a list of species likely to use the habitats on the site is sufficient, with brief descriptions of the existing habitats.
- Include a description of endangered, threatened, sensitive, and candidate animal species that are known to occur in the general area (distance depends on species) of the mitigation site, as well as observations of such species. Also, include those listed as "Priority Species" or "Species of Concern" by the Washington Department of Fish and Wildlife (see shaded box below).

Washington Department of Fish and Wildlife, Priority Habitats and Species List can be found on-line at http://wdfw.wa.gov/hab/phspage.htm.

Species of Concern in Washington include all State Endangered, Threatened, Sensitive, and Candidate species. Species of Concern also include Federal Endangered, Threatened, and Candidate fish stocks. Species of Concern are also considered priority species. They can be found on-line at http://wdfw.wa.gov/wlm/diversty/soc/concern.htm.

K. Description of the landscape position and geomorphology of the mitigation site.

- Class of any existing wetlands on the mitigation site. Use the hydrogeomorphic classification (class and subclass) to describe the position in the watershed.
- Qualitative description of the functions performed by the mitigation site relative to the position in the watershed. This may include its role in attenuating flooding, as a corridor for wildlife between different regions of the watershed, as part of a regional flyway, or in improving water quality regionally.

L. Description of the functions provided by the mitigation site.

Wetlands perform many different functions. Not all wetlands, however, perform all functions to the same level, and the level of detail needed in the assessment for each function may vary. The type of information needed (qualitative vs. quantitative), and therefore the method used to assess functions, varies depending on the scale of the impact (size/type), the complexity of the wetland, etc. See Part 1, Appendix G for a description of the various methods for assessing wetland functions in Washington.

In order to compare the impact site with the mitigation site, it is imperative that the methods used for assessing each be the same. In addition, the same method should be used for monitoring the mitigation site.

- Description of the functions provided by the mitigation site and to what level they are performed (e.g., the site provides the function "Removing Sediment" at a high level, the score for "Removing Sediment" that results from applying [name the method] is X, with X being the highest score that can be achieved.)
- Qualitative or quantitative description of the characteristics that enable the mitigation site to perform specific functions, depending on the method used. (For example, the site removes sediment effectively due to the dense, persistent vegetation that covers 80% of the site and 100% of the area that experience over-bank flooding from the stream. It also occurs in a depression with a restricted outlet thereby reducing the velocity of water flow allowing sediment to be deposited in the site.)
- Description of the sampling and assessment methods used.
- Documentation of the training of professionals assessing the functions.
- List of the references consulted.

M. Categorization of any existing wetlands on the mitigation site(wetland rating)

- The category of any existing wetlands using the Washington State rating system for eastern Washington or western Washington (as revised, current versions are Hruby 2004a,b).
- Copies of the original data sheets used to rate the wetlands.

The rating systems can be found on-line at http://www.ecy.wa.gov/programs/sea/wetlan.html.

N. Description of existing buffers for wetlands and aquatic resources on the mitigation site.

- Size (width) of any undeveloped upland buffers within 330 feet (100m) of the mitigation site. Note how much of the existing buffers extend off-site.
- Qualitative description of the dominant vegetation in the buffer and the physical structure of plants in it (e.g., deciduous forest, coniferous forest, and prevalence of snags and downed woody debris).
- Maps of the buffer areas and the vegetation types (see list of recommended figures and maps).

O. *Information on water quality, where applicable.

- Description of any known water quality problems at the mitigation site and whether they will continue after the mitigation project is completed.
- Assessment of whether the mitigation project is expected to worsen or improve existing water quality conditions.

This applies to projects where the water quality of wetlands or other aquatic bodies on the mitigation site could potentially be affected by mitigation activities. Baseline data on water quality should be collected by monitoring the mitigation site prior to construction activities. The goal is to know what the water quality is prior to mitigation activities, so that if a change occurs, it can be measured against a background standard. Record known or observable sources of sediment, nutrients, hydrocarbons, and other pollutants that affect wetlands and other aquatic resources on the development site.

Basic water quality parameters that should be considered include dissolved oxygen (DO), pH and alkalinity, temperature, turbidity/suspended solids/sediment accretion, nutrients, fecal coliform, and heavy metals. For projects with streams or lakes on site, consult the Washington State's water quality 303(d) list for information on existing water quality problems. It can be found on-line at http://www.ecy.wa.gov/programs/wq/links/impaired_wtrs.html.

K. Include and reference any maps related to the existing conditions of the mitigation site, existing wetlands, and adjacent properties (see list of recommended figures and maps).

1.12 Mitigation Site Plans / Design

1.12.1 Description of Site Plan/Design

A. A qualitative description of the water regime and how adequate amounts of water will be provided to support a wetland over the long term. Describe the proposal and the hydrologic data that will be provided to support your proposal. If the project may result in withdrawal of surface or groundwater, then contact the Department of Ecology Water Resources Section to determine whether a water right permit is needed, and provide documentation to that effect. Information on water rights can be found on-line at http://www.ecy.wa.gov/programs/wr/rights/water-right-home.html..

B. Discuss how the mitigation plan will compensate for lost and degraded functions. Provide rationale for each proposed function and describe the design features that would contribute to providing the function.

C. Provide schematic drawings showing:

- Proposed changes in topography (a general drawing not as detailed as the one requested in 1.12.2[B]).
- Water control structures (a general drawing not as detailed as the one requested in 1.12.3[B]).
- Proposed distribution of plant communities (a general drawing not as detailed as the one requested in 1.12.5[A]).
- Habitat structures and their location (a general drawing not as detailed as the one requested in 1.12.5[J]).

- Existing and proposed buffers (a general drawing not as detailed as the one requested in 1.12.2 [L] and 1.12.5[I]).

D. *Provide section drawings, which show the relationship of topography, the water regime, and vegetation. These are needed primarily when the project entails alteration of the existing grade.

1.12.2 Grading Plan / Site Maps

Site surveys are needed when the mitigation project includes changes to ground elevations. If no changes to grade are proposed, then a simpler map of the site would be sufficient showing property and wetland boundaries, landmarks, scale, site features, and other existing conditions.

A. Orientation and scale (i.e., north arrow; typical scales are 1 inch = 25 or 50 feet).

B. *Existing and proposed elevation contours. Contours at one-foot intervals are typically sufficient for most mitigation plans. Contours at 6-inch intervals may be desirable in certain cases where the seasonal fluctuation of water levels is low or in specific areas on the mitigation site where it is critical to have a high level of accuracy (e.g., wetland outlets, water control structures, areas where vegetation is proposed that has a narrow range of tolerance in water depths and fluctuations in depths).

C. *Spot elevations for low points, high points and structures (such as culverts, hydraulic controls, utilities, and roads).

D. Property boundaries.

E. On-site wetland boundaries (including all wetlands existing and after mitigation).

F. *On-site floodplain and ordinary high water mark (OHWM) boundaries, if applicable.

G. *Survey of benchmarks.

H. *Location and elevation of soil borings or test pits.

I. *Location and elevation of water level sampling devices (i.e., shallow wells, staff gauges, piezometers, continuous monitoring devices).

J. *Location of soils to be stockpiled, if any.

K. *Description of methods of erosion control and bank stabilization, if applicable.

L. Buffer areas proposed for the mitigation site and their boundaries.

1.12.3 Water Regime

A. Description of the proposed frequency and duration of flooding, inundation, or soil saturation.

B. Description of the proposed groundwater and surface water sources and characteristics.

C. *Description of the elevation of the water table and dates when measured (note if table is perched).

D. *Engineering drawings of any proposed water control structures.

1.12.4 Soils

A. Soil logs from an on-site evaluation. Depending on proposed depth of grading, soil information may come from hand-dug shallow pits or from deeper samples that are typically obtained with small drilling rigs. At a minimum, the shallow soil profile should be described even if no changes in site elevations are proposed.

B. Description of how the soil characteristics will be affected by the mitigation activities.

1.12.5 Planting / Landscape Plans

For most projects, planting plans should be prepared by a landscape architect with assistance from a wetland or plant ecologist. In some cases where very simple planting plans are proposed for small areas, the level of expertise provided by a landscape architect may not be needed. The list below includes the minimum information needed for planting plans. If you are enhancing or otherwise altering buffers, include the same information for the buffer.

If vegetation is temporarily removed from the wetland or buffer, a planting plan or, at a minimum, a table summarizing the species, sizes, types, and densities of plants that will be installed to restore vegetation to those areas following construction should be provided.

If relying on natural revegetation, it is critical to provide information on the vegetation present on surrounding sites and information on the existing seedbank (see Section 3.4.1.3 for more information).

Information from a selected reference site (see Part 2, Section 3.4.3) can be used to provide guidance in designing planting plans.

A. Topographic map on which the distribution and spacing of vegetation to be planted is displayed or a typical planting scheme for each plant community (e.g., a black cottonwood [*Populus trichocarpa*] and slough sedge [*Carex obnupta*] community) with planting densities specified. Hatched polygons can be used to indicate where each plant community will be located on the site (see recommended figures and maps).

B. List of plant materials (common and Latin name of each species to be used, size of each that will be planted, source of nursery stock or seed, quantity, etc.).

C. Other planting details as needed to assure success.

D. Expected natural revegetation from existing seed bank and natural recruitment from nearby sites.

E. Description of the methods that will be used to control invasive and exotic plants if they exist in the vicinity.

F. A plan for irrigating the plants until they are established including method, frequency, and amount of water.

G. Description of soil amendments, including use and sources of mulch.

H. *Section drawings showing water levels in relation to plant distributions. The projected average water level during winter wet season, early growing season, and late summer dry season should be displayed.

I. Description of protective features such as buffers, fences, signs.

J. Map of the location and type of habitat structures or habitat features (see recommended list of figures and maps).

1.12.6* Examples of Similar Mitigation Projects

If the mitigation project is perceived by the designers or agency staff to have a higher risk of failure, the mitigation plan should describe the experience the designer has had with this type of mitigation proposal. It should provide examples of sites where the approach proposed has previously been used successfully. Projects with heightened risk may include those that propose an unusual approach or incorporate experimental features or structures. Examples include projects in areas that don't appear to be conducive to the establishment of wetlands or projects that require extraordinary or unusual measures (e.g., deep excavation, stream relocation, clay liners) to meet project objectives. This section of the mitigation plan should provide good assurance that a high-risk plan will be successful.

