Wetlands in Washington State

Volume 2: Guidance for Protecting and Managing Wetlands

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Washington Department of FISH and WILDLIFE

Wetlands
in
Washington State

Volume 2: Guidance for Protecting and Managing Wetlands

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Chapter 1
Introduction to Volume 2

1.1 Overview of Volumes 1 and 2

This document is the second in a two-volume series addressing wetlands in Washington and their management and protection. The first volume, *Freshwater Wetlands in Washington State, Volume 1: A Synthesis of the Science* (Sheldon et al. 2003), is a synthesis of the most current science and was released in draft form to the public in the fall of 2003. All of the comments received on Volume 1, as well as a 16-page summary of the comments with responses, have been posted on the project's web page: http://www.ecy.wa.gov/programs/sea/bas_wetlands/index.html. Volume 1 will be finalized during the fall of 2004.

Volume 1 synthesized the literature regarding:

- Freshwater wetlands in Washington and how they function;
- The effects of human activities on Washington's freshwater wetlands and their functions; and
- The tools used to protect and manage freshwater wetlands and their functions and values.

The key conclusions from Volume 1 are summarized in Chapter 3 in this document.

Volume 2 contains draft guidance for local governments on managing and protecting wetlands and their functions based on the synthesis of the science in Volume 1. Although the focus is local governments, the information contained in this document should be useful to anyone who has an interest in the protection and management of wetlands in the state.

The key themes or messages in Volume 2 are as follows:

- By relying on a site-by-site approach to managing wetlands, we are failing to effectively protect them;
- To effectively protect wetlands and their functions, we also must understand and manage their interaction with the environmental factors that control wetland functions;
- To understand and manage these environmental factors and wetland functions, information generated through landscape analysis is needed and should be used in developing measures to manage and protect wetlands and their functions;

- Protection and management measures should incorporate a full range of components including:
  - Policies and plans such as comprehensive plans, subarea plans, Green Infrastructure plans, etc.;
  - Regulations such as critical areas ordinances, clearing and grading ordinances, etc.; and
  - Non-regulatory programs to restore and preserve using voluntary efforts and incentives that encourage conservation.

1.2 Purpose and Goals of Volume 2

Both Volumes 1 and 2 were written to assist local governments in complying with requirements in the Growth Management Act (GMA) to include the best available science when adopting development regulations to designate and protect critical areas, including wetlands. The GMA requires that local governments protect wetland functions and values, and evaluate and include relevant scientific information in determining what policies, plans, and regulations are needed. (See Chapter 2 for a discussion of the relevant mandates in the Growth Management Act.)

This is a challenging task and one that some cities and counties are poorly equipped to undertake. Many local governments have asked our departments to assist them by providing both general guidance and specific recommended code language for protecting wetlands.

The options and recommendations presented in Volume 2 are advisory only. Local governments are not required to use this guidance. The information presented in this document is not, in and of itself, the "best available science." Rather, it represents the recommendations of the Departments of Ecology and Fish and Wildlife as to how a local government could incorporate the best available science into policies, plans, and regulations to protect wetlands.

Volume 2 was also written to address the fact that wetlands continue to be lost and degraded through human activities in spite of the adoption of "no-net-loss" policies at local, state, and federal levels and an increased knowledge of the complex processes that drive wetland functions. The results of the scientific research synthesized in Volume 1 are clear: We have not stopped the continued degradation of our wetlands and their functions (Sheldon et al. 2003).

As concluded in Volume 1, wetland losses often result from a combination of impacts from human activities that occur both within and outside individual wetlands. Changes from human activities result in cumulative impacts across the landscape. Currently, however, the majority of decisions about managing wetlands in Washington State fail to consider environmental factors that control wetland functions or consequences of human

actions that occur at a landscape scale; they are made on a case-by-case basis related to specific projects.

The Departments' goals for Volume 2, therefore, are to help local governments:

- Use current scientific information to inform their decisions about the protection and management of wetlands and their functions and values to meet the requirements of the GMA; and
- Incorporate a more holistic, landscape-based approach to better protect wetlands and their functions and values and to manage cumulative effects.

The primary objective of Volume 2 is to translate the science synthesized in Volume 1 into recommendations and, where possible, several options for protecting and managing wetlands using landscape analysis, processes for planning, regulatory options, and sample code language, as well as non-regulatory approaches. For example, three different alternatives for buffer widths are provided, one being a matrix using factors such as wetland rating, intensity of effects from the proposed activity, wetland functions and other characteristics. Such approaches allow more flexibility.

In the future, it is hoped that:

- The protection and management of wetlands will be integrated with the management of all environmental resources across the landscape;
- Impacts to wetland functions and values from decisions about land uses will be understood at the appropriate geographic scales;
- Local jurisdictions will plan for future development in a proactive manner so impacts to the environmental factors that control functions are minimized before they occur; and
- When tradeoffs between conflicting values are made, the decision will be made with a full understanding of the "true value" lost or gained.

Implementing a More Comprehensive Approach

This volume presents a four-step approach or framework that integrates the science, the planning process, the regulatory and non-regulatory actions, and the different geographic scales at which natural resources should be managed. It represents the ideal situation where a local government has adequate resources and commitment to undertake this process. The available scientific information makes clear that the most effective way to protect wetland functions and values is to use a comprehensive, landscape-based approach. Addressing only some of the recommended actions, therefore, increases the risk that wetland functions and values will not be adequately protected. (See Chapter 10 for additional discussion of characterizing the risk of proposed solutions for protecting and managing wetlands.)

Although Ecology and Fish and Wildlife understand that not all local governments are currently in a position to implement the comprehensive program described in Volume 2, the entire process is presented so users can understand what information or tasks they are missing, and to help understand the tradeoffs being made and risks taken in the protection of wetland functions and values. At a minimum, local governments should adopt strong wetland regulatory programs until they can incorporate non-regulatory elements and landscape-based planning policies and zoning regulations.

In addition, transforming our approach to managing wetlands from a site-specific focus to a view of the broader landscape is a change of practice for local governments. It will most likely occur incrementally as local governments collect and analyze landscape-scale data and then incorporate that information into their various policies, plans, and regulations. We recognize that many jurisdictions will face a challenge in updating their development regulations to meet the state deadlines for GMA updates, even without incorporating a landscape perspective at this time. However, those jurisdictions that rely solely on regulatory programs to protect wetlands should adopt stringent regulations in order to minimize the risk that wetland functions will be lost until a landscape-based approach can be developed and implemented.

Working with Local Governments on Developing and Using Landscape Analysis

This document provides ideas on how to analyze the landscape as well as references for the various analysis methods that are available (in Chapter 5 and the associated appendices). One method for landscape analysis is being developed by Ecology. It provides suggestions on how to analyze landscape information (such as geology, soils, and water flow) for use in planning, developing protection measures, and identifying wetlands for restoration and preservation. Ecology's process for analyzing the landscape is illustrated in Appendix 5-C through the use of two examples where it has been applied, one in a small area and one in a larger geographic area.

Ecology's method for landscape analysis is being improved as it is applied in different jurisdictions. In addition, the methods are currently lacking in their analysis of wildlife habitat and corridors. This gap will be addressed next year as the Departments of Fish and Wildlife and Ecology work together to better include wildlife factors in the analysis.

Therefore, Ecology invites local governments to work with the agency to conduct landscape analyses and use the information to develop more effective approaches to protecting and managing the landscape and its wetlands. In this way, local governments can plan an important role in further developing an approach to landscape analysis.

1.3 Using Science to Protect and Manage Wetlands

> "To be effective, the nation's wetlands protection and management programs must anticipate rather than react. They should focus on future, not the present or the past; on effectively protecting the remaining resources and actively restoring or creating additional wetlands. They should anticipate needs and problems on the basis of rigorous analyses of regional resources, trends, stresses, and values. They should consider the whole, not just the individual parts."
>
> — The Conservation Foundation, *Protecting America's Wetlands: An Action Agenda. The Final Report of the National Wetlands Policy Forum* (1988).

1.3.1 Ecological Principles to Consider

The Ecological Society of America has taken a lead in compiling and explaining scientific principles on managing natural resources, such as wetlands (Dale et al. 2000). The ecologist's goal is to ensure that future decisions include the best scientific information available. The principles illustrate the need to take a more holistic, landscape approach to managing our natural resources. The principles and their implications in environmental decision-making are briefly summarized in Table 1-1.

Table 1-1. Ecological principles and their implications in making decisions about land use (adapted from Dale et al. 2000 to focus on wetlands rather than land use in general).

Ecological Principle	Implication for Managing Land Use in and around Wetlands
The type, intensity, and duration of disturbances are the major factors shaping populations and the ecosystem as a whole. Disturbances can occur at many different spatial and temporal scales.	Changes in land use that cause new disturbances are likely to cause changes in animal and plant populations and the functions of a wetland. We need to manage disturbances at the scale at which they occur. For example, the eutrophication of a wetland may be a result of disturbances throughout its watershed and this problem cannot be managed only within the wetland itself. Also, it is not possible to target a specific "end point" when creating or restoring wetlands because changes are continuous.
Ecological processes operate at many time scales, and ecosystems change through time.	The current state of a wetland is in part a consequence of historical conditions. Therefore, historical information may be needed to understand how a wetland will respond to disturbance. Managing wetlands to protect their valuable functions requires us to consider how ecological processes change through time both with and without the influence of human activities.
Some species have key, broad-scale effects on the ecosystem (keystone species).	The removal of keystone species can radically change the functions in a wetland and spread well beyond the boundaries of the wetland. Because the effects of keystone species are complicated and not fully understood, we cannot predict the effects on the ecosystem of changes in their numbers or distribution. For example, removing beavers from a river system has significant impacts on the biological diversity and flooding patterns of the entire watershed.

Ecological Principle	Implication for Managing Land Use in and around Wetlands
Local conditions strongly affect environmental functions at a site.	The position of a wetland in the landscape defines the functions it performs. Wetlands in a specific landscape position may perform only certain functions and at specific rates. We need to understand these local conditions when creating, restoring or enhancing wetlands so we do not "plan" for functions that the landscape will not support. For example, wetlands on slopes do not pond water. Creating a ponded wetland on a slope is not compatible with the position in the landscape, and maintaining this wetland will require constant management of the dikes and the outflow structure.
The size, shape, and location of different types of uplands around a wetland influence its functions.	An understanding of the surrounding landscape is needed to understand the implications of decisions made about an individual wetland.

The Ecological Society of America has also proposed guidelines for managers to use in considering the ecological impacts of their decisions about land use (including wetlands) (Dale et al. 2000). These guidelines, listed below, can be considered a checklist of factors to consider when making decisions about managing or protecting wetlands:

- Examine the impacts of local decisions in a regional context.
- Plan for long-term change and unexpected events.
- Preserve rare landscape elements, critical habitats, and associated species.
- Retain large contiguous or connected areas that contain critical habitats.
- Minimize the introduction and spread of nonnative species.
- Avoid or compensate for effects of development on ecological processes.
- Implement land use and land management practices that are compatible with the natural potential of the area.
- Avoid land uses that deplete natural resources over a broad area.

1.3.2 Challenges to Using the Science

Decisions by hearings boards and the courts have made clear that the requirement to "include the best available science in developing policies and development regulations to protect the functions and values of critical areas" is a substantive requirement, not merely a procedural one. (A review of hearings board and court cases that summarizes the key findings related to best available science, prepared by staff from the Department of Community, Trade and Economic Development and the state Attorney General's office, is presented in Chapter 2.)

However, including scientific information within policies, plans, and regulations is challenging. One of the greatest difficulties is that the science doesn't provide a "bright line." Science rarely supplies us with precise solutions for protecting natural resources. For example, the scientific literature often reports on experiments that do not relate directly to managing the resource. The scientists who reviewed the literature for Volume 1 found few studies that actually documented the effectiveness of different ways for managing the wetland resource (see Volume 1, Chapters 5 and 6). Rather, most studies discuss the impacts of human activities on wetlands. Also, very few experiments demonstrate true cause-and-effect relationships. Many impacts of human activities are not well understood and can only be hypothesized based on correlations.

Furthermore, many experiments tend to be very site specific and may not be applicable outside the immediate geographic area where the experiments were performed. Some may be applicable only to other similar settings and others may be applicable to a wide range of settings.

As a result, recommendations based on scientific information are, to a large degree, extrapolations and syntheses of all the information collected. Therefore, many of the recommendations in this document represent the collective interpretations by the authors of Volume 2 on the findings of the scientific information and how it pertains specifically to Washington.