A. Description of the experience the designer has had with the type of mitigation proposed.

B. Examples of sites where the approach has previously been used successfully.

C. Information that demonstrates that the high-risk plan will be successful.

1.13 Site-Specific Goals, Objectives, and Performance Standards

The goals and objectives for a mitigation site are intended to describe the ecological functions planned for the site and how those will be achieved. Performance standards are used to evaluate if the goals and objectives are being met. Each objective should be matched with one or more appropriate performance standards along with methods for monitoring them. In addition, maintenance and contingency measures should also be designed for each objective. See Section Part 2, Section 3.4.2, for more discussion of goals, objectives, and performance standards. Examples are provided in this section.

A. Description of the long-term goals of the mitigation project should be provided and should address:

- The size of the mitigation site (in acres).
- Cowardin class, hydrogeomorphic class or subclass, and categorization (rating) using the Washington State wetland rating system (Hruby 2004a and 2004b), for the wetlands to be restored, created, enhanced, and/or preserved.
- Target functions and/or environmental processes to be restored, created, enhanced and/or preserved.

B. Description of the objectives for each goal, with a minimum of at least one measurable objective for each goal.

C. List of performance standards for each objective (specify the conditions that must occur on the mitigation site in order to meet the established objectives).

1.14 Monitoring Plan

A monitoring plan describes the methods used to collect and analyze data needed to show that performance standards are being met. Monitoring plans are used to track environmental changes at mitigation sites throughout the monitoring period and are required by agency staff. Monitoring plans will vary depending on mitigation objectives and performance standards, but all must be designed to assess the quantitative or qualitative performance standards. The plan should also identify how representative sampling sites will be chosen since this is critical for providing an accurate assessment of the performance standards.

As mentioned previously, the methods used for monitoring specific variables generally need to be the same as those used in establishing baseline data at either the wetland to be affected by the development project or at the reference site. See Section 3.6.3 for further discussion of monitoring.

Monitoring plans will typically include the elements described below.

A. Variables to be measured (i.e., plant survival, canopy cover, plant diversity, water levels and duration of inundation/saturation).

B. Sampling methods for each variable.

C. Schedule for sampling each variable.

D. A map of the sampling locations for each variable. Or describe the methods that will be used to determine sampling locations for each monitoring event. Permanent sampling locations may be the best choice for some variables, but for others, such as percent cover of vegetation, sampling locations may be varied through random selection or other methods for each monitoring event. The map should include clearly identifiable markers on the ground to act as reference points for orientation. These may include roads, benchmarks, and permanent structures.

E. *Laboratory methods to be used, if applicable.

F. Provide a timetable for reporting monitoring results to the agencies. Generally, tie the specific dates to the start of construction (e.g., the first year's monitoring report will be submitted 15 months after the start of construction). (Also see Appendix L for a *Monitoring Report Checklist*.)

1.15 Site Protection

The mitigation plan needs to specify what measures will be taken to protect the site for the long term. The agencies will require some legal proof (e.g., deed restriction, conservation easement) that the site is adequately protected. Section 3.6.2 describes common legal mechanisms for protecting a mitigation site.

Copies of the conservation easement, deed restrictions, or other legal instruments should be provided with the final mitigation plan.

1.16 Maintenance and Contingency Plans

1.16.1 Maintenance Plan

Designing and implementing an appropriate maintenance plan is crucial to the success of a mitigation project. The need for activities such as inspecting irrigation systems, replacing plants, weeding, preventing or managing herbivory, removing trash, and controlling erosion (and for the funding to conduct them) should be anticipated based on the site characteristics, level of public access to the mitigation site, and typical uses of adjacent areas. However, frequency of the activities may change through the monitoring period so maintenance plans should be written with room for flexibility.

A. Description of and reason for each maintenance activity planned.

B. Maintenance schedule for each activity (where applicable).

1.16.2 Contingency Plan

A contingency plan is necessary in case the actions undertaken for the mitigation fail or only partially succeed. A contingency plan contains corrective measures that will be taken if monitoring indicates that performance standards are not being met. The contingency plan should outline the steps that will be taken for each performance standard if it is not met. The points listed below are essential in a contingency plan.

A. Description of initiating procedures. If a performance standard is not met within the time specified in the mitigation plan the permittee will be required to complete the activities in the following list. Minor corrective measures may be taken as part of routine maintenance, and should merely be identified in subsequent monitoring reports. Reporting "problems" in a timely manner will allow mid-course corrections and avoid possible enforcement actions.

- An analysis of the causes of failure.
- Description of the proposed corrective actions.

- Time frame for implementing these actions (which need to be approved by the agencies).

B. *Description of a contingency fund. A contingency fund should be established for use if any corrective actions are necessary. The contingency fund is a type of financial assurance that has a limited purpose and can be combined with other financial assurances when appropriate (see 1.20). Its purpose is to assure implementation of necessary corrective actions in the event the project does not achieve its performance standards at the end of the monitoring period. The description should include what funds will be available for planning, implementing and monitoring any contingency procedures that may be required to achieve the mitigation goals. Generally, the fund amount should equal about 20% of the total cost of mitigation associated with the project.

1.17 Implementation Schedule

The schedule for implementing the mitigation actions should provide a detailed outline of the approximate starting time and duration of all major earth moving, planting, and construction activities that will take place at the mitigation site.

A. Construction sequence for grading, water diversions, plantings, etc.

B. Time schedule and completion dates (must be concurrent with or prior to construction activities that cause the impact[s]). Delays in implementing the construction of the mitigation site may result in an increase in the mitigation required and enforcement actions.

C. Permit conditions specifying time limits.

1.18 *Financial Assurances

If financial assurances are required, describe them here. The mitigation plan should describe what type of financial assurance will be in place. In certain cases the agencies may require an applicant to provide a financial assurance before issuing a permit. Financial assurances include performance bonds, dedicated bank accounts, and other financial instruments. A financial assurance provides a third party the necessary financial resources to implement the mitigation project should the applicant fail to do so. Financial assurances may be released when certain activities are completed successfully:

- Construction of the mitigation site.
- Submittal of an as-built report after construction is completed.
- Submittal and acceptance of annual monitoring reports.
- Implementation of corrective measures.

Recommended Figures and Maps

The list of recommended figures and maps have also been described throughout the recommended outline. Many of the maps below may be combined where appropriate. For example, NWI maps (item F) typically come on 1:24K-scale topo maps (item B).

A. Vicinity map. This map should show the general location of the project within the county or city, and the proximity of the development site relative to the mitigation site. The map should have major roads, cities, towns and other landmarks clearly identified.

B. U.S. Geological Survey (USGS) quadrangle map (1:25,000 or 1:24,000), with the development site and mitigation site and their drainage basins clearly marked. This means marking the boundary of the immediate watershed in which the site occurs. By immediate watershed we mean the catchment that drains to the subject wetland. Catchment is defined as the smallest unit within a subwatershed that demarcates the area that drains to a wetland (or stream).

   The boundaries can be identified using existing resources such as watershed or basin management plans. Alternatively, the topographic map can be marked to indicate all the area that drains to the site and to which the site drains. Watershed boundaries generally connect high points and ridges that are the dividing lines in determining the direction in which water moves on the landscape. The bottom of the watershed may be a lake, a coastline, or the point at which the creek in the watershed flows into a larger creek or river.

The Methods for Assessing Wetland Functions (Hruby et al. 1999 and 2000) provides some guidance on delineating watersheds (Hruby et al. 1999, Part 2, Appendix J, Interpretation of Topographic Maps and Watershed Delineation, which can be found on-line at http://www.ecy.wa.gov/programs/sea/pubs/99115/99-115part2.PDF).

C. Local area map (scale not larger than 1 inch = 400 feet) showing the development site and mitigation site and zoning designations and land uses of adjoining parcels. (This map may be larger than the standard 8.5" x 11" page). Include clearly identifiable markers on the ground for orientation; these "reference points" might include existing roads, fence lines, conspicuous trees, or structures to help locate the site "on the ground." It is often simplest to mark site location and zoning designations on a recent aerial photo where neighboring developments can simply be viewed on the photo. However, developments that have occurred since the photo was taken should be marked on the photo so that current conditions are reflected.

D. Aerial photo (scale 1 in. = 400 ft. to 1 in. = 100 ft.) with overlays displaying the sites and wetland boundaries. Existing aerial photos can be copied or purchased from a variety of sources such as university libraries, Washington State Department of Transportation (if site is near state highways), Washington State Department of Ecology (oblique aerial photos of areas along state shorelines are available on their web site), Washington State Department of Natural Resources, and others.

E. Topographic base map (scale not larger than 1 in. = 400 ft.) showing existing conditions of the development site and mitigation site. This map should include wetlands and other waters of the U.S./state that are under state, federal, or local jurisdiction; topography; structures; roads/driveways; edge of vegetation lines (e.g., edge of existing forested area); fence lines; registered well locations and other relevant existing features.

F. U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory Map with the site identified. This may be combined with the topo map in item "B" above.

G. Map showing the approximate location of all aquatic resources. This map should display existing wetlands, streams, and lakes at or near (within about 300 feet) the site. This information can be prepared using local critical areas inventories, basin plans, National Wetlands Inventory maps, USGS maps, state stream catalog, or other sources.

H. Floodplain map displaying the development and mitigation site in relation to flood plains.

I. Map of the project plan showing the development footprint and indicating the areas of affected wetlands and other aquatic resources.

J. Soil survey map with the site identified and with the source of the information noted (in the text include a description of the soil series and note any hydric soils).

K. Map showing soil sampling locations. Typically the location of the soil pits used for delineation (the delineation report can simply be referenced).

L. Map of buffer areas at the development and mitigation site with vegetation types indicated.

M. Maps of the proposed planting plan for the mitigation site. Maps (or tables also listed in the next section) should indicate plant species, plant form (e.g., container, bare root), plant size, number of plants, planting densities, and planting details (e.g., detail of how container plants will be installed).

N. Map showing current contours of the mitigation site as surveyed. This is required for mitigation proposals that involve earthwork (grading on the mitigation site[s]). A contour interval of one foot is typically needed, although this may vary from project to project.

O. Map of the proposed grading plan (if applicable) for the mitigation site. These are typically at one-foot contour intervals. If staff gauges/shallow monitoring wells/piezometers were installed on site to monitor existing hydrology, it is useful to show these and to note their elevations on the grading plan. This is used to interpret the water level data and allows easy comparison of water levels to proposed grading elevations. Soil sampling locations can also be marked on the grading plans.

P. Map of the location of habitat structures / features.

Q. Schematic drawings showing:

- Proposed changes in topography.
- Water control structures.
- Proposed distribution of plant communities.
- Habitat structures and their location.
- Existing and proposed buffers.

R. Section drawings, which show the relationship of topography, the water regime, and vegetation. These are needed primarily when the project entails alteration of grade elevations.

Recommended Tables

1. Summary of key information regarding the wetlands that will be impacted. The information should include their ratings (both local and State of Washington), hydrogeomorphic (HGM) classes, Cowardin classes, total size, area of permanent impacts to wetlands and buffers (direct impact and indirect), and area of temporary impacts to wetlands and buffers. Total acreage of impacts should be summarized for every category (e.g., impacts to Category 2 wetlands and palustrine forested areas, direct impacts, and so on) either in this same table or a separate one.

2. Summary of the functions of the impacted wetlands.

3. Summary of the proposed mitigation ratios. The summary should include each rating category, acres of mitigation needed based on those ratios, and acres of proposed mitigation broken down by type (e.g., restoration, enhancement).

4. Summary of the key elements of the proposed planting plan for the mitigation site(s). Tables should indicate plant species, plant form (e.g., container, bare root), plant size, number of plants, planting densities, and planting details (e.g., detail of how container plants will be installed).

5. Summary of water level monitoring data at the mitigation site(s). This is applicable for projects that are proposing grade changes as part of the mitigation.

Appendix D - Mitigation Plan Checklist[5]

Included	Omitted	Introduction and Summary of Document
		Cover / Title Page
		Project Name
		Reference #'s (e.g., Corps application #)
		Date of publication
		Who it was prepared for and by / contact information
		Table of Contents
		List of Figures
		List of Tables
		Responsible Parties
		Executive Summary
		Proposed Development Project
		Project description
		Project location, maps
		Type of development (existing and proposed land uses)
		Size of the development project
		Construction schedule
		Description of the development site (baseline conditions)
		Historic and current land uses and zoning designations
		Existing wetlands on or adjacent to the development site
		Other aquatic resources on or adjacent to the development site
		Known historic or cultural resources on the development site
		Maps showing the baseline conditions of the development site and adjacent properties
		Assessment of the Impacts at the Development Site
		Area (acreage) of wetland impacts
		Description of the water regime
		Description of the soils
		Description of the vegetation
		Description of fauna using the site
		Position and function of the wetland(s) in the landscape
		Description of functions provided by the wetlands

5 Items with asterisk (*) are required for more complex projects. See Section 2.2 for more details. If an item is not required for a draft mitigation plan it is indicated in parentheses (final plan only).

		Wetland rating
		Buffers
		*Water quality
		Mitigation Approach
		Mitigation sequencing
		Project-specific goals
		Mitigation strategy
		Proposed Mitigation Site(s)
		Location, including map
		Site ownership
		Site selection rationale
		Site constraints
		Existing (Baseline) Conditions of the Mitigation Site
		Historic and current land uses and zoning designations
		Known historic or cultural resources on the mitigation site
		Existing wetlands on or adjacent to the development site
		Other aquatic resources on or adjacent to the development site
		*Maps showing current contours as surveyed. This is needed particularly when mitigation activities will alter ground elevations.
		Description of the water regime
		Description of the soils
		Description of the vegetation
		Description of fauna using the site
		Position and function of the wetland(s) in the landscape
		Description of functions provided by the wetlands
		Wetland rating
		Buffers
		*Water quality
		Maps related to the existing conditions of the mitigation site, existing wetlands, and adjacent properties.

		Mitigation Site Plans / Design
		Description of Site Plan/Design
		Description of the water regime and how adequate amounts of water will be provided to support a wetland
		Type of development (existing and proposed land uses) Discussion of how the mitigation plan will compensate for lost and degraded functions
		Schematic drawings
		*Section drawings showing relationship of topography to water regime and vegetation
		Grading Plan / Site Maps
		Orientation and scale
		*Existing and proposed elevation contours
		*Spot elevations for low points, high points, and structures
		Property boundaries
		On-site wetland boundaries
		*On-site floodplain and ordinary high water mark boundaries
		*Survey of benchmarks
		*Location and elevation of soil borings or test pits
		*Location and elevation of water level sampling devices
		*Location of soils to be stockpiled, if any
		*Description of methods of erosion control and bank stabilization
		Buffer areas for the mitigation site and their boundaries
		Water Regime
		Description of the proposed frequency and duration of flooding, inundation, or soil saturation
		Description of the proposed groundwater and surface water sources and characteristics
		*Description of the elevation of the water table and dates measured
		*Engineering drawings of any proposed water control structures
		Soils
		Soils logs from on-site evaluation
		Description of how the soil characteristics will be affected by the mitigation activities
		*Description of the elevation of the water table and dates measured
		*Engineering drawings of any proposed water control structures

		Planting / Landscape Plans
		Topographic map showing typical planting scheme (distribution and spacing of vegetation)
		List of plant materials
		Other planting details
		Expected natural revegetation from existing seed bank and natural recruitment from nearby sites.
		Description of methods to control invasive species
		A plan for irrigating the plants
		Description of soil amendments
		*Section drawings showing water levels in relation to plant distributions
		Description of protective features (fences, signs)
		Map of location and type of habitat structures
		*Examples of Similar Mitigation Projects
		*Description of the experience the designer has had with the type of mitigation proposed
		*Examples of other sites that have used the same approach
		*Other information that demonstrates that the high-risk plan will be successful
		Site-Specific Goals, Objectives, and Performance Standards
		Goals
		Objectives for each goal
		Performance standards for each objective
		Monitoring Plan
		Variables to be measured
		Sampling methods for each variable
		Schedule for sampling each variable
		A map of sampling locations or describe how the locations with be determined for each monitoring event
		*Laboratory methods to be used, if applicable
		Timetable for reporting monitoring results to the agencies (final plan only)
		Site Protection
		Describe measures that will be taken to protect the site over the long term
		Copies of legal documents (e.g., conservation easement, deed restriction) (final plan only)

Maintenance and Contingency Plans (final plan only)		
		Maintenance plan
		Description of and reason for each maintenance activity planned
		Maintenance schedule for each activity (where applicable)
		Contingency plan
		Initiating procedures
		*Description of contingency funds
		Implementation Schedule (final plan only)
		Construction sequence for grading, water diversions, plantings, etc.
		Time schedule and completions dates
		Permit conditions specifying time limits
		***Financial Assurances (final plan only)**

Appendix E - Multi-Agency Compensatory Mitigation Plan Checklist and Supplement

The checklist, and associated supplement, found in this appendix is one of the products associated with the National Wetlands Mitigation Action Plan (NWMAP). Released on December 26, 2002, the NWMAP identified 17 tasks to complete to improve the effectiveness of compensatory mitigation. One of those tasks was to develop a model mitigation plan checklist for permit applicants, which is now used by each district of the U.S. Army Corps of Engineers. NWAP can be found on-line at http://www.mitigationactionplan.gov/index.html.

The mitigation checklist on the following page was developed at the national level and then modified to more appropriately reflect the needs of the Corps, EPA, and Ecology in Washington State. The modified version is found in Appendix D.

Multi-Agency Compensatory Mitigation Plan Checklist[6]

Mitigation Goals and Objectives

- Describe functions lost at impact site
- Describe functions to be gained at mitigation site
- Describe overall watershed improvements to be gained

Baseline Information for Impact and Proposed Mitigation Sites

- Provide data on physical attributes of sites (soils, vegetation, hydrology)
- Describe historic and existing land uses and resources impacted
- Describe reference site attributes if available

Mitigation Site Selection and Justification

- Describe process of selecting proposed site
- Likelihood of success, future land use compatibility, etc.

Mitigation Work Plan

- Location
- Construction Plan
- Describe planned hydrology, vegetation, soils, buffers, etc.

Performance Standards

- Identify success criteria
- Compare functions lost and gained at impact and mitigation sites
- Describe soils, vegetation and hydrology parameter changes

Site Protection and Maintenance

- List parties and responsibilities
- Provide evidence of legal protective measures
- Maintenance plan and schedule

Monitoring Plan

- Provide monitoring schedule, identify party (ies) and responsibilities
- Specify data to be collected, including assessment tools and methodologies

Adaptive Management Plan

- Identify party (ies) and responsibilities
- Remedial measures (financial assurances, management plan, etc.)

Financial Assurances

- Identify party (ies) responsible for assurances
- Specify type of assurance, contents and schedule

6 Refer to "Supplement: Compensatory Mitigation Plan Checklist" for further explanation of specific checklist items.

Supplement: Compensatory Mitigation Plan Checklist

This document is intended as a technical guide for Clean Water Act (CWA) Section 404 permit applicants[7] preparing compensatory mitigation plans. Compensatory mitigation is required to offset impacts that cannot be avoided and minimized to the extent practicable. The purpose of this document is to identify the types and extent of information that agency personnel need to assess the likelihood of success of a mitigation proposal. Success is generally defined as: a healthy sustainable wetland/water that – to the extent practicable – compensates for the lost functions of the impacted water in an appropriate landscape/watershed position. This checklist provides a basic framework that will improve predictability and consistency in the development of mitigation plans for permit applicants. Although every mitigation plan may not need to include each specific item, applicants should address as many as possible and indicate, when appropriate, why a particular item was not included (For example, permit applicants who will be using a mitigation bank would not be expected to include detailed information regarding the proposed mitigation bank site since that information is included in the bank's enabling instrument). This checklist can be adapted to account for specific environmental conditions in different regions of the U.S.