For example, the recommendation that a 200-foot buffer will adequately protect the wildlife habitat functions of high-quality wetlands of eastern Washington is not based on a specific scientific study. Rather it represents a synthesis of many studies (see Chapter 5 in Volume 1). These studies show that different species need different widths of buffers that range from 100 feet to more than 600 feet. Furthermore, very few studies have focused on the needs of wildlife in wetlands of eastern Washington. In order to provide general guidance, therefore, the authors and reviewers of this document were forced to make an informed decision on the size of a buffer needed to protect wildlife in eastern Washington. In the absence of information about the species actually using a wetland, it was judged that a 200-foot buffer would adequately protect wildlife in wetlands that provide good habitat and are well connected in the landscape.

1.4 Science and Risk Management

One of the major recommendations made in Volume 2 is that local jurisdictions should understand the risk to the wetland resource resulting from their decisions. The uncertainties of translating the science to specific protection measures, described above, is one of the reasons that local governments need to assess the risks. Using buffers again as an example, one might ask: *How wide of a buffer is wide enough?* The science does not say that a 100-foot buffer will protect a certain type of wetland, whereas a 95-foot buffer will not. Instead, scientific information on buffers clearly states that buffers are important, that they perform many functions that are critical to maintaining wetland functions, and that a wide range of buffer widths provides a wide range of benefits depending on a number of factors.

Therefore, answering the critical question *How wide a buffer is enough?* is largely an exercise in deciding how much risk is acceptable. A regulation that sets a 300-foot buffer around every wetland significantly reduces the risk to those wetlands from human activities in the immediate vicinity of the wetland. That regulation can be characterized as relatively "low risk." On the other hand, a jurisdiction that decides they will provide a 50-foot buffer for all wetlands would have to characterize their action as "high risk" because a 50-foot buffer will not protect many wetland functions.

In this document, risk is addressed by tailoring the degree of protection to several factors that the scientific literature says are important. Continuing to use buffers as an example, one option presented in Volume 2 provides different buffer widths depending on the type of wetland and the functions it performs, as well as the type and intensity of adjacent land use. Risk characterization is discussed in detail in Chapter 10.

"Characterizing the risk" of decisions is also an important tool for improving approaches to wetland protection. Scientific data on the effectiveness of protection measures can be collected and used to monitor the success of wetland management. This information then provides an objective basis on which to revise management approaches (see Chapter 12 for more information on adaptive management).

In the end, decision-makers should consider the entire context of wetland protection and management when choosing the level of protection afforded to wetlands—from reducing impacts to wetlands through good planning and zoning based on landscape analysis, to non-regulatory approaches such as stewardship incentives and restoration programs.

1.5 Scope of Volume 2

Non-GMA Protection of Wetlands Is Not Addressed in Volume 2

The regulations and management programs implemented by federal, state, and tribal governments are not discussed in Volume 2 except where a mandate directs the action of local governments. For example, the definition of wetlands used by local governments is specified in state law (see Chapter 8).

Although it plays a vital role in local management and protection of wetlands, the Shoreline Management Act (SMA) is not covered in detail in this document. We refer readers to the new SMA guidelines which contain requirements for local governments to follow in developing policies and regulations to protect wetlands within shoreline jurisdiction. (For more information see the web site at: http://www.ecy.wa.gov/programs/sea/SMA/index.html)

The linkage between the landscape analysis required in the SMA guidelines and that discussed in this document is described in Chapter 7. The SMA guidelines include requirements for the inventory and analysis of ecosystem-wide processes. These requirements are consistent with the recommendations in Volume 2 for incorporating landscape analysis into local planning and protection efforts.

Vegetated Tidal Wetlands Are Addressed in Volume 2

The recommendations made in this document are not strictly limited to freshwater wetlands. Vegetated tidal wetlands (a subset of all tidal wetlands) are addressed specifically in the revised wetland rating system for western Washington because they were included in past versions of the method, even though the scientific information about them was not summarized in Volume 1. The scientific information on which recommendations for tidal wetlands were based is summarized in Appendix 8-A.

How "Values" Are Addressed in Volume 2

As discussed in Volume 1, wetland functions are the things that wetlands "do." Society, however, does not necessarily attach value to all wetland functions. Value is usually associated with goods and services that society recognizes. For example, trapping sediments is a wetland function that improves water quality, and this is often valued by society. Not all of the environmental factors that control wetland functions or the functions themselves, however, are recognized or valued.

Sometimes what is valued is not what a wetland does but some other aspect of the wetland ecosystem that is considered important socially. For example, "recreation" is valued by society and is often called a function even though it is not something a wetland "does." Other aspects of the wetland ecosystem that are valued and have been called functions include "education" and "aesthetic quality." These "values" are sometimes referred to as "social functions" to separate them from functions based on environmental factors.

The social functions cannot be assessed or rated using the same methods used to assess functions based on environmental factors. Valuing social functions requires methods based on economic, sociologic, and psychological tools, rather than on ecology and other environmental sciences.

The issue of "values" arises in this document in two ways. First, the GMA mandates that local governments protect wetland functions and values. However, the GMA does not define these terms or differentiate between them. One can assume that the GMA intended that the term "values" includes such things as recreation, education, and aesthetics. The wetland function assessment methods and the rating systems developed by the state do not address the social functions/values of wetlands such as recreation, aesthetics, education, and so on. In addition, the social functions are not part of the landscape analysis that is discussed in Chapter 5.

Second, "values" are also opinions held by communities in regard to what is important to them. For example, a community or rural area might value one wetland function more than another. Water quality improvement might be more valued than flood control in an area with water quality problems if that community is not in an area prone to flooding. In addition, a community might value certain amenities in their neighborhoods or rural areas above others. For example, a community might value keeping the maximum amount of vegetated area through clustered development more than scattered development that fragments vegetation. The need to identify and consider these values is addressed in Chapters 6 and 7. The landscape analysis offered in Chapter 5 provides important

information needed to make decisions regarding what is valued and what communities, and their wetlands, will be like in the future.

1.6 Process of Developing Volume 2

Production of this document (Volume 2) and Volume 1 was funded through a grant from the U.S. Environmental Protection Agency. Attendees of two focus groups provided early direction for the volumes. Meetings of focus groups were held in Olympia and Moses Lake in early 2002 to solicit ideas for the scope and objectives of the project. This information was used to guide the development of both volumes. These focus groups were attended by over 60 individuals, primarily representatives from local governments and consulting firms.

The guidance contained in Volume 2 was developed by a team of staff members from agencies and consulting firms using the synthesis of the science in Volume 1. The team (called the Core Team) consists of staff from the Washington State Departments of Ecology; Fish and Wildlife; Community, Trade and Economic Development; Sheldon & Associates; and a contract editor. A list of the members of the Core Team is provided in Appendix 1-A.

The Core Team developed the guidance in conjunction with a team of local government staff. The members of the Local Government Wetlands Advisory Team (LGWAT) are also listed in Appendix 1-A. LGWAT was convened in December 2003 to provide ongoing input and guidance to the development of this volume. This group met several times to review and respond to draft concepts and materials developed by the Core Team. Additionally, meetings were held with representatives from the business and environmental communities to solicit their ideas and comments on concepts and early draft documents.

Volume 2 was written by several members of the Core Team. Various sections, chapters, and appendices, therefore, have different primary authors. Editors revised the text into a coherent whole.

Opportunities for Comment and Process for Finalizing Volume 2

The draft of Volume 2 is being distributed for review during a four-week period to solicit comments. It is being provided to all those who have requested a hard copy, or a CD, or who can download it from the project's web page. In July, a newsletter was sent to the project's mailing list of over 1,200 recipients, informing them of the upcoming review period. They were requested to inform Ecology if they wanted to review the draft and needed to receive it in hard copy or CD format. For all those for whom we have an address, an email will be sent when the document has been posted on the project's web site.

Instructions are provided with this volume to inform reviewers about the process for submitting comments. Please read the instructions carefully before providing your

review. The agencies are requesting a critique of the general guidance and specific recommendations as well as feedback on suggested additions to the document. Comments regarding organization and ease of reading are also welcome.

After comments have been submitted and organized, the Core Team will review them and revisions will be made. Once completed, sometime in the fall of 2004, Volume 2 will be released in its final form.

1.7 How to Use Volume 2

Local governments are encouraged to read and understand the entire document before determining how they want to protect wetland functions and values. Although we provide a brief summary of Volume 1 in Chapter 3 of this document, we highly recommend reading Volume 1 as well, especially key points and conclusions.

We recognize that many local governments will want to rely largely on a regulatory approach to protecting wetlands and will be inclined to skip over the recommendations related to using a landscape approach to understanding and protecting wetlands, as well as the non-regulatory elements. However, we believe the key message from the scientific literature is that reliance upon a strictly regulatory, permitting approach will fail to adequately protect wetland functions and values.

Citations in the Text

This document is not intended to be a scientific treatise and, in general, does not reference specific scientific literature. While Chapter 3 provides an overview of the scientific basis for the recommendations in this document, the more detailed, peer-reviewed and referenced information on wetland science is contained in Volume 1. Also, many of the recommendations in this document cannot be tied to a specific scientific article, and cannot be cited as such (or the list of citations would be extremely long and cumbersome). Citations therefore are provided only when a specific recommendation was also made within the scientific literature. Some additional literature sources are cited in Chapter 6 and elsewhere in other parts of Volume 2. Many of these are not strictly scientific in nature and therefore were not included in the synthesis of the science in Volume 1.

As mentioned previously, the guidance provided in Volume 2 is advisory only. The Growth Management Act <u>does not</u> require that local governments adopt the protection standards recommended in this document. Local governments are free to use or adapt the options and recommendations presented here or develop entirely different approaches to protecting wetlands to fit their particular circumstances.

1.8 How Volume 2 Is Organized

Volume 2 is organized into 12 chapters plus references and appendices. The first three chapters in this document explain the purpose, legal basis, and basic scientific foundation for the recommendations that follow. Chapter 4 outlines a suggested framework that local governments can follow to protect and manage wetlands. The remaining chapters, Chapters 5-12, describe the primary elements of this framework. Methods for analyzing the resource, recommended language for plans and codes, and various supporting information are provided in the appendices.

Chapter 2
The Growth Management Act and Protection of Critical Areas

2.1 Introduction

This chapter provides background on the Washington State Growth Management Act (GMA) and its directives to local governments to protect critical areas such as wetlands. It also clarifies issues regarding the protection of critical areas and incorporation of best available science into critical areas regulations.

As defined in Chapter 36.70A.030(5) Revised Code of Washington (RCW), "critical areas" include wetlands; areas with a critical recharging effect on aquifers used for potable water; fish and wildlife habitat conservation areas; frequently flooded areas; and geologically hazardous areas.

2.2 An Overview of the GMA

In 1990 the Washington State Legislature passed the GMA (RCW 36.70A) to guide local jurisdictions in their decisions regarding land use. The GMA dictates that counties and cities with certain characteristics must plan for future growth (RCW 36.70A.040). GMA identifies 14 goals that are to be used by local governments to "guide" the development of comprehensive plans and development regulations, including crafting critical areas ordinances, to meet the intent and requirements of the GMA (RCW 36.70A.020). The goals include a range of actions from concentrating urban development to reduce sprawl, providing for a range of affordable housing, and ensuring transportation infrastructure is coordinated between jurisdictions, to assuring property rights.

In addition to the human-focused goals, GMA includes goals that address maintaining the extraction of natural resources, such as timber and mining, and agricultural land uses, while avoiding incompatible uses; providing for open space and recreation, including conserving fish and wildlife habitats; and protecting the environment and the quality of life in the state. Cities and counties have responded to these mandates by developing or updating their comprehensive plans and development regulations.

GMA requires jurisdictions to develop regulations that implement their comprehensive plan provisions (RCW 36.70A.040). Comprehensive plans and development regulations, including critical areas regulations, are subject to continuing review and evaluation by the county or city that adopted them. In 2002, the Legislature amended the GMA to require

counties and cities to take legislative action to review and, if needed, revise their comprehensive land use plans and regulations on a seven-year cycle to ensure the plans and regulations comply with the requirements of GMA (RCW 36.70A.130). (The review cycle had previously been five years.)

The GMA also requires local jurisdictions to include the best available science in the development of policies and development regulations used to both designate and protect critical areas (RCW 36.70A.172) functions and values. The Legislature considered the requirement for best available science an important step toward regulatory reform and timely permitting of projects.