1. Mitigation Goals and Objectives

Impact Site

a. Describe and quantify the aquatic resource type and functions that will be impacted at the proposed impact site. Include temporary and permanent impacts to the aquatic environment.

b. Describe aquatic resource concerns in the watershed (e.g. flooding, water quality, habitat) and how the impact site contributes to overall watershed/regional functions. Identify watershed or other regional plans that describe aquatic resource objectives.

Mitigation Site

c. Describe and quantify the aquatic resource type and functions for which the mitigation project is intended to compensate.

d. Describe the contribution to overall watershed/regional functions that the mitigation site(s) is intended to provide.

7 The checklist may be used in other federal or state programs as well; however, additional information may be needed to satisfy specific program requirements. For example, Attachment A indicates additional information needed by the Natural Resources Conservation Service (NRCS) to satisfy the Swampbuster provisions of the Food Security Act.

2. Baseline Information - for proposed impact site, proposed mitigation site & if applicable, proposed reference site(s).

a. Location

1. Coordinates (preferably using DGPS) & written location description (including block, lot, township, county, Hydrologic Unit Code (HUC) number, as appropriate and pertinent.

2. Maps (e.g., site map with delineation (verified by the Corps), map of vicinity, map identifying location within the watershed, NWI map, NRCS soils map, zoning or planning maps; indicate area of proposed fill on site map).

3. Aerial/Satellite photos.

b. Classification – Hydrogeomorphic as well as Cowardin classification, Rosgen stream type, NRCS classification, as appropriate.

c. Quantify wetland resources (acreage) or stream resources (linear feet) by type(s).

d. Assessment method(s) used to quantify impacts to aquatic resource functions (e.g., HGM, IBI, WRAP, etc.); explain findings. The same method should be used at both impact and mitigation sites.

e. Existing hydrology

1. Water budget. Include water source(s) (precipitation, surface runoff, groundwater, stream) and losses(s). Provide budgets for both wet and dry years.

2. Hydroperiod (seasonal depth, duration, and timing of inundation and/or saturation), percent open water.

3. Historical hydrology of mitigation site if different than present conditions

4. Contributing drainage area (acres).

5. Results of water quality analyses (e.g., data on surface water, groundwater, and tides for such attributes as pH, redox, nutrients, organic content, suspended matter, DO, heavy metals).

f. Existing vegetation

1. List of species on site, indicating dominants.

2. Species characteristics such as densities, general age and health, and native/nonnative/ invasive status.

3. Percent vegetative cover; community structure (canopy stratification).

4. Map showing location of plant communities.

g. Existing soils

1. Soil profile description (e.g., soil survey classification and series) and/or stream substrate (locate soil samples on site map).

2. Results of standard soils analyses, including percent organic matter, structure, texture, permeability.

h. Existing wildlife usage (indicate possible threatened and endangered species habitat).

I. Historic and current land use; note prior converted cropland.

j. Current owner(s)

k. Watershed context/surrounding land use.

1. Impairment status and impairment type (e.g., 303(d) list) of aquatic resources.

2. Description of watershed land uses (percent ag, forested, wetland, developed).

3. Size/Width of natural buffers (describe, show on map).

4. Description of landscape connectivity: proximity and connectivity of existing aquatic resources and natural upland areas (show on map).

5. Relative amount of aquatic resource area that the impact site represents for the watershed and/or region (i.e., by individual type and overall resources).

3. Mitigation Site Selection & Justification

a. Site-specific objectives: Description of mitigation type(s)[8], acreage(s) and proposed compensation ratios.

b. Watershed/regional objectives: Description of how the mitigation project will compensate for the functions identified in the Mitigation Goals section 1(c).

c. Description of how the mitigation project will contribute to aquatic resource functions within the watershed or region (or sustain/protect existing watershed functions) identified in the Mitigation Goals section 1(d). How will the planned mitigation project contribute to landscape connectivity?

d. Likely future adjacent land uses and compatibility (show on map or aerial photo).

e. Description of site selection practicability in terms of cost, existing technology, and logistics.

8 That is, restoration, enhancement, creation or preservation: see Regulatory Guidance Letter (RGL) 02-2, Mitigation RGL, for definitions for these terms.

f. If the proposed mitigation is off-site and/or out-of-kind, explain why on-site or in-kind options[9] are not practicable or environmentally preferable.

g. Existing and proposed mitigation site deed restrictions, easements and rights-of-way. Demonstrate how the existence of any such restriction will be addressed, particularly in the context of incompatible uses.

h. Explanation of how the design is sustainable and self-maintaining. Show by means of a water budget that there is sufficient water available to sustain long-term wetland or stream hydrology. Provide evidence that a legally defensible, adequate and reliable source of water exists.

I. USFWS and/or NOAA Fisheries Listed Species Clearance Letter or Biological Opinion.

j. SHPO Cultural Resource Clearance Letter.

4. Mitigation Work Plan

a. Maps marking boundaries of proposed mitigation types; include DGPS coordinates.

b. Timing of mitigation: before, concurrent or after authorized impacts; if mitigation is not in advance or concurrent with impacts, explain why it is not practicable and describe other measures to compensate for the consequences of temporal losses.

c. Grading plan

1. Indicate existing and proposed elevations and slopes.

2. Describe plans for establishing appropriate microtopography. Reference wetland(s) can provide design templates.

d. Description of construction methods (e.g., equipment to be used)

e. Construction schedule (expected start and end dates of each construction phase, expected date for as-built plan).

f. Planned hydrology

1. Source of water.

2. Connection(s) to existing waters.

3. Hydroperiod (seasonal depth, duration, and timing of inundation and saturation), percent open water, water velocity.

4. Potential interaction with groundwater.

9 See Federal Guidance on the Use of Off-Site and Out-of-Kind Compensatory Mitigation under Section 404 of the CWA.

5. Existing monitoring data, if applicable; indicate location of monitoring wells and tream gauges on site map.

6. Stream or other open water geomorphic features (e.g., riffles, pools, bends, deflectors).

7. Structures requiring maintenance (show on map) Explain structure maintenance in section 6(c).

g. Planned vegetation

1. Native plant species composition (e.g., list of acceptable native hydrophytic vegetation).

2. Source of native plant species (e.g. salvaged from impact site, local source, seed bank) stock type (bare root, potted, seed) and plant age(s)/size(s).

3. Plant zonation/location map (refer to grading plan to ensure plants will have an acceptable hydrological environment).

4. Plant spatial structure – quantities/densities, % cover, community structure (e.g., canopy stratification).

5. Expected natural regeneration from existing seed bank, plantings, and natural recruitment.

h. Planned soils

1. Soil profile

2. Source of soils (e.g., existing soil, imported impact site hydric soil), target soil characteristics (organic content, structure, texture, permeability), soil amendments (e.g., organic material or topsoil).

3. Erosion and soil compaction control measures.

I. Planned habitat features (identify *large woody debris*, rock mounds, etc. on map).

j. Planned buffer (identify on map).

1. Evaluation of the buffer's expected contribution to aquatic resource functions.

2. Physical characteristics (location, dimensions, native plant composition, spatial and vertical structure.

k. Other planned features, such as interpretive signs, trails, fence(s), etc.

5. Performance Standards

a. Identify clear, precise, quantifiable parameters that can be used to evaluate the status of desired functions. These may include hydrological, vegetative, faunal and soil measures. (e.g., plant richness, percent exotic/invasive species, water

inundation/saturation levels). Describe how performance standards will be used to verify that objectives identified in 3(b) and 3(c) have been attained.

b. Set target values or ranges for the parameters identified. Ideally, these targets should be set to mimic the trends and eventually approximate the values of a reference wetland(s).

6. Site Protection and Maintenance

a. Long-term legal protection instrument (e.g. conservation easement, deed restriction, transfer of title).

b. Party(ies) responsible and their role (e.g. site owner, easement owner, maintenance implementation). If more than one party, identify primary party.

c. Maintenance plan and schedule (e.g. measures to control predation/grazing of mitigation plantings, temporary irrigation for plant establishment, replacement planting, structure maintenance/repair, etc.).

d. Invasive species control plan (plant and animal).

7. Monitoring Plan

a. Party(ies) responsible for monitoring. If more than one, identify primary party.

b. Data to be collected and reported, how often and for what duration (identify proposed monitoring stations, including transect locations on map).

c. Assessment tools and/or methods to be used for data collection monitoring the progress towards attainment of performance standard targets.

d. Format for reporting monitoring data and assessing mitigation status.

e. Monitoring schedule

8. Adaptive Management Plan

a. Party(ies) responsible for adaptive management.

b. Identification of potential challenges (e.g., flooding, drought, invasive species, seriously degraded site, extensively developed landscape) that pose a risk to project success. Discuss how the design accommodates these challenges.

c. Discussion of potential remedial measures in the event mitigation does not meet performance standards in a timely manner.

d. Description of procedures to allow for modifications of performance standards if mitigation projects are meeting mitigation goals, but in unanticipated ways.

9. Financial Assurances

a. For each of the following, identify party(ies) responsible to establish and manage the financial assurance, the specific type of financial instrument, the method used to estimate assurance amount, the date of establishment, and the release and forfeiture conditions:

    1. Construction phase
    2. Maintenance
    3. Monitoring
    4. Remedial measures
    5. Project success

b. Types of assurances (e.g., performance bonds, irrevocable trusts, escrow accounts, casualty insurance, letters of credit, etc.).

c. Schedule by which financial assurance will be reviewed and adjusted to reflect current economic factors.

Attachment A - Natural Resources Conservation Service (NRCS) Program Requirements[10]

NRCS conservation practice standards and specifications

NRCS Environmental Evaluation

Mitigation agreement

Federal/State/Local required permits

Compatible use statement:

- Allowable uses (e.g. hunting, fishing)
- Prohibited uses (e.g. grazing, silviculture)
- Uses approved by compatible use permit

Copy of recorded easement

Subordination waiver on any existing liens on mitigation site

Statement of landowner's tax liability

Copy of Warrantee Deed from landowner's attorney (no encumbrances, if so list)

Copy of certified wetland determination:

- NRCS-CPA-026 Highly Erodible Land and Wetland Conservation
- Certification
- Wetland label map

Copy of FSA Good Faith Waiver

Copy of easement(s) ingress/egress granted to USDA employees for gaining Legal access to mitigation site

Copy of NRCS-CPA-38 Request for Certified Wetland Determination/Delineation

10 For a complete list of the program requirements needed by NRCS to satisfy the Swampbuster provisions of the Food Security Act see the National Food Security Act Manual.