The GMA contains a variety of provisions that are directly relevant to applying landscape-scale planning and developing regulations based on science. For example, there is a requirement to identify open space corridors within and between Urban Growth Areas (RCW 36.70A.160). The GMA states that the corridors are to provide lands that are "… useful for recreation, wildlife habitat, trails, and connection of critical areas as defined in RCW 36.70A.030." This provision directly reflects one of the key findings of the synthesis of the science, which identifies habitat fragmentation (elimination of habitat links between wetlands) as one of the significant adverse effects of urbanization on biodiversity (see Chapter 3 in Volume 1). Another provision is under the land use element (RCW 36.70A.070(1)), which requires the "protection of the quality and quantity of groundwater used for public water supplies" and, where applicable, for the review of "drainage, flooding, and storm water run-off in the area and nearby jurisdictions and provide for guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state, including Puget Sound, or waters entering Puget Sound."

In passing the GMA, the Legislature also required that local governments coordinate their comprehensive plans with jurisdictions that share either common borders or regional issues, to be consistent across political boundaries. Variations in zoning regulations, density of housing, and other land uses, as well as the infrastructure built for transportation, water service, sewage, and other necessary public utilities, had been resulting in inconsistent and incompatible uses and expectations across jurisdictional boundaries.

2.3 A Review of Hearings Board Cases and Court Cases

The following sections present a review of court cases and Growth Management Hearings Board cases prepared by Alan Copsey, Washington State Attorney General's Office, and Chris Parsons, Washington State Department of Community, Trade and Economic Development. The text in these sections is from a memorandum (dated April 2004) to state agencies developed by Chris Parsons, summarizing Alan Copsey's information about GMA and critical areas protection. Minor edits have been made to the formatting of this text, such as the addition of subheadings, to make it consistent with the format of other chapters in this volume.

2.3.1 Designating Critical Areas and Adopting Regulations to Protect Them

The GMA recognizes that the first formal step required in implementing the GMA is the designation and protection of critical areas. This is important for two reasons: (1) to exclude critical areas from urban growth designations and impacts, and (2) to prevent irreversible environmental harm while comprehensive plans and implementing development regulations are prepared.

All three Growth Management Hearings Boards in Washington State (Central Puget Sound, Eastern Washington, and Western Washington) have recognized and given effect to the required priority of critical areas designation and protection.[1] In an oft-quoted passage, the Central Board explained:

> *It is significant that the Act required cities and counties to identify and conserve resource lands and to identify and protect critical areas before the date that IUGAs had to be adopted. This sequence illustrates a fundamental axiom of growth management: "the land speaks first." Only after a county's agricultural, forestry and mineral resource lands have been identified and actions taken to conserve them, and its critical areas, including aquifers, are identified and protected, is it then possible and appropriate to determine where, on the remaining land, urban growth should be directed pursuant to RCW 36.70A.110.*[2]

RCW 36.70A.170(1) requires that all appropriate critical areas in all counties and cities must be designated. The GMA permits no exemptions, exclusions, or limitations on applicability that would result in some critical areas not being designated. The requirement to designate may be met by designating or mapping known critical areas at the time the critical areas ordinance is adopted, or by adopting a process to designate or map critical areas as information becomes available.

RCW 36.70A.060(2) requires all counties and cities in Washington to adopt development regulations to protect designated critical areas.[3] The Western Board has described RCW 36.70A.060(2) as imposing a *duty* on local governments to adopt development regulations that protect critical areas; inherent in that duty is the requirement that the regulation contain appropriate and specific criteria and standards to ensure protection.[4]

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[1] *See Bremerton v. Kitsap Cy.*, CPSGMHB No. 95-3-0039c (Final Decision & Order, Oct. 6, 1995); *Association to Protect Anderson Creek v. City of Bremerton*, CPSGMHB No. 95-3-0053 (Final Decision & Order, Dec. 26, 1995); *City of Port Townsend v. Jefferson Cy.*, WWGMHB No. 94-2-0006 (Final Decision & Order, Aug. 10, 1994); *C.U.S.T.E.R. Ass'n v. Whatcom Cy.*, WWGMHB No. 96-2-0008 (Final Decision & Order, Sept. 12, 1996); *Knapp v. Spokane Cy.*, EWGMHB No. 97-1-0015c (Final Decision & Order, Dec. 24, 1997).

[2] *Bremerton v. Kitsap Cy.*, CPSGMHB No. 95-3-0039c (Final Decision & Order, Oct. 6, 1995).

[3] RCW 36.70A.060(2).

[4] *See Whatcom Envtl. Coun. v. Whatcom Cy.*, WWGMHB No. 95-2-0071 (Final Decision & Order, Dec. 20, 1995); *Willapa Grays Harbor Oyster Growers Ass'n v. Pacific Cy.*, WWGMHB No. 99-2-0019 (Final Decision & Order, Oct. 28, 1999).

All designated critical areas must be protected, but not all critical areas must be protected in the same manner or to the same degree.[5] To "protect" critical areas generally means to preserve their structure, value, and functions.[6] The required standard of protection should be to prevent adverse impacts or, at the very minimum, to mitigate adverse impacts.[7]

While local governments have discretion to adopt critical areas regulations that may result in local impacts upon some critical areas, or even the loss of some critical areas, there must be no net loss of the structure, value, and functions of the natural systems constituting the protected critical areas.[8] A county or city must provide a detailed and reasoned justification for any critical area not protected.[9] All such decisions and justifications must be based on a substantive consideration of the best available science.[10]

Development in critical areas is not absolutely prohibited under the GMA, so long as the structure, functions, and values of the critical areas are protected.[11]

The GMA does not categorically exempt preexisting land uses from the requirement to protect critical areas. A city or county may need to regulate preexisting uses in order to

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[5] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995); *Easy v. Spokane Cy.*, EWGMHB No. 96-1-0016 (Final Decision & Order, Apr. 10, 1997); *Confederated Tribes & Bands of the Yakama Indian Nation v. Yakima Cy.*, EWGMHB No. 94-1-0021 (Final Decision & Order, Mar. 10, 1995); *Save Our Butte Save Our Basin Soc'y v. Chelan Cy.*, EWGMHB No. 94-1-0015 (Final Decision & Order, Aug. 8, 1994); *Clark Cy. Natural Res. Coun. v. Clark Cy.*, WWGMHB No. 92-2-0001 (Final Order, Nov. 10, 1992).

[6] RCW 36.70A.172(1); WAC 365-195-825(2)(b); *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995).

[7] *Save Our Butte Save Our Basin Soc'y*, EWGMHB No. 94-1-0015 (Compliance Hearing Order, Apr. 8, 1999, and Final Decision & Order, Aug. 8, 1994); *English v. Bd. of Cy. Comm'rs of Columbia Cy.*, EWGMHB No. 93-1-0002 (Final Decision & Order, Nov. 12, 1993).

[8] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995). These decisions address wetlands and fish and wildlife habitat conservation areas, but their rationale applies also to frequently flooded areas and critical aquifer recharge areas insofar as they are protected for their ecological or hydrological function and value.

[9] *Friends of Skagit Cy. v. Skagit Cy.*, WWGMHB No. 96-2-0025 (Final Decision & Order, Jan. 3, 1997); *Whatcom Envtl. Coun. v. Whatcom Cy.*, WWGMHB No. 95-2-0071 (Final Decision & Order, Dec. 20, 1995).

[10] RCW 36.70A.172(1); *Honesty in Envtl. Analysis. & Legislation (HEAL) v. Cent. Puget Sound Growth Mgmt. Hrgs. Bd.*, 96 Wn. App. 522 (1999).

[11] *Knapp v. Spokane Cy.*, EWGMHB No. 97-1-0015 (Final Decision & Order, Dec. 24, 1997); *Association to Protect Anderson Creek v. Kitsap Cy.*, CPSGMHB No. 95-3-0053 (Final Decision & Order, Dec. 26, 1995); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995).

fulfill its statutory duty to "protect critical areas" under RCW 36.70A.060(2).[12] Any exemptions for preexisting use must be limited and carefully crafted.[13]

Some critical areas, such as wetlands and fish and wildlife habitat conservation areas, may constitute ecosystems that transcend the boundaries of individual parcels and jurisdictions, so that it is necessary to address the protection of their structure, function, and values on a larger scale (such as a watershed).[14]

2.3.2 Relationship of Critical Areas Regulations to Other Land Uses

Critical areas regulations are to overlay all other land uses, including designated natural resource lands and designated urban growth areas, and are to preclude land uses and developments that are incompatible with the preservation of critical areas.[15] This overlay requirement makes sense in the overall scheme of the GMA, under which all lands are designated in one of three categories:

- urban land (i.e., within a designated urban growth area),
- natural resource land (i.e., designated as agricultural, forest, or mineral resource land), or
- rural land (which may include limited areas of more intense rural development and a variety of land uses).

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[12] *Protect the Peninsula's Future v. Clallam Cy.*, WWGMHB No. 00-2-0008 (Final Decision & Order, Dec. 19, 2000).

[13] *Id.*; *Friends of Skagit Cy. v. Skagit Cy.*, WWGMHB No. 96-2-0025 (Final Decision & Order, Jan. 3, 1997).

[14] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Final Decision & Order, Jan. 8, 1997).

[15] WAC 365-190-020. Critical areas overlaying designated urban growth areas, *see Advocates for Responsible Dev. v. City of Shelton*, CPSGMHB 98-2-0005 (Final Decision & Order, Aug. 10, 1998); *Litowitz v. City of Federal Way*, CPSGMHB No. 96-3-0005 (Final Decision & Order, July 22, 1996); *Pilchuck Audubon Soc'y v. Snohomish Cy.*, CPSGMHB No. 95-3-0047 (Final Decision & Order, Dec. 6, 1995); *Association of Rural Residents v. Kitsap Cy.*, CPSGMHB No. 93-3-0010 (Final Decision & Order, June 3, 1994).Critical areas overlaying designated natural resource lands, *see Protect the Peninsula's Future v. Clallam Cy.*, WWGMHB Nos. 00-2-0008/ 01-2-0020 (Compliance Order/Final Decision & Order, Oct. 26, 2001); *Mitchell v. Skagit Cy.*, WWGMHB No. 01-2-0004 (Final Decision & Order, Aug. 6, 2001); *Saddle Mtn. Minerals v. City of Richland*, EWGMHB No. 99-1-0005 (Order Finding Partial Compliance, Apr. 18, 2001); *Friends of Skagit Cy. v. Skagit Cy./Skagit Audubon Soc'y v. Skagit Cy.*, WWGMHB Nos. 96-2-0025/ 00-2-0033c (Compliance Hearing/Final Decision & Order, Aug. 9, 2000); *Saddle Mtn. Minerals v. Grant Cy.*, EWGMHB No. 99-1-0015 (Final Decision & Order, May 24, 2000); *Island Cy. Citizens' Growth Mgmt. Coalition*, WWGMHB No. 98-2-0023 (Final Decision & Order, June 2, 1999); *Friends of Skagit Cy. v. Skagit Cy.*, WWGMHB No. 96-2-0025 (Final Decision & Order, Jan. 3, 1997). Critical areas overlaying rural lands, *see City of Anacortes v. Skagit Cy.*, WWGMHB No. 00-2-0049c (Final Decision & Order, Feb. 6, 2001).

These three designations have been called the "fundamental building blocks of land use planning under the GMA"[16]; other land use designations and restrictions overlay these three primary designations. As long as critical areas are protected, "other, non-critical portions of land can be developed as appropriate under the applicable land use designation and zoning requirements."[17]

2.3.3 Including Best Available Science in Critical Areas Regulations

RCW 36.70A.172(1) requires all local governments to include the best available science when adopting development regulations to designate and protect critical areas. In addition, they "shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries." This language actually imposes three interrelated requirements:

- the requirement to include the best available science when designating and protecting critical areas;
- the requirement to give special consideration to the preservation or enhancement of anadromous fisheries;
- the requirement to adopt development regulations that protect the functions and values of critical areas.

There are two reported appellate court decisions interpreting RCW 36.70A.172, focused primarily on what it means to *include* the best available science.[18] In the HEAL case, the Court did not attempt to explain what constitutes best available science, although it suggested in passing that the Board could not displace a local government's judgment as to which science in the record is the "best."[19] On the other hand, the Court strongly stated that a local government "cannot ignore the best available science in favor of the science it prefers simply because the latter supports the decision it wants to make."[20] This language suggests the Board in fact may review whether a local government has identified and relied on the best available science and remand to the local government to achieve compliance with RCW 36.70A.172(1).