Appendix F - Executive Summary Data Sheet

Executive Summary

Location Information	Wetland impact site(s)				Mitigation site(s)			
Site Name								
County								
City								
Section (¼, ¼), Township, Range								
Latitude, Longitude (GIS verified?)								
Watershed								
WRIA								
Tax Parcel #								
Is the mitigation site(s) off of the project development site? Yes or No								

Construction schedule (development site and compensation site[s]):

Summary of project, including proposed type and location of work, discussion of avoidance and minimization measures, goals and objectives, wetland functions impacted and mitigated (note assessment method used), and the general design concept (include where it has been done before)

Wetland Impact Sites

Wetland Name	Size (acres)	Does the wetland extend off the project site? (Y/N)	Type of Wetland (404, Isolated, PCC)	Wetland Rating / Total Score (Ecology)	Water Quality Improvement Score	Hydrologic Score	Habitat Score	Local Rating	Landscape Position (Floodplain, Terrace, Slope)	HGM Class (Depressional, Riverine, Slope, etc.) (Atypical?)
Total acres of wetland impact:										
Total wetland acres on-site:										

Acres of wetland impacts and mitigation (Cowardin classification)[11]

Wetland Type	Acres Impacted	Restoration (acres)	Creation (acres)	Enhancement (acres)	Preservation (acres)	Total acres of mitigation	Mitigation ratios	*Other Mitigation Provided
Forested								
Scrub-shrub								
Emergent								
Open water								
Aquatic bed								
*Other								
Total								

*Describe other impacts (streams, lakes, estuaries, coastal waters) and/or other mitigation activities:

Describe the Buffers being provided for the mitigation site, including minimum and maximum width, total buffer area, and description of surrounding land uses.

Describe the water regime at the mitigation site(s), including source of water, expected water depth, average outflow (winter, spring, summer), and ownership of water rights

Provide a list of performance standards and the estimated time to reach each (if too numerous reference the page number where they can be found)

[11] The information provided in the tables should also be provided for the pre-existing conditions at the mitigation site, especially if the site is being enhanced. This will provide baseline from which the effectiveness of mitigation activities can be determined.

Appendix G - Hiring a Qualified Wetland Professional

This appendix contains recommendations to help locate and select a professional who is qualified to assist with wetland issues. Wetland professionals are usually hired to identify and delineate wetlands, rate them, assess functions and values, and provide assistance with wetland regulations and permits. They often complete the necessary application forms and studies needed to meet regulations. They also provide advice about designing and implementing compensatory mitigation projects that are needed to replace wetlands if they will be lost or degraded.

Wetland professionals are generally hired by landowners or developers who want to do something on their property that may affect a wetland. In addition, many local governments hire professionals to provide review as a third party. Some professionals are self-employed; others work for larger environmental or engineering consulting firms.

What is a Qualified Wetland Professional?

There is no government sanctioned program for certifying someone as a "qualified wetland professional" or "qualified wetland specialist." Generally, the term means a person with professional experience and comprehensive training in wetland issues, including experience performing wetland delineations, assessing wetland functions and values, analyzing wetland impacts, and recommending and designing wetland mitigation projects.

The Society of Wetland Scientists administers a professional certification program for wetland scientists that has two levels of certification: Professional Wetland Scientist (PWS) and Wetland Professional In-Training (WPIT). A person certified as a PWS would be considered a qualified wetland scientist. This program is discussed further in the shaded box at the end of this appendix.

If the person is not a certified PWS, there is no simple means of determining if they are adequately qualified to undertake the tasks listed above. However, the following criteria are indicators of someone who may be qualified to perform the wide range of tasks typically required of a wetland professional:

- At a minimum, a Bachelor of Science or Bachelor of Arts or equivalent degree in hydrology, soil science, botany, ecology, resource management, or related field. A graduate degree in one of these fields is usually an indication of more advanced expertise.
- At least two years of full-time work experience as a wetland professional; including delineating wetlands using the state or federal manuals, preparing wetland reports, conducting function assessments, and developing and implementing mitigation plans. Generally, the more years of experience, the greater the expertise.
- Completion of additional wetland-specific training programs. This could include a more comprehensive program such as the University of Washington Wetland Science and Management Certificate Program or individual workshops on wetland delineation, function assessment, mitigation design, hydrophytic plant or hydric soil identification, etc.

Keep in mind that most people engaged in professional wetland work have greater expertise in some aspects of the field than others. A person may have in-depth training in plant ecology or soils or hydrology, but few people have all three. A person may have extensive experience in wetland delineation or function assessment and have little experience in designing and implementing mitigation projects. Thus, it is important to be clear what specific tasks need to be completed and make sure the person or firm being hired has the specific expertise needed. Generally, more complex projects require multiple individuals that provide collective expertise to address all aspects of the project.

How to Find a Qualified Wetland Professional

There are a number of ways to find the names of wetland professionals. Finding a qualified one, however, can be difficult since this group of professionals is not required to be certified, licensed, or bonded in the State of Washington. One approach is to look in the Yellow Pages under *Environmental and Ecological Services*. You can also contact the local government planning office and ask for a list of professionals that work in its jurisdiction. Some local governments maintain lists of wetland professionals they consider to be well qualified.

Wetland professionals may also be found by requesting the advice of associations or businesses that commonly encounter wetlands in their work, such as the Building Industry Association and Association of Washington Business. Finally, state and federal resource agencies can be asked for referrals. Be aware, however, that most agencies will not be able to provide recommendations because of questions of fairness.

Finally, the Society of Wetland Scientists maintains a searchable database of "professional wetland scientists." See the shaded box at the end of this appendix.

How to Select a Qualified Wetland Professional

A number of factors should be considered before hiring a wetlands professional. When interviewing professionals, their qualifications should be carefully considered (see above for the minimum recommended). Be sure to ask the following questions before making a selection:

Does the professional have training or experience in the use of the 1987 federal or 1997 Washington State wetland delineation manuals? The selected professional should have the ability to apply the methods for identifying wetlands used by state and federal agencies. Make sure that the professional can identify wetlands and their boundaries consistent with regulating agencies.

Has the professional had additional training or expertise in related fields such as hydrology, soil science, botany, or ecology?

Is the professional familiar with local, state, and federal wetland regulations?

How long has the professional been doing wetlands work? How much experience do they have delineating wetlands in the field, assessing wetlands functions and values, or working with wetland regulations? Has the person worked in the part of the state where you propose to develop? Ask the professional for examples of previous work similar to the

services being requested. Can the professional take you to a successful wetland mitigation project they designed and/or implemented?

Does the professional have experience working with regulatory agencies? Ask the professional to describe their working relationship with the agencies that will be reviewing and/or permitting your project.

Does the professional have experience working on a team? Given the complexity of some projects, it is expected that a wetland professional will team up with others who have experience in related fields such as water quality, wildlife, stormwater management, and hydrogeology. Ask the professional for a list of people with whom they have worked on a team in the past.

Who were some of the professional's past clients? Request referrals and ask clients if they were satisfied with the professional's work. Ask whether there were any problems that occurred during or after the project, how the professional handled those problems, and what they charged for their work. Find out what type of track record the company has with local, state, and federal agencies. Be sure to ask for references that include clients who have had projects reviewed and approved by the regulatory agencies (Corps, Ecology, and local government).

Talk with colleagues and other businesses, such as real estate, land development, homebuilding, etc. that are routinely involved in wetland concerns. Ask them about their experiences and knowledge regarding the professional being considered.

If you are considering a consulting firm, find out exactly who will be working on your project. Will it be the principal professional with the years of experience, or someone with less experience who works for them?

Get an estimate of how much the professional will charge. Compare rates but do not let cost be the sole criterion. Be sure to consider training, experience, and the other factors as well. A good professional who charges more may end up saving money by reducing permit processing delays.

Society of Wetland Scientists Professional Certification Program

The Society of Wetland Scientists keeps a list of those who have qualified for their professional certification program for wetland scientists. The certification program website http://www.wetlandcert.org allows you to search by name, city, and/or state.

As explained in the Professional Wetland Scientist program overview:

> *Certification is not required by any agency and has no official or legal standing. However, certification signifies that the academic and work experience of a Professional Wetland Scientist (PWS) meets the standards expected by his or her peers of a practicing wetland professional and provides acknowledgment to his or her peers of adherence to standards of professional ethics with regard to the conduct and practice of wetland science.*
>
> *Wetland Professional in Training (WPIT) is considered a preliminary step for persons who meet the requirements for either (but not both) education and experience. Professional Wetland Scientist (PWS) certification is awarded for those meeting both educational and experience requirements.*
>
> *Minimum degree requirements for WPIT and PWS are the BA or BS degrees, with course distribution of 15 semester hours each in biological and physical sciences and 6 hours in quantitative areas. For certification as a PWS, an additional 15 semester hours in wetland-related courses are required. In addition to comprehensive training in wetland science, a PWS is expected to have professional experience of at least 5 years as a wetland scientist, demonstrating the application of current technical knowledge dealing with wetland resources and activities.*

Appendix H - Checklist & Sample Outline for a Delineation Report

At a MINIMUM, a delineation report should include:

Field data sheets (complete set that were filled out during the wetland determination and delineation). These could be added as an Appendix to the report.

A map identifying wetland boundaries and the locations of all data collection points (for large and/or complex projects, a large scale [1":400' to 1":100'] aerial photo with overlays displaying site property and wetland boundaries is helpful). This map must also clearly delineate the boundaries of the area evaluated.

An explanation of the approach used to delineate the wetlands and synthesize the data. Describe the vegetation, soils, and hydrologic characteristics and summarize the available information used in making the wetland determination. The following are examples of potential sources of information[11]:

- USGS quadrangle map (or other topographic map of the area).
- National Wetland Inventory (NWI) map.
- Local wetland inventories.
- County soil surveys.
- Stream and tidal gage data.
- Previous site documentation and/or analysis (e.g., environmental checklist, environmental impact assessment or statement (EIA or EIS), geotechnical report).
- Federal Emergency Management Agency (FEMA) flood insurance rate maps.
- Regional maps that characterize the area.
- Local experts.
- USGS land use and land cover maps.
- Survey plans and engineering designs for the proposed development project.
- Aerial photos.
- Other site specific information.

Information on rare plants and high-quality wetlands from the Washington National Heritage Program.

Information on priority habitats and species from the Washington Department of Fish and Wildlife.

11 These are potential sources of information that may have been helpful in making a determination, but not all listed sources of information may be applicable to a given situation. The delineator is not required to obtain information from all of the listed sources of information.

The following sample outline for a wetland delineation report has been copied with permission from the *Field Guide for Wetland Delineation: 1987 Corps of Engineers Manual* prepared by the Wetland Training Institute. Additional information can be found at the end of that field guide in the section of the document entitled "Preparing a Delineation Report."

I. Introduction

- A. Who authorized the delineation
- B. Why is it being done
- C. Location of site (Map)
- D. Date of site visit (s)
- E. Identification of delineators

II. Methods

- A. Brief description of method used
- B. Any modification of methods
- C. Sources of existing information used

III. Results and Discussion

- A. Description of the site
  1. Topography
  2. Plant communities
  3. Soils mapped and found (map)
  4. Hydrology information
  5. Existing wetland mapping (e.g., NWI/state/local)
- B. Findings
  1. Types of wetlands identified (e.g., Cowardin, et al 1979)
     a. Description
     b. Locations
     c. Area
     d. Contrast with nonwetland
     e. How was boundary chosen (e.g., feature on the landscape)
  2. Types of other waters identified
     a. Description
     b. Locations
     c. Area
     d. Contrast with nonwetland
     e. How was boundary chosen (e.g., feature on the landscape)
  3. Include maps/drawings showing results

IV. Conclusion

- A. Brief summary of total area and types of wetlands and other regulated waters
- B. Statement regarding the need for permits
- C. Caution that final authority rests with the appropriate agencies

V. Literature Cited

VI. Appendix A (Data Sheets)

Appendix I - List and Description of Wetland Functions

This *List and Description of Wetland Functions* was developed by the Statewide Technical Committee and the Assessment teams of the Washington State Wetland Function Assessment Project (WFAP). Information on WFAP can be found on-line at: http://www.ecy.wa.gov/programs/sea/wfap/index.html .

This is not a comprehensive list of all functions that are performed by wetlands and not all of the functions listed are performed by each of the different hydrogeomorphic classes (e.g., *riverine*, *depressional*, *lacustrine*) of wetlands. The description of each function was found in *Freshwater Wetlands in Washington State, Volume 1 – A Synthesis of the Science* (Sheldon et al. 2005). Volume 1 can be found on-line at http://www.ecy.wa.gov/programs/sea/bas_wetlands/index.html

Functions	Description
Functions Related to Improving Water Quality	
Removing Sediment	This function is defined in terms of the processes and characteristics that retain sediment within a wetland and prevent its downstream movement. A wetland performs this function if there is a net annual decrease of sediment load to downstream surface waters.
Removing Nutrients/Phosphorous	This function is defined in terms of the processes and characteristics within a wetland that remove phosphorus present in surface waters and prevent its movement into surface waters and groundwater.
Removing Nutrients/Nitrogen	This function is defined in terms of the processes and characteristics within a wetland that remove dissolved nitrogen present in surface waters or groundwater and prevent its further movement into surface waters or groundwater.
Removing Metals and Toxic Organic Compounds	This function is defined in terms of the processes and characteristics within a wetland that retain toxic metals and toxic organic compounds coming into the wetland and prevent their movement into surface waters and groundwater.
Removing Pathogens	This function can be defined in terms of the processes and characteristics within a wetland that retain or kill pathogenic organisms such as viruses and bacteria that can cause diseases in humans.
Functions Related to Maintaining the Water Regime in a Watershed (Hydrologic Functions)	
Reducing Peak Flows	This function is defined in terms of the processes and characteristics within a wetland by which the peak flow in a watershed can be reduced during major storm or snowmelt (i.e., events that would otherwise cause flooding).
Reducing Erosion	This function is defined in terms of the processes and characteristics within a wetland that detain high flows during storms and reduce the duration of erosive flows, thus decreasing downstream erosion in streams.

Functions	Description
Functions Related to Habitat	
Recharging Groundwater	This function is defined in terms of the processes and characteristics within a wetland that allow surface water to infiltrate into the groundwater system.
General Habitat	This function is defined in terms of the processes and characteristics within a wetland that indicate a general suitability and opportunity as habitat for a broad range of species. A suitable habitat for a suite of different fauna can be provided by a broad range of structures, vegetation, and interspersion of "habitat" types within the wetland and the upland habitats contiguous to a wetland. Characteristics in a wetland can be quite different and continue to provide highly suitable conditions for a range of species.
Habitat for Invertebrates	This function is defined in terms of the processes and characteristics within a wetland that help maintain a high number of invertebrate species.
Habitat for Amphibians	This function is defined in terms of the processes and characteristics within a wetland that contribute to the feeding, breeding, or refuge needs of amphibian species.
Habitat for Anadromous Fish	This function is defined in terms of the processes and characteristics within a wetland that contribute to the feeding, breeding, or refuge needs of anadromous fish species.
Habitat for Resident Fish	This function is defined in terms of the processes and characteristics within a wetland that contribute to the feeding, breeding, or refuge needs of resident native fish.
Habitat for Wetland-Associated (Aquatic) Birds	This function is defined in terms of the processes and characteristics within a wetland that provide habitats or life resources for species of wetland-associated birds. Wetland-associated bird species are those that depend on aspects of the wetland ecosystem for some part of their life needs: food, shelter, breeding, or resting.
Habitat for Wetland-Associated (Aquatic) Mammals	This function is defined in terms of the processes and characteristics within a wetland that support one or more life requirements of aquatic or semi-aquatic mammals.
Richness of Native Plants	This function is defined in terms of the degree to which the wetland provides a habitat for many different native plant species.
Supporting Food Webs (Primary Production and Export)	This function is defined in terms of the processes and characteristics within a wetland that support complex food webs within the wetland and surrounding ecosystems through the export and assimilation of the primary productivity of the wetland. The function combines three major ecosystem processes: primary production, secondary production, and export of production.

Appendix J - Site Selection Checklist

The checklist below can be used to help you determine if a potential site is appropriate for compensatory mitigation. The more "yes" answers to the following questions the greater the likelihood that the site is appropriate for compensatory mitigation and will be sustainable over time. "No" answers, while not sufficient to remove a site from consideration, are "red flags" of potential constraints or problems which should be recognized and considered. When going through the list of questions consider whether or not the site possesses the physical, chemical, and biological characteristics to support the proposed goals and objectives for wetland compensatory mitigation. See Section 3.3, *Selecting a Site*, for further discussion of considerations for site selection. In addition, the site selected should meet all of the regulatory requirements for compensatory mitigation, such as where it should be located (see Part 1, particularly Chapter 6, including the section on choosing a location).

Yes	No	Source of Water
☐	☐	Does the proposed mitigation site have a natural source of water (e.g., overbank flooding, precipitation, ground water) sufficient to support a wetland and the target functions for the mitigation project?
☐	☐	Will the source of water be sustainable and relatively predictable over the long term (i.e., without long-term irrigation and engineered solutions such as tide gates, diversions, and pumping requiring long-term maintenance)?
☐	☐	If applicable, will you be able to obtain the appropriate water rights?
☐	☐	Does the site contain previous wetland areas that can be restored (re-established or rehabilitated)?
☐	☐	Does the site have the necessary physical and soil features to maintain the desired hydroperiod? (e.g., Will the types of soil on the site be able to support the proposed water regime of the wetlands? For example, sandy soils may not retain water long enough.)
Yes	**No**	**Soils**
☐	☐	Does the soil have hydric indicators and/or is the site within an area of listed/mapped hydric soils?
☐	☐	Does the soil have levels of organic matter and nutrients (from a soil analysis) that will support the targeted vegetation and functions? Soil characteristics can often influence vegetative success and ultimately a project's success.
☐	☐	Is the soil free of contamination (e.g., heavy metals, toxic organics, salts, acids)?

☐	☐	Is the soil structure intact and not significantly altered by previous land-use activities (e.g., grading, farming/tilling)? Previous land-use activities can result in soil compaction and create an impermeable soil layer, preventing infiltration of surface waters which support root growth and plant establishment.
Yes	**No**	**Landscape Position**
☐	☐	Will the proposed wetland have a hydrogeomorphic (HGM) classification appropriate for its position in the landscape regardless of whether it is the same HGM class as the wetland that was impacted? (e.g., a potential wetland in a riverine setting should be a riverine flow through or riverine depressional wetland and not a slope or depressional wetland not supported by overbank flooding)
☐	☐	Has the position of the site, in relation to other wetlands, habitats, and processes occurring in the landscape, been considered? (Refer to Habitat Connectivity below.)
☐	☐	Can the site address management problems identified within the basin (e.g., flooding, sedimentation, water quality, etc.)?
☐	☐	Have the restoration/protection goals for the larger watershed (e.g., 2514 watershed plans) been considered (if they have been developed) in determining the location and type of mitigation?
☐	☐	If the hydroperiod of the site has been significantly altered, does the project provide for measures that restore it to the proper HGM class? (e.g., remove levees for wetlands in the floodplain)
Yes	**No**	**Land Use**
☐	☐	Is the wetland mitigation proposed for the site consistent with provisions of existing land-use plans, zoning and other documents?
☐	☐	Is the site free from past land-use practices that may affect compensatory mitigation success? (e.g., Has there been filling, dumping of toxics, or permanent alteration of natural water flow processes through forest clearing, ditching, or paving activities in the watershed?)
☐	☐	Are the proposed mitigation goals and objectives compatible with the surrounding land uses of the proposed site? (e.g., Will increased hydrology negatively affect adjacent farming operations?)
☐	☐	Does the location of the site allow it to be protected from direct, indirect and cumulative impacts from current and potential future land use? (i.e., Do existing conditions in the potential contributing basin for the site appear to support planned wetland processes and functions?)