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[16] *See Forster Woods' Homeowners Ass'n v. King Cy.*, CPSGMHB No. 01-3-0008 (Final Decision & Order, Nov. 6, 2001)

[17] *See Association to Protect Anderson Creek v. City of Bremerton*, CPSGMHB No. 95-3-0053 (Final Decision & Order, Dec. 26, 1995); *Knapp v. Spokane Cy.*, EWGMHB No. 97-1-0015c (Final Decision & Order, Dec. 24, 1997).

[18] *Honesty in Envtl. Analysis & Legislation (HEAL) v. Cent. Puget Sound Growth Mgmt. Hrgs. Bd.*, 96 Wn. App. 522 (1999). *Whidbey Envtl. Action Network (WEAN) v. Island Cy.*, 118 Wn. App. 567, 76 P.3d 1215 (2003)

[19] *Id.*, 96 Wn. App. at 530.

[20] *Id.*, 96 Wn. App. at 534.

In the WEAN case, the Central Board concluded that some of the stream buffers in Island County that were adopted to protect fish and wildlife habitat conservation areas were not supported by the scientific information in the record before the County. The Court of Appeals affirmed, rejecting the County's argument that the Board must defer to the local government's discretionary balancing of the best available science with other factors. The Court explained that RCW 36.70A.172(1) requires the best available science to be included in the record and considered substantively in the development of critical areas policies and regulations.[21] The Court briefly reviewed the science in the record and held that the Board's disapproval of the stream buffers was supported by sufficient evidence.

If a local government chooses to depart from best available science, then it is recommended that the jurisdiction follow the criteria provided in WAC 365-195-915 for demonstrating that the best available science has been "included" in the development of critical areas policies and regulations. The local government's record supporting adoption of those policies and regulations should include the following:

- the specific policies and regulations adopted to protect the functions and values of critical areas;
- copies of (or references to) the best available science used in the decision making;
- the nonscientific information used as a basis for departing from science-based recommendations;
- the rationale supporting the local government's reliance on the identified nonscientific information;
- actions taken to address potential risks to the functions and values of the critical areas the policies and regulations are intended to protect.

Implicit in the rule is the presumption that the Growth Management Hearings Boards and the courts review both the local government's assessment of what constitutes the best available science and the substantive relationship between the best available science and the adopted critical areas regulations. Local governments must substantively consider the best available science when adopting development regulations to designate or protect critical areas. The adopted regulations must protect the functions and values of the critical areas. If the local government determines this protection can be assured using an approach different from that derived from the best available science, the local government must demonstrate on the record how the alternative approach will protect the functions and values of the critical areas.

[21] 76 Wn.2d at 1222-23, citing *Honesty in Environmental Analysis & Legislation (HEAL) v. Central Puget Sound Growth Management Hearings Board*, 96 Wn. App. 522, 532, 979 P.2d 864 (1999).

2.3.4 Protecting the Functions and Values of Critical Areas

Local governments must adopt development regulations that protect the functions and values of critical areas. This reference to functions and values has been interpreted to mean the functions and values of the ecosystems of which a given critical area is a part. Accordingly, while a local government is not prohibited from allowing localized impacts on some critical areas, or even the loss of some critical areas, it may not allow a net loss of the functions and values of the ecosystem including the impacted or lost critical areas. Moreover, any loss or adverse impact should be allowed only for good cause and evaluated using the best available science.

The Central Board has explained that RCW 36.70A.172(1), read together with RCW 36.70A.060 and RCW 36.70A.020(8), requires local governments to protect critical areas, maintain and enhance anadromous fisheries, and conserve fish and wildlife habitat.[22] RCW 36.70A.172(1) thus conveys a legislative intent to protect the functions and values of critical areas, recognizing that wetlands and fish and wildlife habitat conservation areas, in particular, are interrelated ecosystems important to the preservation and enhancement of anadromous fisheries:

> *[T]he Act's requirement to protect critical areas, particularly wetlands and fish and wildlife habitat conservation areas, means that the values and functions of such ecosystems must be maintained. While local governments have the discretion to adopt development regulations that may result in localized impacts upon, or even the loss of, some critical areas, such flexibility must be wielded sparingly and carefully for good cause, and in no case result in a net loss of the value and functions of such ecosystems within a watershed or other functional catchment area*.[23]

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[22] *Tulalip Tribes of Wash. v. Snohomish Cy.*, CPSGMHB No. 96-3-0029 (Order on Motions, Oct. 6, 1996).

[23] *Id.*

Chapter 3
Key Conclusions from Volume 1

This chapter briefly summarizes the information and conclusions presented in Volume 1 of this two-volume report. The first section highlights the major conclusions from the scientific literature that relate to protecting and managing wetlands. The subsequent sections summarize the findings of Chapters 2 through 7 of Volume 1.

Please note that this is intended to be a brief overview of Volume 1. More detailed lists of key points and discussions of conclusions are provided at the end of major sections in each chapter of Volume 1.

3.1 Major Conclusions About Our Current Efforts to Protect Wetlands

In spite of wetland regulatory programs at federal, state, and local levels, the data show that impacts to wetlands continue. The existing scientific information points to the fact that we have not achieved the federal and Washington state goal of "no net loss of wetland functions or area." From 1986 to 1997 the estimated annual loss of wetlands nationwide continued to be about 58,500 acres per year. On a positive note, this was about a quarter of the rate of previous losses (National Research Council 2001). Such losses of wetlands have also been documented for the Pacific Northwest (see Chapter 7 in Volume 1).

The review of the information on how we manage wetlands points to several reasons why losses continue. These include:

- Case-by-case permitting under current regulations does not meet the goal of no net loss (National Research Council 2001). The majority of decisions concerning wetlands in Washington State and the nation are based on case-by-case actions related to specific projects, without any opportunity to consider the broader landscape, the environmental factors that control wetland functions, or consequences. This pattern is a result of the current structure of programs at local, state, and federal regulatory agencies. The results of the research on case-by-case permitting processes are clear: There are consistent wetland losses regionally and statewide. These impacts are often the result of cumulative and synergistic impacts across the landscape.

- The functions performed by wetlands can be affected by actions taken in other parts of the watershed (see Chapter 2 in Volume 1).

- Decisions made without an understanding of how a wetland is affected by and can affect its watershed often result in actions that do not adequately protect functions of wetlands. Since the case-by-case approach has not worked to ensure that there is no net loss of wetland area and functions for over 20 years, it can be assumed that wetlands and their functions will be adequately protected to meet this goal only if protection and management occur at a larger geographic scale. The National Research Council (2001) concludes that "a watershed approach would improve permit decision-making."

3.2 Wetlands in Washington and How They Function (Chapter 2 of Volume 1)

Types of Wetland Functions and How They Are Controlled

Chapter 2 of Volume 1 discusses the functions of wetlands, which are things that wetlands "do." Wetland functions are generally grouped into three broad categories:

- Biogeochemical functions, which are related to trapping and transforming chemicals and include functions that improve water quality in the watershed;
- Hydrologic functions, which are related to maintaining the water regime in a watershed and include such functions as reducing flooding; and
- Food web and habitat functions.

The functions that wetlands perform are controlled by environmental factors that occur in the broader landscape as well as within the wetland. The primary factors that control wetland functions are climate, geomorphology, the source of water, and the movement of water. These factors affect wetland functions directly or through a series of secondary factors including nutrients, salts, toxic contaminants, soils, temperature, and the connections between different ecosystems.

The most important environmental factors that control wetland functions at an individual site may occur outside the boundary of the wetland. For example, riverine wetlands are affected to a great degree by processes operating at the scale of the entire watershed of the river. In contrast, depressional wetlands often are subject to processes that occur primarily within the basin that contributes surface or groundwater to the wetland. Thus, the environmental factors that control the structure and functions of a wetland occur at both the landscape scale (in the watershed where the wetland is located and beyond) as well as at the site scale (within and near the wetland).

Information about the factors that control functions at the landscape scale is still evolving. Ongoing research is continually strengthening our understanding of these factors.

An understanding of wetland functions for the purposes of managing and protecting them will require knowledge of how the major controls of functions change or are affected by humans at different geographic scales. We need to understand how climate, topography, and the movement of water, nutrients, sediment, etc. are affected by human activities in the larger landscape as well as within and in the immediate vicinity of the wetland. Environmental disturbances caused by human activities and their effects on the functions of wetlands are summarized in Sections 3.3 and 3.4 below.

Classification of Wetlands in Washington as a Key to Understanding Their Functions

The diverse areas of Washington State support many kinds of wetlands that vary in functions. For example, vernal pools on the scablands differ greatly from the floodplain marshes along the Snoqualmie River, and wetlands that formed in the potholes created by glaciers have different functions from those found along the shores of salt lakes in the Grand Coulee.

Scientists have divided wetlands in Washington into different groups based on their functions (see Table 3-1). The environmental factors of geomorphology, the source of water, and the movement of water are the basic characteristics used to divide wetlands into these groups.

Table 3-1. Subclasses and "families" of wetlands in different regions of Washington State (Hruby et al. 1999, 2000).

Class	Subclasses and Families by Region			
	Lowlands of Western WA	**Lowlands of Eastern WA**	**Columbia Basin**	**Montane (East and West)**
Riverine	Impounding Flow-through	ND	ND	ND
Depressional	Outflow Closed	ND	Alkali Freshwater Long-duration Short-duration	ND
Slope	ND	ND	ND	ND
Flats	ND	Probably does not occur in the region.	Probably does not occur in the region.	ND
Lacustrine (lake) Fringe	ND	ND	ND	ND
Tidal Fringe	Salt Water Fresh Water	Does not occur in the region.	Does not occur in the region.	Does not occur in the region.
ND = Subclasses in the region have not yet been defined.				

3.3 Environmental Disturbances Caused by Human Activities and Uses of the Land (Chapter 3 of Volume 1)

Chapter 3 of Volume 1 discusses the major types of environmental disturbances created by human activities and uses of the land and water. These disturbances change the environmental factors that in turn control wetland functions. Chapter 3 of Volume 1 addresses the disturbances created by four major types of land uses in Washington State: agriculture, urbanization, logging, and mining.

Several types of disturbances have been documented to change the factors that control wetland functions. These disturbances include:

- Changing the physical structure within a wetland (e.g., filling, removing vegetation, tilling soils, compacting soils)
- Changing the amount of water (increasing or decreasing the amount)
- Changing the fluctuation of water levels (volume, frequency, amplitude, direction of flow)
- Changing the amount of sediment (increasing or decreasing the amount)
- Increasing the amount of nutrients
- Increasing the amount of toxic contaminants
- Changing the acidity or alkalinity
- Increasing the concentration of salt (salinization)
- Decreasing the connection between habitats (fragmentation)
- Other disturbances that are not as well documented including alteration of soils, construction of roads, noise, recreational access, invasion of exotic species, and access by domestic pets

As with performance of functions, a general conclusion that can be made from the scientific literature is that disturbances can also occur at several geographic scales. Much of the early research focused on disturbances at a single site or wetland. More recent research has documented the significance of disturbances that occur at the much larger scale of the landscape.

The effects of different human land uses on the flow and fluctuations of water are well documented. Changes in land uses and vegetation communities alter the patterns of surface and shallow groundwater movement across a landscape. Flows of water can be reduced or increased by different land uses, as can the volume, frequency, and amplitude of water levels downgradient of the disturbance. Removal of vegetation and/or

compaction of native soils through agricultural practices, creation of lawns or grazed pastures, or creation of impervious surfaces through urbanization all have the same relative consequence: increased volumes of water and rates of flow after a given storm event. As with urbanization, agriculture can influence the water regime of wetlands, leading to loss of wetlands in some areas and creation or maintenance of wetlands in other areas where wetlands did not originally exist, such as areas influenced by irrigation.

Human activities also increase sediment and other pollutants in runoff. Pollutants often adhere to sediment particles that enter wetlands. In agricultural areas, pesticides and fertilizers can contribute to contamination of surface waters. In urban areas, stormwater runoff frequently contains sediment, organic matter, phosphorus, metals, and other pollutants. Mining increases the acidity of surface waters as well as adding toxic heavy metals. Logging increases sediments and can also change the amount of water and its fluctuations.

Fragmentation of habitats is also of increasing concern in the literature. As connections between wetlands and other habitats are broken and more wetlands across the landscape are converted to other uses, the remaining habitat becomes more isolated. This potentially puts wildlife populations at risk.

A key finding is that different land uses may cause the same change in the controls of wetland functions. For example, changing the input of sediment can affect wetland functions (as discussed in Section 3.4 below). Urban land uses, agricultural practices, and logging have all been shown to increase sediments in a watershed. From the wetland's "point of view," the source of the sediment is irrelevant—the impact of excess sediments on wetland functions is similar, regardless of the source of the sediments.

The disturbances created by some types of land use are summarized in Table 3-2. The table is organized by the type of land use and the scale at which the disturbance occurs. This table represents a synthesis of the severity of impacts as compiled by the authors of Volume 1 based on the information in the literature.

Table 3-2. Summary of types of environmental disturbances created by some types of land use.

Key to symbols used in table:

(xx) land use creates a significant disturbance to environmental factors

(x) land use creates a disturbance

(nm) studies on impacts of this land use do not mention this disturbance

(h) literature is lacking but disturbances can be hypothesized based on authors' experiences

(?) information lacking

Disturbance	Scale of Disturbance	Agriculture	Urbanization	Mining
Changing the physical structure within wetlands (filling, vegetation removal, tilling of soils, compaction of soils)	Site scale	xx	xx	h
Changing the amounts of water	Landscape scale Site scale	xx xx	xx xx	? h
Changing fluctuations of water levels (frequency, amplitude, direction of flows)	Landscape scale Site scale	xx xx	xx xx	? h
Changing the amounts of sediment	Landscape scale Site scale	xx xx	xx xx	h h
Increasing the amount of nutrients	Landscape scale Site scale	xx xx	xx xx	nm nm
Increasing the amount of toxic contaminants	Landscape scale Site scale	xx xx	xx xx	x xx
Changing the acidity	Landscape scale Site scale	nm nm	nm nm	x xx
Increasing the concentrations of salt	Landscape scale Site scale	x x	nm nm	nm nm
Decreasing the connection between habitats	Landscape scale	xx	xx	h
Other disturbances	Site scale	xx	xx	h

3.4 Impacts of Human Disturbances on the Functions of Wetlands (Chapter 4 of Volume 1)

As described above, Chapter 3 of Volume 1 discusses how human land uses cause disturbances in the environmental factors that control wetland functions. Chapter 4 takes the discussion a step further by explaining how a change in these environmental factors can actually result in a change in wetland functions.

The literature findings are displayed in a summary format in Table 3-3. This table summarizes the effects on wetland functions of each type of human disturbance listed in Table 3-2 (change in physical structure, change in water, change in sediment, etc.).

By combining the information in Tables 3-2 and 3-3, it is possible to associate changes in functions of wetlands with general types of human land use, as shown in Table 3-4.

For example, Table 3-2 shows that urbanization creates significant disturbances that change the amount of water, fluctuations of water levels, input of sediments, nutrients, and contaminants to wetlands. Table 3-3 shows that disturbances to water flows, fluctuations of water levels, and input of sediments, nutrients, and contaminants have a significant impact on the wetland functions of providing habitat for plants, invertebrates and reptiles/amphibians. Table 3-4 synthesizes the information from the previous two tables to show that urbanization impacts the habitat for plants, invertebrates, reptiles, and amphibians in wetlands. These tables, therefore, summarize how human land uses create various disturbances in the environment, and those disturbances in turn affect the factors that control wetland functions, ultimately leading to changes in those functions.

Table 3-3. Synthesis of the information reported in the literature on the impact of different human disturbances on wetland functions.

Key to symbols used in table:

++ Significant impacts on specific functions have been documented
+ Some data suggest impacts, or impacts could be hypothesized
0 Data indicate that impacts are minimal
? Information is lacking and/or may vary by species

	Functions							
Disturbance Type	**Hydrologic**	**Water Quality**	**Plants**	**Habitat for Invertebrates**	**Habitat for Amphibians and Reptiles**	**Habitat for Fish**	**Habitat for Birds**	**Habitat for Mammals**
Changing the physical structure of wetland	+	+	++	++	+	+	++	+
Changing the amount of water	+	+	++	++	++	+	+	?
Changing fluctuations of water levels	?	?	++	+	++	+	?	?
Changing amounts of sediment	+	?	++	++	?	?	?	?
Increasing amounts of nutrients	+	+	++	++	++	+	+	+
Increasing amounts of toxic contaminants	?	+	++	++	++	++	++	?
Changing acidity	0	+	+	++	++	+	+	+
Increasing concentrations of salt	0	?	++	++	?	?	+	?
Decreasing connections between habitats	0	?	?	?	++	?	++	+
Other disturbances	?	?	++	+	++	++	++	++

Note: A (++) does not indicate the direction of the impacts to functions. In some cases the disturbance can increase the function or the richness and abundance of species and in other cases it can decrease them. A disturbance can also decrease or increase a function depending on the intensity of the disturbance (e.g., small amounts of nutrients can increase invertebrate richness and abundance, but too much will cause eutrophication).

Table 3-4. Synthesis of the impacts of some land uses on wetland functions.

Key to symbols used in table:

++ Significant impacts on specific functions have been documented
+ Some data suggest impacts or impacts could be hypothesized
? Information is lacking
+? Some impacts have been documented but more information is needed

Land Use	Functions							
	Hydrologic	Water Quality Improvement	Plants	Habitat for Invertebrates	Habitat for Reptiles and Amphibians	Habitat for Fish	Habitat for Birds	Habitat for Mammals
Agriculture	+	+	++	++	++	++	++	+?
Urbanization	+	+	++	++	++	++	++	+?
Mining	?	?	+	++	++	+	+	+?

Note: A (++) does not indicate the direction of the impacts to functions. In some cases the land use can increase the function or the richness and abundance of species and in other cases it can decrease them. A land use can also decrease or increase a function depending on the intensity of the land use.

3.5 The Science and Effectiveness of Wetland Management Tools (Chapter 5 of Volume 1)

How Wetlands Are Defined

Wetlands are defined using well established language that is generally consistent between federal and Washington state laws. In some jurisdictions, all lands that meet the definition of “wetland” are regulated. However, it is not unusual for a jurisdiction to differentiate within its regulations between “wetlands” (i.e., biological wetlands) and “regulated wetlands” (i.e., wetlands that they intend to regulate). The definition of what constitutes a regulated wetland may vary from jurisdiction to jurisdiction.

Delineation of wetland boundaries is conducted according to either the federal or state delineation manual. These manuals are consistent and, when applied correctly, will result in the same wetland boundary. In the State of Washington, however, local jurisdictions are required by state law to use the state manual (RCW 36.70A.175, Chapter 173.22.080 WAC).

As discussed in Chapter 5 of Volume 1, certain wetland types are sometimes excluded from regulation. These can include small wetlands, isolated wetlands, and Prior Converted wetlands. The scientific literature makes clear that small wetlands and isolated wetlands provide important functions and does not provide any rationale for excluding these wetlands from regulation. Little scientific information is available on

Prior Converted wetlands, but there is no evidence to suggest that they are unimportant in providing wetland functions.

Wetland rating systems are a useful tool for grouping wetlands based on their needs for protection. One method used in Washington is the *Washington State Wetland Rating System*, which places wetlands in categories based on their rarity, sensitivity, our inability to replace them, and their functions. Many local governments in Washington have modified the state rating system for use in their own jurisdictions.

Wetland Buffers

Wetland buffers are one management tool for protecting wetland functions. The literature findings on buffers and their effectiveness are related to the type of wetland function, what activities are being buffered, and the characteristics of the wetland and the buffer itself.

The literature confirms that for improving water quality (e.g., sediment removal and nutrient uptake) there is a non-linear relationship between the width of the buffer and increased effectiveness in water quality improvement. Sediment removal and nutrient uptake are provided at the greatest rates within the immediate outer portions of a buffer (nearest the source of sediment/nutrient), with increasingly larger widths of buffers required to obtain measurable increases in those functions beyond this initial removal. Additionally, the long-term effectiveness of buffers in providing this function is not well documented in the literature and represents a need for future research.

To protect wildlife that depend on wetlands, the literature has documented the need for significantly larger buffers than those that are adequate to provide sediment removal and nutrient uptake. Research confirms that many wildlife species depend upon wetlands for only portions of their life cycles and they require upland habitats adjacent to the wetland to meet all their life needs. Some species use upland habitats that are far removed from the wetland. The literature documents that, without access to appropriate upland habitat and the opportunity to move safely between habitats across a landscape, it is not possible to maintain viable populations of many species.

In the long term, human actions can reduce the effectiveness of buffers through removal of buffer vegetation, soil compaction, sediment loading, and dumping of garbage.

Authors who synthesized the literature on the effectiveness of buffer widths suggest buffers between 25 and 75 feet for wetlands with minimal wildlife habitat functions and adjacent low-intensity land uses; 50 to 150 feet for wetlands with moderate habitat functions or adjacent high-intensity land uses; and 150 to 300 feet for wetlands with high habitat functions. Effective buffer widths for protecting water quality ranged from 25 to 50 feet for 60% removal of pollutants, to 150 to 200 feet for 80% removal of pollutants.

3.6 The Science and Effectiveness of Wetland Mitigation (Chapter 6 of Volume 1)

As discussed in Chapter 6 of Volume 1, according to the rules implementing the Washington State Environmental Policy Act (Chapter 197.11 WAC), mitigation involves the following steps that are performed sequentially:

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 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/or*
6. *Monitoring the impact and taking appropriate corrective measures (WAC 197.11.768).*

The term "compensatory mitigation" refers to the compensation stage of the sequential mitigation process (number 5 in the list of steps above). For wetlands, it typically involves producing new wetland area, functions, or both as compensation for wetland area, function, or both that have been or will be lost due to a permitted activity. Compensatory wetland mitigation generally entails performing one or more of the following types of compensation:

- **Restoring** wetland conditions (and functions) to an area
- **Creating** new wetland area and functions
- **Enhancing** functions at an existing wetland
- **Preserving** an existing high-quality wetland to protect it from future development

Chapter 6 of Volume 1 synthesizes the literature on compensatory mitigation from the last 15 years. The majority of projects that provide compensatory mitigation described in the literature have been neither fully successful nor complete failures. One challenge in synthesizing this information was the range of meanings for and the implications of the very terms *success* and *failure*.

Compliance of Projects with Permit Requirements

While most of the mitigation projects documented in the literature were implemented, compliance of the projects with permit requirements was generally low. This was a result of inadequate acreage of wetland, failure to achieve performance standards, and a lack of monitoring and maintenance. The few studies that examined the effect of regulatory follow-up suggested that it had a positive influence on the level of compliance and success for compensatory wetland mitigation projects.

Ecological Effectiveness of Different Types of Compensation

There is a general lack of information about the relative ecological effectiveness of the various types of compensation (e.g., restoration, creation, enhancement, etc.). Creation is generally the most frequently used type of compensation, but studies of its effectiveness produced mixed results.

Enhancement of wetlands is also frequently used, but few studies have examined its effectiveness. Limited studies from Washington indicated a low level of success among enhanced wetlands, primarily due to a minimal gain in functions in the timeframe between construction of the mitigation project and the evaluation of gain in functions. It may simply take longer for a gain in functions to appear (15 to 20 years rather than 5 to 10 years).

Restoring wetlands was noted as a high priority in the literature, but this type of compensation is not frequently used. This could be because restoration is often not an option on a project-by-project basis when costs and local regulations defer to on-site mitigation options. Restoration appears to be a more frequent choice in non-regulatory situations.

Preservation and the use of a mixture of compensation types appear to be used occasionally based on the literature review, and studies provided limited information on the effectiveness of these types of compensation. Two studies from Washington indicated that mixed compensation projects had a higher level of compliance than creation or enhancement, and all mixed projects were moderately successful.

Replacement Ratios

Replacement ratios are a tool used to account for the risk of mitigation failure and the temporal loss of functions. Required replacement ratios vary from one jurisdiction to another, based on the type of compensation proposed and project-specific circumstances.

The review of the literature indicated that the wetland functions and acreage achieved by using replacement ratios were less than what was required. In some cases the result was less than 1:1 replacement of acreage and a net loss of wetland acreage and function on the landscape.

Functions and Characteristics of Mitigation Wetlands

The functions performed and the structural characteristics that developed in created and restored wetlands usually differed from those in reference wetlands discussed in the literature. The one exception was the group of functions that improve water quality; these appeared to be performed in a similar capacity in mitigation wetlands as in reference wetlands. (None of the studies reviewed for Volume 1 actually compared the functions provided by wetlands that had been developed as compensation against the functions provided by the wetlands that were lost. Instead, reference wetlands were used as the basis for comparison with mitigation wetlands.)

For the most part, reference wetlands were found to provide habitat for a greater diversity or abundance of wildlife than created or restored wetlands. Birds were an exception since half of the studies found no difference between created/restored sites and reference wetlands, particularly for ducks.

Created and restored wetlands were also found to exhibit different vegetation characteristics and plant communities than reference wetlands. The effect of wetland age on the vegetation of created and restored wetlands was noted in various studies.