Yes	No	Habitat Connectivity
☐	☐	Is the site in close proximity to other wetlands, undisturbed areas or aquatic sites, and/or are the connections to those habitats relatively undisturbed? This is particularly important if the main goal of the mitigation project is to provide wildlife habitat for certain species.
Yes	**No**	**Buffers**
☐	☐	Does the site have adjacent upland or other habitats that can provide, or be developed to provide, a buffer of sufficient width to protect the target wetland functions for the long term (i.e., in other words future land uses have been considered)?
Yes	**No**	**Invasive Species**
☐	☐	Are the site and adjacent areas relatively free of invasive species?
Yes	**No**	**Seed Banks**
☐	☐	Is the site likely to have an existing native seed bank?
Yes	**No**	**Endangered Species**
☐	☐	Are there any ESA-listed species present on the site? The presence of ESA-listed species (i.e., the answer to this question is "Yes") may make the site a priority for site protection (i.e., compensatory mitigation may be appropriate) or compensatory mitigation activities could be limited.
Yes	**No**	**Other Factors**
☐	☐	Long term-maintenance – Can the goals and objectives of the mitigation site be achieved, without continual long-term maintenance?
☐	☐	Site ownership - Is the site free of ownership or legal constraints that would prevent its long-term protection?
☐	☐	Legal mechanisms for protection – Is it possible to obtain a conservation easement from the owner of the property? Conservation easements will help ensure that the site will be protected for the long term.
☐	☐	Cultural resources – Is it likely that the site is free of cultural resources? The site is not listed on the National Register of Historic Places or the project has not raised concerns with the local Native American Tribes with knowledge of the area.
☐	☐	Location near an airport – Has the Federal Aviation Administration guidance on locating certain land uses been considered? Sites affected by FAA guidance and rules may result in design constraints.
☐	☐	Cost- Have the potential costs of the site been considered? The cost of land acquisition, activities such as earthwork and disposal of excavated materials can be high and should be considered in site selection.

Appendix K - 2005 Washington State Noxious Weed List

This list, determined by the Washington State Noxious Weed Control Board, is adopted annually by rule (Chapter 16-750 WAC).

Noxious weeds are non-native plants introduced to Washington through human actions. Because of their aggressive growth and lack of natural enemies in the state, these species can be highly destructive, competitive or difficult to control. These exotic species can reduce crop yields, destroy native plant and animal habitat, damage recreational opportunities, clog water-ways, lower land values and poison humans and livestock.

To help protect the state's resources, the Washington State Noxious Weed Control Board adopts a State Noxious Weed List each year. This list categorizes weeds into three major classes - A, B & C -according to the seriousness of the threat they pose to the state or a region of the state.

Plants in bold are new to the list or have new classifications. Contact the Weed Board for information on B-designate areas.

To find out more about weeds and weed control in Washington, contact:

Washington State Noxious Weed Control Board
P.O. Box 42560
Olympia, WA 98504
(360) 902-1901

Web site: http://www.nwcb.wa.gov

Washington State Department of Agriculture

21 North First Avenue #103
Yakima, WA 98902
(509) 225-2604

Local County Noxious Weed Control Boards.

Class A weeds: Non-native species with a limited distribution in Washington. Preventing new infestations and eradicating existing infestations is the highest priority. Bold print means eradication is required by law.

Common Name	Scientific Name		Common Name	Scientific Name
Bighead knapweed	*Centaurea macrocephala*		Meadow clary	*Salvia pratensis*
Buffalobur	*Solanum rostratum*		Mediterranean sage	*Salvia aethiopis*
Clary sage	*Salvia sclarea*		Milk thistle	*Silybum marianum*
Common crupina	*Crupina vulgaris*		Purple starthistle	*Centaurea calcitrapa*
Denseflower cordgrass	*Spartina densiflora*		Salt meadow cordgrass	*Spartina patens*
Dyers woad	*Isatis tinctoria*		Silverleaf nightshade	*Solanum elaeagnifolium*
Eggleaf spurge	*Euphorbia oblongata*		Slenderflower thistle	*Carduus tenuiflorus*
Garlic mustard	*Alliaria petiolata*		Spanish broom	*Spartium junceum*
Giant hogweed	*Heracleum mantegazzianum*		Spurge flax	*Thymelaea passerina*
Goatsrue	*Galega officinalis*		Syrian bean-caper	*Zygophyllum fabago*
Hydrilla	*Hydrilla verticillata*		Texas blueweed	*Helianthus ciliaris*
Italian thistle	*Carduus pycnocephalus*		Velvetleaf	*Abutilon theophrasti*
Johnsongrass	*Sorghum halepense*		Vochin knapweed	*Centaurea nigrescens*
Kudzu	*Pueraria montana var. lobata*		Wild four o'clock	*Mirabilis nyctaginea*
Lawnweed	*Soliva sessilis*		Yellow devil hawkweed	*Hieracium floribundum*

Class B Weeds: Non-native species presently limited to portions of the state. Species are designated for control in regions where they are not yet wide-spread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal.

Common Name	Scientific Name		Common Name	Scientific Name
Annual bugloss	*Anchusa arvensis*		Common bugloss	*Anchusa officinalis*
Austrian Fieldcress	*Rorippa austriaca*		Common catsear	*Hypochaeris radicata*
Black knapweed	*Centaurea nigra*		Common cordgrass	*Spartina anglica*
Blackgrass	*Alopecurus myosuroides*		Dalmatian toadflax	*Linaria dalmatica ssp. dalmatica*
Blueweed	*Echium vulgare*		Diffuse knapweed	*Centaurea diffusa*
Bohemian knotweed	*Polygonum bohemicum*		Eurasian watermilfoil	*Myriophyllum spicatum*
Brazilian elodea	*Egeria densa*		Fanwort	*Cabomba caroliniana*
Brown knapweed	*Centaurea jacea*		Garden loosestrife	*Lysimachia vulgaris*
Camelthorn	*Alhagi maurorum*		Giant knotweed	*Polygonum sachalinense*
Gorse	*Ulex europaeus*		Polar hawkweed	*Hieracium atratum*
Grass-leaved arrowhead	*Sagittaria graminea*		Policeman's helmet	*Impatiens glandulifera*

Common Name	*Scientific Name*		Common Name	*Scientific Name*
Hedgeparsley	*Torilis arvensis*		Puncturevine	*Tribulus terrestris*
Herb-Robert	*Geranium robertianum*		Purple loosestrife	*Lythrum salicaria*
Himalayan knotweed	*Polygonum polystachyum*		Queen-devil hawkweed	*Hieracium glomeratum*
Hoary alyssum	*Berteroa incana*		Rush skeletonweed	*Chondrilla juncea*
Houndstongue	*Cynoglossum officinale*		Russian knapweed	*Acroptilon repens*
Indigobush	*Amorpha fruticosa*		Saltcedar	*Tamarix ramosissima*
Japanese knotweed	*Polygonum cuspidatum*		Scotch broom	*Cytisus scoparius*
Kochia	*Kochia scoparia*		Scotch thistle	*Onopordum acanthium*
Leafy spurge	*Euphorbia esula*		Smooth cordgrass	*Spartina alterniflora*
Lepyrodiclis	*Lepyrodiclis holosteoides*		Smooth hawkweed	*Hieracium laevigatum*
Longspine sandbur	*Cenchrus longispinus*		Spotted knapweed	*Centaurea biebersteinii*
Meadow knapweed	*Centaurea jacea x nigra*		**Sulfur cinquefoil**	*Potentilla recta*
Mouseear hawkweed	*Hieracium pilosella*		Swainsonpea	*Sphaerophysa salsula*
Musk thistle	*Carduus nutans*		Tansy ragwort	*Senecio jacobaea*
Myrtle spurge	*Euphorbia myrsinites*		Wand loosestrife	*Lythrum virgatum*
Orange hawkweed	*Hieracium aurantiacum*		Water primrose	*Ludwigia hexapetala*
Oxeye daisy	*Leucanthemum vulgare*		White bryony	*Bryonia alba*
Hawkweed oxtongue	*Picris hieracioides*		Wild carrot	*Daucus carota*
Parrotfeather	*Myriophyllum aquaticum*		Wild chervil	*Anthriscus sylvestris*
Perennial pepperweed	*Lepidium latifolium*		Yellow floating heart	*Nymphoides peltata*
Perennial sowthistle	*Sonchus arvensis ssp. arvensis*		Yellow hawkweed	*Hieracium caespitosum*
Plumeless thistle	*Carduus acanthoides*		Yellow nutsedge	*Cyperus esculentus*

Class C Weeds: Non-native weeds found in Washington. Many of these species are widespread in the state. Long-term programs of suppression and control are a County option, depending upon local threats and the feasibility of control in local areas.