Types of Wetlands Produced through Compensation Projects

The review of the literature indicates that compensatory mitigation is producing more acreage of open water wetlands than has been lost. The ability of compensatory mitigation projects to produce wetlands of other Cowardin classes (e.g., emergent, scrub-shrub, forested) varies.

Compensatory mitigation is also producing wetlands with significantly different hydrogeomorphic (HGM) classes than were present in the reference wetlands near that location. (The HGM classification is based on the position of the wetland in the landscape, the wetland's water source, and the flow and fluctuation of the water once in the wetland.) This has resulted in mitigation wetlands that have more inundation for a longer period than in reference wetlands, as well as HGM classes of wetlands that are atypical for the landscapes in which they are being created.

Some unique types of wetlands, such as bogs, fens, and mature forested wetlands, may not be reproducible, especially not within current regulatory timeframes. Other wetland types, such as vernal pools, may be reproducible given the right conditions.

Suggestions for Improving Compensatory Mitigation

The literature provides numerous suggestions on virtually every aspect of the compensatory mitigation process. Key suggestions include:

- Improving regulatory guidance on a variety of topics, such as measurable, meaningful, and enforceable performance standards for compensatory mitigation;
- Finding better sites that provide increased benefits due to their location within a watershed;

- Monitoring compensatory mitigation wetlands more effectively;
- Maintaining compensatory mitigation sites; and
- Increasing the regulatory follow-up of compensation projects.

The review of the literature indicates that improvements have been made in compensatory mitigation over the past two decades, particularly in terms of what is required. Based on the research reviewed, the overall success and permit compliance have not noticeably improved. Most studies indicate that created and restored wetlands do not provide the same characteristics or level of functions as reference wetlands (water quality functions may be the exception). Though older created and restored wetlands generally exhibit characteristics of the vegetation that lead to improved habitat for wildlife, the soils and the hydroperiods may remain so modified that they will not replicate reference systems in the foreseeable future. Since the effectiveness of compensatory mitigation remains highly variable, it is important to understand the cumulative effects of the continuing loss of wetland acreage and functions (summarized in the next section).

3.7 Cumulative Impacts on Wetlands (Chapter 7 of Volume 1)

The literature reviewed for Volume 1 indicates that project-by-project decisions cannot, by their very site-specific nature, adequately address the complexities of wetland systems as they function in a landscape context. The majority of wetland management decisions in Washington State are related to individual projects, without an opportunity to consider the environmental factors that control functions or cumulative impacts.

As discussed in Chapter 7 of Volume 1, the causes of cumulative impacts are not limited to the policies or regulations of a single agency but can also result from multiple agencies making land use decisions in isolation. Also, cumulative effects are difficult to assess because of the large spatial and temporal scales involved, the wide variety of processes and interactions, and the lag times that often separate a land use activity from resulting effects.

While the literature did not focus on the reasons for the lack of landscape-scale wetland management in Washington, some impediments can be assumed:

- The costs of analysis, inventories, assessments, and rankings;
- The costs of implementing a landscape-scale program relative to existing project-driven programs that are often funded by applicant fees;
- Inconsistent mandates driving the agendas and priorities of regulatory agencies;
- Lack of examples of successful tools for interagency collaboration and implementation;

- Lack of awareness and understanding of the ecological consequences of existing regulatory programs by the public and the staff of implementing agencies; and
- Lack of support for local jurisdictions to tackle the process of identifying and prioritizing aquatic resources for long-term protection and/or potential alteration.

The literature recommends a broader approach for the management and restoration of aquatic resources including wetlands. Researchers recognize the need for an analysis of the broader landscape and the environmental factors that control functions and cumulative effects (the historic, ongoing, and future impacts on an ecosystem).

For this reason, the guidance provided in Volume 2 stresses the importance of starting with an understanding of the landscape as well as wetland functions at the site scale. This understanding of the landscape can then be incorporated into more effective planning, regulatory, and non-regulatory tools.

Chapter 4
Framework for Protecting and Managing Wetlands Using Best Available Science

4.1 Introduction

This chapter outlines a four-step framework for developing and implementing approaches to wetland management and protection by local governments. The framework is an adaptation of one developed for the "Statewide Strategy to Recover Salmon" (Washington State Joint Natural Resources Cabinet 1999). It provides the structure on which the concept of "adaptive management" is based. The framework incorporates the findings of the synthesis of the science from Volume 1, such as using landscape analysis, to guide the decision-making process when developing plans, policies, codes, ordinances, and non-regulatory approaches.

The review of the literature in Volume 1 (Chapter 2) emphasizes that wetlands are an integral part of the landscape. To protect and manage wetlands and their functions, local governments therefore need to understand how changes in landscape processes resulting from human activities at the larger scale can affect wetlands at the smaller, site scale. Once such an understanding is developed, it is possible to plan for, and minimize, the impacts of human activities at all geographic scales, and thereby effectively protect wetlands and their functions.

This chapter introduces the four steps of this framework. Following chapters describe each step in more detail. Examples and additional information are provided in appendices.

Analyzing the landscape that influences wetlands is a relatively new idea. Planners and managers of natural resources face a challenge in incorporating landscape information into the planning and protection process. Three common questions posed by planners and managers are:

- What are landscape processes and what do we know about them and their interaction with wetlands?
- What tools can be used to most effectively incorporate a "landscape perspective" into wetland management?
- How do we organize planning and protection activities to incorporate information about the landscape as well as protecting individual wetlands?

The first question is answered in Chapter 5, which describes landscape analysis. The four-step framework described in this chapter, and the guidance that follows in subsequent chapters and appendices in this document, attempts to answer the last two questions.

The following key terms are used to describe processes and functions in Volume 2:

Landscape processes – Environmental factors that occur at larger geographic scales such as basins, subbasins, 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.

Wetland functions – The physical, biological, chemical, and geologic interactions among different components of the ecosystem that occur with 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.

4.2 Four-Step Framework for Management and Protection of Wetlands

The framework for management is designed to provide a number of opportunities to incorporate landscape information into decision-making at the planning stages as well as into decisions regarding individual wetlands. The four steps of the framework include:

1. Analyzing landscape processes that influence wetland resources (called "landscape analysis"), as well as processes that occur at the scale of the site itself,

2. Prescribing solutions for protecting and managing wetlands based on landscape analysis information (developing policies, plans, codes, ordinances, and non-regulatory approaches),

3. Taking actions to implement the solutions (such as applying regulations at individual wetlands, restoring wetlands, providing non-regulatory incentives), and

4. Monitoring the results of the actions taken and the effectiveness of the solutions (such as tracking acreage and functions of wetlands lost and gained, whether plans and programs are being implemented).

If the data collected through monitoring indicate that wetlands are not being adequately protected, then the management actions need to be revised accordingly. Evaluation of the

monitoring data initiates a feedback loop called adaptive management. Thus, the four-step framework is iterative and ongoing.

Figure 4-1 conceptually illustrates the four-step framework that can be used by local governments to develop and implement effective approaches to protecting wetlands and other critical areas. The first two steps—analyzing the landscape and its wetlands and prescribing solutions—can be considered long-term planning, and the second two—taking actions and monitoring results—as implementation. As mentioned previously, an additional component is a feedback loop called "adaptive management." It is the process of assessing what has or has not been effective and making modifications based on these insights.

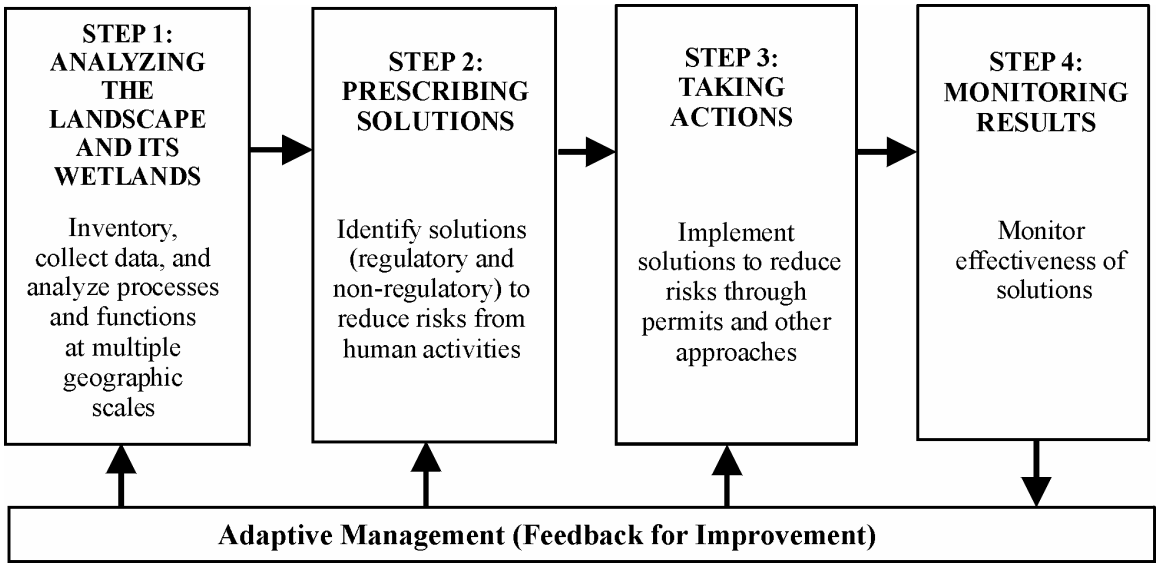


Figure 4-1. A suggested framework for local governments to use in protecting and managing wetlands. These four steps serve as the framework for discussions in this volume.

4.2.1 Incorporating Different Geographic Scales in the Four-Step Framework

The synthesis of the science presented in Volume 1, and the ecological principles listed Chapter 1, indicates the need for analyzing, planning, and managing at a landscape scale as well as protecting resources at the scale of individual sites. Therefore, the words used to describe different scales must be clarified to provide a "common language."

Local governments can manage and protect wetlands at different geographic scales. Three geographic scales are discussed this document. These are the **contributing landscape, the management area, and the site.** Figure 4-2 provides a conceptual example of these three geographic scales.

The **contributing landscape** is the geographic area within which the landscape processes occur that influence the functions or structure of wetlands located in a *management area*

(defined below). A contributing landscape may span jurisdictional boundaries and even span several watersheds (see Figure 4-2). Given that the contributing landscape may cross jurisdictional boundaries, efforts to protect the wetland ecosystem need to be coordinated and integrated with programs of other local governments. Because most ecosystems are linked across the landscape, it is important that measures to protect wetlands are coordinated with those for protecting other resources including riparian areas, floodplains, estuaries, shorelines, and fish and wildlife habitat.

The **management area** is the geographic area for which plans and regulations are being developed by a local government. The management area is usually a subset of the contributing landscape because it can be based on political boundaries (e.g., a jurisdiction such as a city), or it may be defined geographically to include a specific basin, subbasin, or WRIA (Water Resource Inventory Area) in a county.

The **site** is the area encompassed within the boundary of a single wetland. It too may span private property lines or jurisdictional boundaries.

In Figure 4-3, each of the four steps of the framework described earlier is divided into a series of actions that would be undertaken at each of these three geographic scales.

Steps 1 through 4 of the framework are described in detail following the figures.

Figure 4-2. An example of contributing landscape, management area, and site scales.

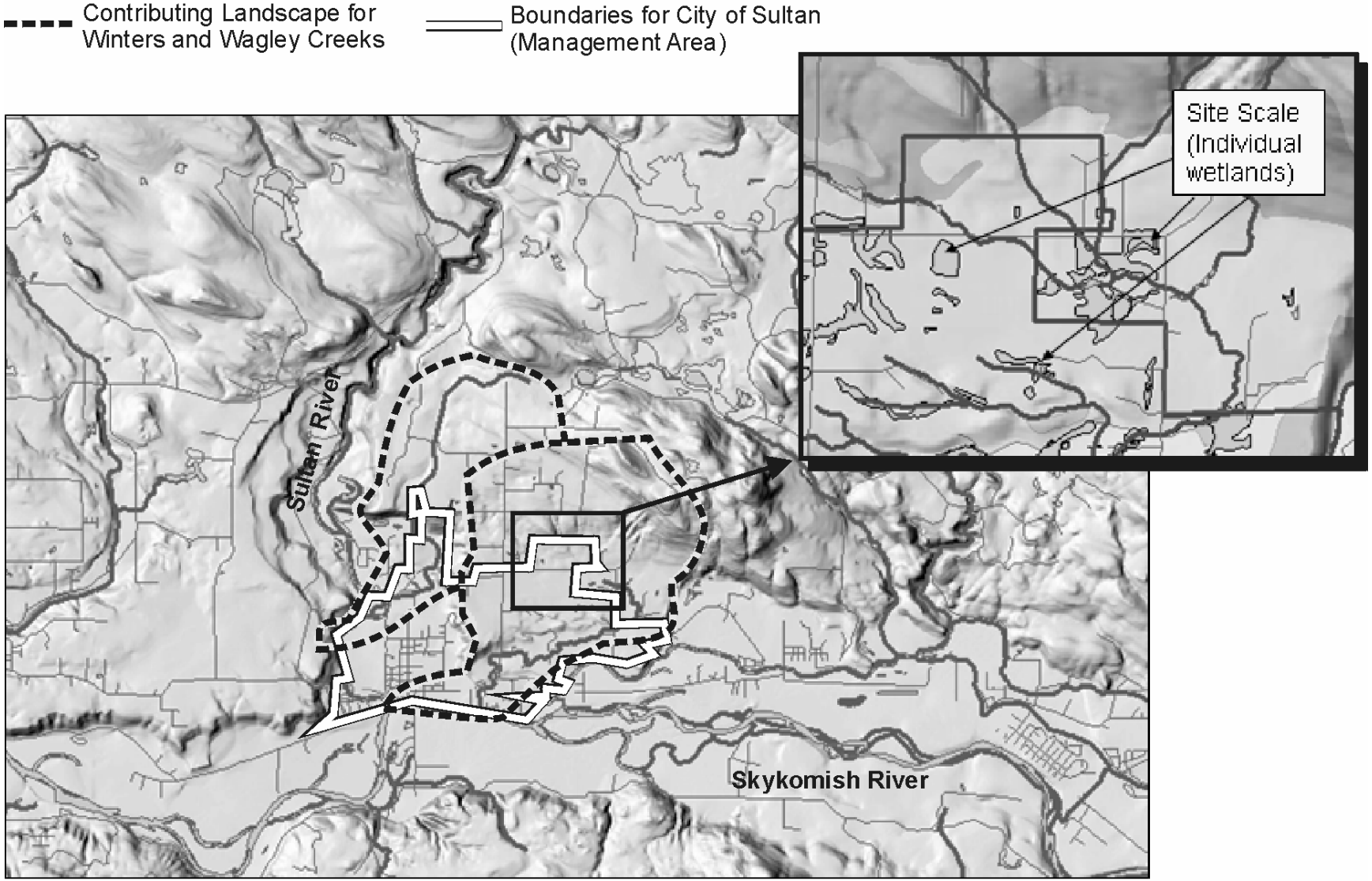
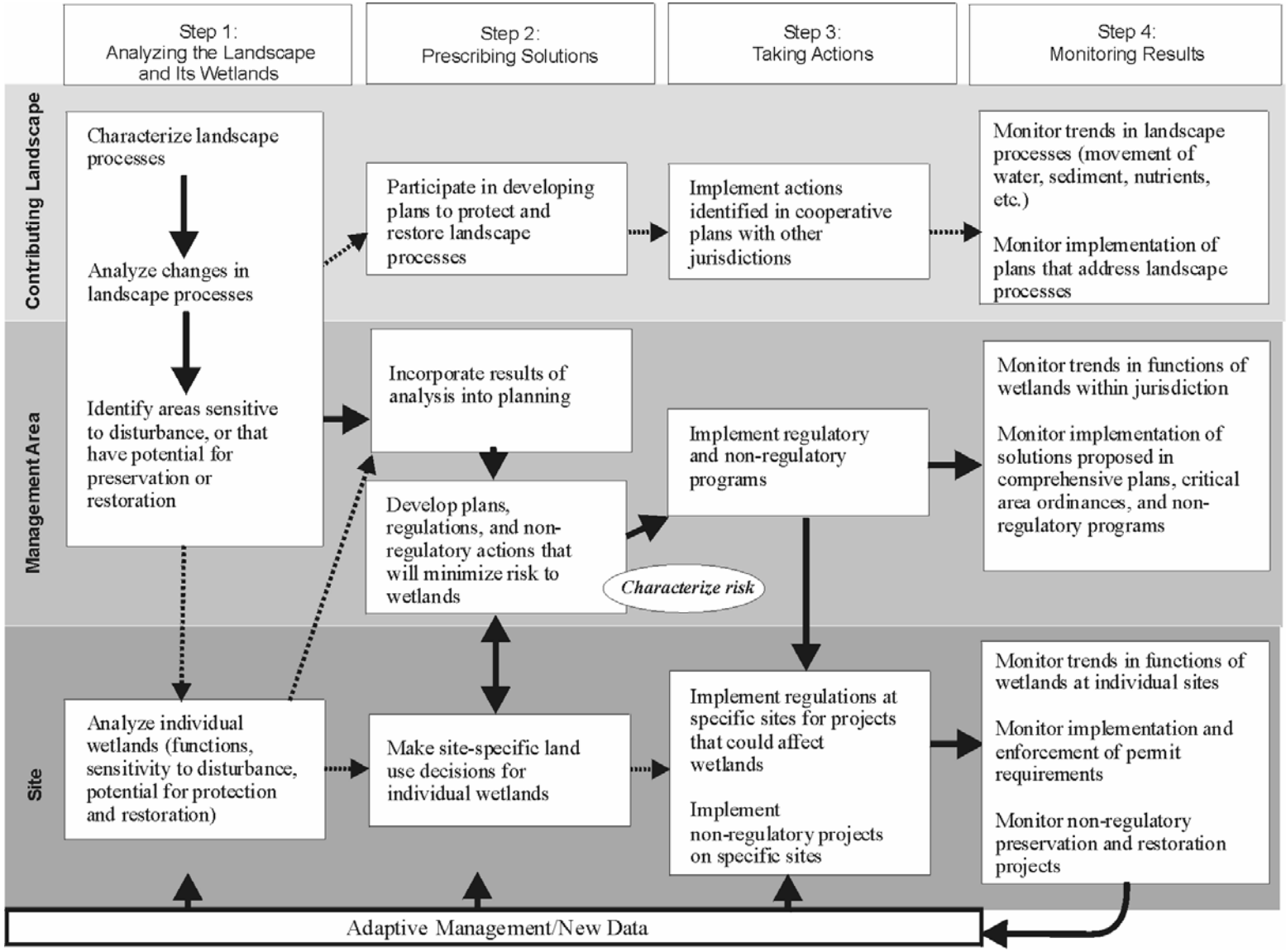


Figure 4-3. Four-step framework incorporating the three geographic scales. Solid arrows represent the process that should be undertaken in developing comprehensive plans and critical areas ordinances. Dashed arrows show additional pathways that can be followed to enhance a wetlands protection and management program.



4.2.2 Step 1: Analyzing the Landscape and Its Wetlands (Landscape Analysis)

Step 1 involves a *landscape analysis*, which is the first step necessary to understand how landscape processes influence wetlands, and to incorporate this information in decisions about land use and its effects on wetlands. As will be discussed in Chapter 5, a landscape analysis is more complex than what is typically required for a wetland inventory, though the two share some similarities. A landscape analysis is needed to interpret and understand the analysis of the functions for individual wetlands.

To facilitate the landscape analysis, Ecology recommends producing annotated maps that identify areas of critical concern for managing wetlands and their contributing landscape. A series of annotated maps can summarize complex geographic information and provide a scientific basis for establishing land use designations and making other decisions about land use. The information can be used in evaluating the relative impacts for a range of alternative scenarios of future development that are created in Step 2.

The paragraphs below briefly describe Step 1 at the various geographic scales shown in Figure 4-2. The process for the landscape analysis is described in detail in Chapter 5.

Analysis of the Contributing Landscape and the Management Area

The analyses of the contributing landscape and the management area are similar. The difference in the analyses for these two geographic scales is more an issue of resolution than a different approach. If the management area is smaller than the contributing landscape, the analysis of the management area can make use of more detailed information. Local jurisdictions can then develop more detailed plans and be provided a better assurance that the risks to their wetlands are minimized. The same tools and methods, however, can be used at either geographic scale.

The purpose of the analysis is to develop an understanding of landscape processes that can affect wetland functions. This includes understanding the movement of water, nutrients, sediments, and toxic compounds, and how wetlands that function as habitat are affected by fragmentation of the landscape. It involves inventorying wetland resources, identifying where critical landscape processes occur, and determining how those critical processes have been modified by human activities. From this understanding one can then determine how these landscape processes may have been changed in the past and how they might change with future development.

There are two main goals of the landscape analysis. The first goal is to identify locations within the contributing landscape and the management area where landscape processes could be negatively influenced by human land uses (e.g., paving areas that provide groundwater recharge). These areas can be considered sensitive and in need of specialized management approaches when planning future changes in land use. These areas may not necessarily include only wetlands, but may encompass important upland

areas such as aquifer recharge areas or upland habitat corridors that connect wetlands across the landscape.

The second goal is to identify areas where landscape processes have been degraded but could be repaired, such as through wetland restoration. Planning for restoration could help offset unavoidable impacts identified through the planning process.

This information is used during Step 2 (Prescribing Solutions) and Step 3 (Taking Actions).

Analyzing Wetlands at the Site Scale

The main goal of the analysis at the site scale is to understand the functions of an individual wetland and how that wetland interacts with the landscape. This analysis can occur at two different times in the planning and regulatory process: during comprehensive planning, and during review of permits for individual projects.

If a local jurisdiction's program to manage and protect wetlands involves preservation or restoration, then individual wetlands will need to be analyzed during the planning process (Step 2). The planning process will identify those wetlands most suited for preservation or restoration.

The functions of individual wetlands are also analyzed during permitting when a proposed activity will alter a wetland. It is important for local governments to establish what will be required for site-specific analysis of wetlands during Step 2, when administrative rules, guidance, or regulations are developed. For example, the requirements should state what must be included within wetland reports and compensatory mitigation plans. The local jurisdiction should also consider methods for assessing wetland functions and for establishing ratings, buffers, and mitigation ratios. Site-specific analysis is usually the responsibility of the applicant who is proposing changes to a specific wetland.

For further guidance on Step 1, Analyzing the Landscape and Its Wetlands, see Chapter 5 and Appendices 5-A through 5-C of this volume.

4.2.3 Step 2: Prescribing Solutions

Step 2 describes the processes by which local governments develop the solutions they propose to use to protect and manage wetlands within their jurisdiction. The goal of Step 2 is to identify means for incorporating the results of the landscape analysis in Step 1 into effective planning, regulatory, and non-regulatory tools.

This is the step in which Smart Growth planning approaches such as Green Infrastructure or Alternative Futures (discussed in Chapter 6) can be applied, and when comprehensive plans, critical areas ordinances, shoreline management plans, restoration plans, and incentives for conservation are typically developed.

Prescribing Solutions at the Scale of the Contributing Landscape

To develop solutions for a contributing landscape, which often extends outside the regulatory authority of a local jurisdiction, the jurisdiction will need to coordinate with other, contiguous governments. In reality, however, adjacent jurisdictions may not share the same values or priorities. The ability of a local jurisdiction to plan for geographic areas outside of its purview may, therefore, be limited. Only general guidance can be provided at this point.

For areas of the contributing landscape that fall within the management area, the process of prescribing solutions is the same as for the management area, as described below.

Prescribing Solutions at the Scale of the Management Area

Solutions for protecting and managing wetlands within the management area can be prescribed in many forms. Generally they include policies contained within comprehensive plans or community plans; codes (such as zoning) and ordinances (including those for critical areas and clearing and grading); stormwater management plans; shoreline master programs; and non-regulatory approaches such as preservation and restoration plans and incentives for conservation such as tax relief.

The approach to prescribing solutions proposed here is to plan for future development and the protection of wetlands by analyzing different alternative scenarios (called "Alternative Futures") in terms of their impacts on wetlands and landscape processes. These scenarios should include both general planning approaches, such as different patterns of zoning, and more specific approaches, such as different widths of buffers for wetlands with different ratings. The local government usually incorporates other factors into the scenarios based on the priorities of citizens for their communities. (See Chapter 6 for further discussion.)

The effects of the different scenarios can be compared and evaluated to determine which solution might reduce or limit the impacts on landscape processes. Analyses of scenarios are an important way to summarize detailed scientific information, and they can be very helpful in decision-making.

This is also the step at which a jurisdiction should ensure consistency between various policies, plans, and regulations administered by the jurisdiction that may influence wetland resources. For example, a grading code may have to be modified to reflect considerations for wetlands or their buffers.