Common Name	Scientific Name	Common Name	Scientific Name
Absinth wormwood	*Artemisia absinthium*	Canada thistle	*Cirsium arvense*
Babysbreath	*Gypsophila paniculata*	Cereal rye	*Secale cereale*
Black henbane	*Hyoscyamus niger*	Common groundsel	*Senecio vulgaris*
Bull thistle	*Cirsium vulgare*	Common reed	*Phragmites australis; non-native genotypes*
Butterfly bush	*Buddleia davidii*		
Common tansy	*Tanacetum vulgare*	Hoary cress	*Cardaria draba*
Curly-leaf pondweed	*Potamogeton crispus*	Jointed goatgrass	*Aegilops cylindrica*
Dodder	*Cuscuta approximata*	Old man's beard	*Clematis vitalba*
English ivy	*Hedera helix 'Baltica'*	Poison hemlock	*Conium maculatum*
English ivy	*Hedera helix 'Pittsburgh'*	Reed canarygrass	*Phalaris arundinacea*
English ivy	*Hedera helix 'Star'*	Scentless mayweed	*Matricaria perforata*
English ivy	*Hedera hibernica 'Hibernica'*	Spikeweed	*Hemizonia pungens*
Field bindweed	*Convolvulus arvensis*	Spiny cocklebur	*Xanthium spinosum*
Fragrant waterlily	*Nymphaea odorata*	St. Johnswort	*Hypericum perforatum*
Hairy whitetop	*Cardaria pubescens*	White cockle	*Silene latifolia ssp. alba*
Hairy willowherb	*Epilobium hirsutum*	Yellow flag iris	*Iris pseudocorus*
Hawkweed, spp.*	*Species except those listed as Class A or Class B*	Yellow toadflax	*Linaria vulgaris*

Appendix L - Mosquitoes and Wetlands

There has been some concern expressed that wetlands may create breeding areas for mosquitoes that potentially spread human diseases. Understanding the habitat requirements of different types of mosquitoes may help when designing wetland mitigation sites. However, there is very little information on the subject. Willot (2004) concludes that the issue of mosquitoes and mosquito-born diseases is almost completely ignored in all the scientific literature about wetlands. In the journal *Wetlands*, only 3 out of 254 research articles even mention the issue of mosquito-born diseases. "The primary texts in conservation biology and the majority of research papers addressing restoration and wetland construction generally do not acknowledge that mosquitoes create practical implementation problems, and also problems for the theoretical case for restoration as it is currently presented in much of the literature" (Willot 2004).

In spite of the lack of information on mosquitoes in wetland mitigation sites, the research on constructed wetlands indicates that they do not increase the risks to human health if they are properly managed (Knight et. al 2003). Interesting highlights of the report by Knight et. al include:

1. There are two groups of mosquitoes - those that breed in permanent water (i.e., lay their eggs on the water surface) and "floodwater" mosquitoes that lay their eggs on moist surface and the eggs hatch only when flooded. The major vectors of the diseases of most concern (West Nile virus, malaria, and encephalitis) are "permanent water" breeders. So wetlands that dry out regularly are not major breeding areas for the disease vectors.

2. There is no effective biological control of adult mosquitoes. Even though some aerial vertebrate predators consume mosquitoes, bats and birds such as purple martins do not routinely eat mosquitoes. They do not feed during the peak activity period of many mosquito species, they feed on non-biting adults (i.e., swarming males), and at natural densities cannot consume sufficient numbers of mosquitoes to significantly reduce population sizes. Mosquitoes can effectively be controlled only in their juvenile (aquatic) life stages.

Hydroperiod seems to be the dominant factor that determines whether an area can become larval mosquito habitat, and for which type of mosquito. In Minnesota, water depths of less than 3 feet (shallow) seemed to be most preferable to mosquitoes (Read and Johnson 2004). Water circulation may also be key to mosquito control. Studies of salt marsh in San Francisco Bay after a levee breach, support the idea that hydrologic restoration may be a means of mosquito control and management (Kramer et al. 1995 and Liu n.d.). These studies noted a reduction in the salt marsh mosquitoes *Aedes dorsalis* and *A. squamiger* after levee breach allowed bay water to flood study wetlands. The authors suggest that enhanced tidal circulation might have reduced mosquito abundance by impeding the conditioning process of the eggs, by promoting predation on eggs and larvae, or by decreasing the amount of standing water available for breeding (Kramer et al. 1995).

Other studies suggest that the presence of fish seemed to be one of the best ways to preclude mosquitoes, as they are very effective predators. An on-going study in Washington's

Willapa Bay (Sargeant et al. 2005) suggests that freshwater ditches with fish in them had a much smaller population of freshwater mosquito larvae and adults. However, studies in Minnesota (Read and Johnson 2004) also stress that mosquitoes are a natural part of the ecosystem and their equilibrium level with their natural predators is often well above the human tolerance level.

Knight et al. (2003) also discusses different options for designing wetlands to reduce breeding by mosquitoes however there is often a trade-off in the design. Better mosquito control reduces the habitat for other species or the water quality functions that a wetland can provide. Mosquito control in wetlands that have a high value for habitat will usually require some additional type of mosquito control.

When developing wetland mitigation sites it is important to think about mosquito control ahead of time, and where mosquito control is a concern it should be considered part of the ongoing maintenance plan of a mitigation site.

Sources of Information on Mosquito-Born Diseases

There are a number of information sources available on mosquitoes and mosquito-born diseases:

- The Washington State Department of Health's Office of Environmental Health and Safety "provides technical assistance and training to local health departments, veterinarians, and the public on transmission, prevention, control, and epidemiology of diseases transmitted to humans from animals." They have a number of fact sheets available on their website: http://www.doh.wa.gov/ehp/ts.
- The U.S. Environmental Protection Agency's Office of Wetlands, Oceans, and Watersheds also maintains a number of fact sheets, including one entitled West Nile Virus and Wetlands, at http://www.epa.gov/owow/wetlands/facts/contents.html.

References

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Kramer, V.L., J.N. Collins, and C. Beesley. 1995. Reduction of Aedes dorsalis by Enhancing Tidal Action in a Northern California Marsh. American Mosquito Control Association. 11:389-95.

Liu, A.E. No Date. Restoration of a San Francisco Bay Salt Marsh: Evaluating Corixid and Mosquito Populations.

Read, N. and K. Johnson. 2004. Wetland Characteristics that Enhance or Reduce Mosquito Production. Symposium. Society of Wetland Scientists Meeting. July 19th, 2004. Seattle, WA.

Sargeant, S.L., L.K. O'Rourke, and M.L. Blanton. 2005. Analysis of Conditions: Potential for Changing Mosquito Population Dynamics at the Willapa Bay Restoration Project Site in Light of West Nile Virus. Battelle Marine Sciences Laboratory, Sequim, WA.

Willot, E. 2004. Restoring nature, without mosquitoes? Restoration Ecology. 12: 147-153.

But what should homeowners do?

You can control mosquitoes to protect your family from West Nile virus and other mosquito-born diseases without poisoning your property or harming the environment.

Controlling mosquitoes: Whatever you do, don't drain wetlands. If you plan on altering a wetland on your property contact the agencies to determine what permits might be necessary (refer to Appendix B, *Agency Contact*s).

- Don't use non-native fish or other wildlife to control mosquitoes in ponds; they're not very effective and may threaten native species. Check with the Washington Department of Fish and Wildlife before releasing fish into any water body.
- Ecology recommends that homeowners destroy mosquito larvae before they hatch with a naturally-occurring organism, Bacillus thuringiensis israelensis, or Bti. Bti has been used throughout the world for more than 20 years and has demonstrated little or no risk to humans, pets, birds, or water quality. Individuals may use Bti products labeled for home and garden use in enclosed ponds and pools on their own property, as long as the water does not drain to natural waters such as lakes, rivers, streams, or ground water.
- Permits are required before pesticides can be introduced to lakes, rivers, streams, and wetlands and must be applied by a licensed applicator. For more information, contact your local health district or the Department of Ecology.

Prevention: The most important steps in protecting your family are to prevent mosquito bites and reduce mosquito habitat around your home. Follow these tips:

- Make sure window and door screens are "bug tight." Repair or replace if needed.
- Stay indoors at dawn and dusk when mosquitoes are the most active.
- Wear a long sleeve shirt, long pants, and a hat when going into mosquito-infested areas, such as wetlands or woods.
- Use a mosquito repellant containing DEET[12], and carefully follow directions on the label.
- Empty anything that holds standing water - old tires, buckets, plastic covers, and toys.
- Change water in your birdbaths, fountains, wading pools and animal troughs weekly.
- Recycle unused containers - bottles, cans, and buckets that may collect water.
- Make sure roof gutters drain properly, and clean clogged gutters in the spring and fall.
- Fix leaky outdoor faucets and sprinklers.

Portions of this box were excerpted from a Department of Ecology News Release (March 20, 2003, Preparing for W. Nile virus needn't harm the environment).

12 The Center for Disease Control recently adopted new guidance on mosquito repellants. Two new repellants have been registered with EPA: Picaridin (KBR 3023) and oil of lemon eucalyptus [p-menthane 3,8-diol (PMD)], a plant based repellent. For more information go to http://www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm.

Appendix M - Monitoring Report Checklist

☐	Monitoring report details.	
	☐	Project name.
	☐	Associated permit and reference number(s) (assigned by the Corps, Ecology, local government).
	☐	Who prepared the monitoring report (name, address, and phone number).
	☐	Who the monitoring report was prepared for (name, address, and phone number).
	☐	Date of the monitoring report, including the time period for which the monitoring activities occurred.
☐	Brief description of the development project.	
	☐	Location of the development project and directions to the development site(s).
	☐	Date construction of the development project started.
	☐	Area (acres) and type(s) of wetlands affected by the development project. Also briefly describe impacts to other aquatic resources.
☐	Brief description of the mitigation project.	
	☐	Goals and objectives of the mitigation project.
	☐	Location of the mitigation project and directions to the mitigation site(s).
	☐	Date construction of the mitigation site(s) was completed. Specify when different activities were completed (e.g., excavation, planting, installation of irrigation systems).
	☐	Area (acres) and type(s) of existing wetlands at the site and proposed for restoration (re-establishment and rehabilitation), creation (establishment), enhancement, and/or preservation (this could be from the executive summary of the mitigation plan).
	☐	Who completed mitigation site activities (name, address, and phone number).
	☐	Copies of any records of long-term protection (e.g., conservation easement, deed restriction).
☐	8 1/2" x 11 map of the mitigation site(s).	
	☐	Inset showing the geographic location of the site.
	☐	Landmarks.
	☐	Type(s) of wetlands and other aquatic habitats (as constructed).
	☐	Locations of photographic record stations.
☐	Summary of management actions (maintenance and contingencies) implemented at the mitigation site(s).	
☐	Summary of monitoring results.	
	☐	List of performance standards for the mitigation project.
	☐	Table of monitoring results compared to performance standards for specified target dates.
	☐	Summary of field data taken to determine compliance with performance standards.
	☐	Photographic record of the site from the most recent monitoring visit at record stations (photo pans are required in addition to along transect lines).
	☐	Summary of any problems or significant events that occurred on the site that may affect the ultimate success of the mitigation project.
	☐	Summary of any lessons learned.