Prescribing Solutions at the Site Scale

Prescribing solutions at the site scale for local jurisdictions involves developing ways to protect wetlands that have been identified during the landscape analysis as requiring tailored protection that is different from the protection afforded to most other wetlands through critical areas regulations. These wetlands are often called "wetlands of local significance." They may include wetlands with a high value for recreation, aesthetics,

potential for restoration, or potential as mitigation banks, or they may be crucial to supporting a landscape process such as aquifer recharge.

The solutions for protecting these wetlands can be specified in advance by using policies in the comprehensive plan or community plans, or even site-specific or wetland-type-specific regulatory language. For example, the City of Everett identified specific actions at individual wetlands in the mouth of the Snohomish River estuary that could be taken to restore landscape processes (City of Everett 1997). There was a high probability of success with an important increase in functions.

For guidance regarding tools for Step 2, Prescribing Solutions, see Chapters 6 through 9 of this volume.

Characterizing the Risk from Proposed Solutions

A characterization of risks should be used to evaluate the different solutions being suggested for managing and protecting wetlands (see Chapter 10). Such a characterization provides a way to develop, organize, and understand the decisions being made about future land uses. It also enables decision makers and the public to make more informed decisions about land uses and wetland resources. Solutions that cause a higher risk to the wetland resource because they are driven by other societal needs can be balanced by other solutions that reduce the risks (e.g., through restoration). Avoiding impacts and maintaining functions, however, is generally more cost effective and less risky (see Volume 1, Chapter 6 for further discussion).

4.2.4 Step 3: Taking Actions

Step 3 ensures that the solutions developed and adopted in Step 2 are effectively implemented through taking actions at the different geographic scales. Examples of taking actions include:

- Implementing regional, subarea, or community plans on the ground,
- Applying critical areas and clearing and grading ordinances at specific wetland sites when a development is proposed,
- Restoring or preserving wetlands identified in a restoration plan via a landscape analysis,
- Setting up a Public Benefit Rating System to provide tax relief for landowners with wetlands (see Chapter 9 for more information).

Taking Action at the Scale of the Contributing Landscape

Taking action at the scale of the contributing landscape requires adequate funding and coordination over time. Although the benefits can be great if the solutions are carried

out, the challenges are great as well. For example, of the three regional plans that have been developed to protect wetlands—the Everett Snohomish Estuary Wetland Integration Plan (SEWIP), the Mill Creek Special Area Management Plan (SAMP), and the Port of Skagit Wetland Industry Negotiations (WIN)—only one (Skagit WIN) was ever adopted and implemented.

Taking Action at the Scale of the Management Area

Taking action to implement plans, regulations, and non-regulatory approaches adopted by a jurisdiction for its management area is critical to protecting wetlands. The scientific literature reviewed for Volume 1 indicated that one of the major reasons why the functions and values of wetlands continue to be degraded is a lack of resources to implement and follow through on proposed solutions.

In the case of a critical areas ordinance for wetlands, an adequate number of staff is needed. The staff should be trained to review proposals and enforce the conditions placed on those proposals to ensure that wetlands are protected as planned. This holds true especially for compensatory mitigation; Chapter 6 of Volume 1 highlights the fact that many compensation projects designed to replace wetland functions lost through development have failed in part because of a lack of regulatory oversight and follow-through. Likewise, plans for restoration need staff to implement them, sources of funding secured, and sites restored on the ground.

Taking Action at the Site Scale

Taking action at a specific wetland involves applying the specific management measures identified for that site. As with taking action for the management area, implementation requires monitoring the compliance and effectiveness of compensatory mitigation or non-regulatory actions taken at individual sites.

For further discussion of Step 3, Taking Actions, see Chapter 11 of this volume.

4.2.5 Step 4: Monitoring

Monitoring at all three geographic scales (contributing landscape, management area, site) should be an integral part of a strategy to protect and manage wetlands. Monitoring should address the following central question: *Are the actions taken by a local jurisdiction effectively protecting or restoring the functions and values of the wetlands within its purview?*

Local jurisdictions cannot determine whether their solutions (developed in Step 2 and implemented in Step 3) are actually protecting wetlands without collecting data that monitor the success of their approach at the three geographic scales. Monitoring whether adequate protection has been achieved, followed by any needed corrective action, is especially critical because all the information collected to date, and reviewed in Volume 1, indicates that there is continued loss of wetlands and their functions and values.

Monitoring associated with assessing the protection and management of wetlands by local jurisdictions can be divided into three categories:

- **Monitoring trends** regarding changes in landscape processes and the level of performance of the functions provided by wetlands at the site scale;
- **Monitoring the actions taken to implement** the regulatory and non-regulatory solutions developed at all geographic scales;
- **Monitoring the effectiveness of actions taken to protect and manage wetlands** to determine how well the overall approach (including all solutions) is meeting the goals to protect and manage wetlands at all geographic scales.

If the functions and values of wetlands are not adequately protected, managers need to know whether this results from inadequate implementation, inadequate standards, or inadequate strategies. Therefore, all three aspects of monitoring are important in providing feedback to guide future decision-making.

For further discussion of Step 4, Monitoring, see Chapter 12 of this volume.

4.2.6 Adaptive Management

Adaptive management—the "feedback loop"—is based on a review of the information collected through the monitoring step and a determination of what changes are necessary to improve protection when goals are not met so that future management, policies, and regulations are more effective in protecting the wetland resource (Washington State Joint Natural Resources Cabinet 1999). Scientists agree that some of the continued degradation of the functions and values of natural systems such as wetlands is a result of a lack of monitoring and adaptive management (Dale et al. 2000). This aspect of managing and protecting wetlands is therefore vital to successfully protecting wetlands over time.

The key element of adaptive management is a commitment to periodically revisit the four steps in the framework described earlier. Monitoring should provide new data and information that feed into Step 1 (Analyzing the Landscape and Its Wetlands). As the data are analyzed, new information can be generated that may require changing the solutions prescribed (Step 2) and the actions that need to be taken (Step 3). The effectiveness of the new solutions and actions then also needs to be monitored (Step 4) and the cycle repeated over time.

For further discussion of Adaptive Management, see Chapter 12 of this volume.

Chapter 5
Analyzing the Landscape and Its Wetlands

5.1 Introduction

Chapter 4 outlined the four basic steps proposed as the framework for protecting and managing wetlands. The first step in the framework is to analyze the landscape and its wetlands (Figure 5-1). This chapter describes how the landscape and wetlands might be analyzed, and it provides the basic questions that should be answered to complete such an analysis. The questions should enable local governments to develop their own methods for landscape analysis if desired.

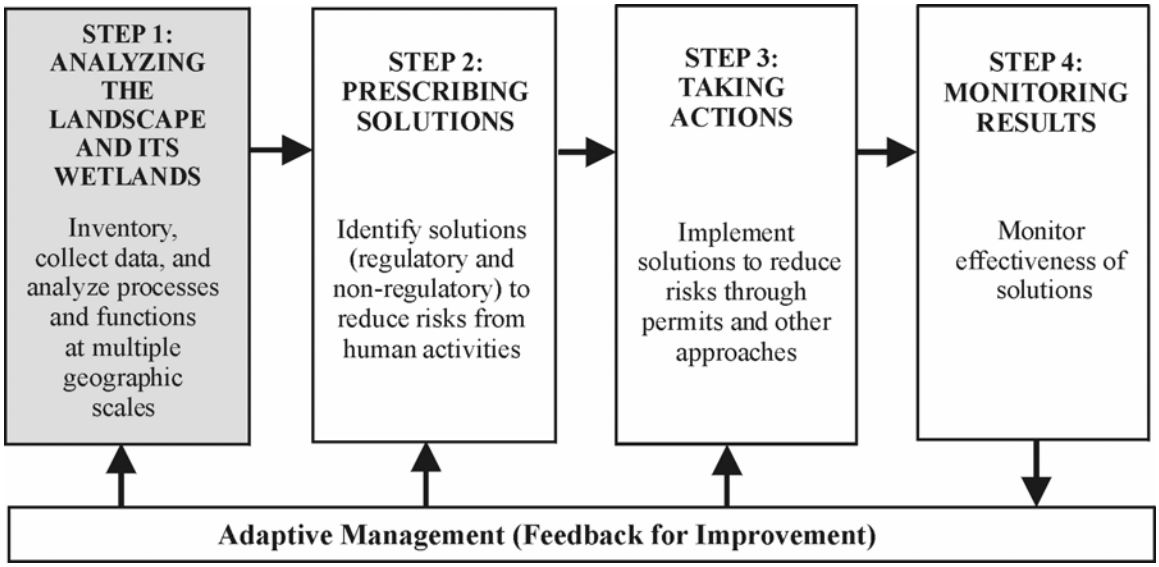


Figure 5-1. Step 1 in the process of protecting and managing wetlands is to analyze wetland resources (shaded box). Step 1 is discussed in detail in this chapter.

The questions discussed in this chapter are derived from the work on environmental processes in the Pacific Northwest done by Bedford (1996, 1999), Booth (1991), Brinson (1993), Gersib (2001), Naiman et al. (1992, 1993, 1997), Horner (1986), Horner et al. (1996), LaBaugh et al. (1987), Beechie and Bolton (1999), Stanley and Grigsby (2003), Winter (1983, 1986, 1988, 1989, 1992), and Ziemer and Lisle (1998). Any method or methods that provide answers to these questions can be used.

Why do we analyze more than just wetlands?

The synthesis of current science (Chapter 2 in Volume 1) indicates that the functions performed by wetlands are controlled by processes that may occur in other parts of the landscape as well as at the site of the wetland itself. To protect and manage the functions and values of wetlands, we need to understand how changes to these wider scale processes can impact wetlands.

Where to Find Supporting Information in Appendices

The following appendices provide additional information and details to help the reader more fully understand the landscape analysis described in this chapter:

Appendix 5-A identifies some of the existing sources of data that can be used to answer the questions when analyzing the landscape and its wetlands.

Appendix 5-B summarizes numerous literature sources that provide more detail on how to analyze environmental processes at the contributing landscape, management area, and site scales.

Appendix 5-C illustrates two examples of how the analytical process discussed in this chapter is being used in two areas of Washington State to characterize and analyze existing processes and functions, identify changes in functions, and identify measures for restoration.

A method for analyzing the landscape and its wetlands that uses existing data is being developed

As noted in Chapter 1 of this document, some local governments will be interested in a method that Ecology is developing to analyze the landscape and its wetlands. The method uses existing data available through various agencies, and is designed to provide the information needed to make land use decisions throughout the four-step framework described in Volume 2. The method being developed by Ecology is illustrated by examples of landscape analysis that are presented in Appendix 5-C. Ecology's method has been applied in several jurisdictions and is being improved with each application. The current methods being developed by Ecology do not address wildlife corridors. This gap will be addressed next year as the Departments of Fish and Wildlife and Ecology work together to better include wildlife in the landscape analysis. Ecology would like to work with local governments to apply this method in other jurisdictions and further improve it as funding and time are available.

The questions that need to be addressed in the analysis of the landscape and its wetlands apply regardless of the methods used to analyze the resource. The method being developed by Ecology is only one way they can be answered. Other methods that may provide similar information are summarized in Appendix 5-B.

The next section of this chapter (Section 5.2) summarizes the importance of the interaction between landscape processes and wetland functions because this information may not be common knowledge for some planners. Section 5.3 provides background on the goals of landscape analysis, again because this is a new approach in protecting and managing wetlands. Section 5.4 describes the basic questions that should be answered when analyzing the contributing landscape and management area to assist with decision-making. Section 5.5 then addresses analysis at the scale of individual wetlands.

5.2 Landscape Processes and Their Influence on Wetlands and Their Functions

Chapter 2 in Volume 1 describes how landscape processes interact with climate, topography, and surface geology to determine the biological, physical, and chemical characteristics (structure) of wetlands and other aquatic resources (e.g., the soils, plant species, configuration of inlets and outlets, etc.). The structure of wetlands then has a direct influence on the type and level of functioning within wetlands. The sequence, however, does not go only in one direction. Some wetland functions can in turn influence the structure of other wetlands and landscape processes (e.g., when wetlands provide habitat for beavers; see diagram in Figure 5-2).

In the Pacific Northwest, the landscape processes that are often associated with wetland functions include:

- The movement of **water** (surface and subsurface) through the contributing landscape and at the wetland site itself;
- The movement of **sediment**;
- The movement of **nutrients** and other chemicals (salts, toxic contaminants);
- The movement of **energy** in the form of carbon (plant and animal material);
- The movement and actions of **wildlife**; and
- The dispersal of **plants.**

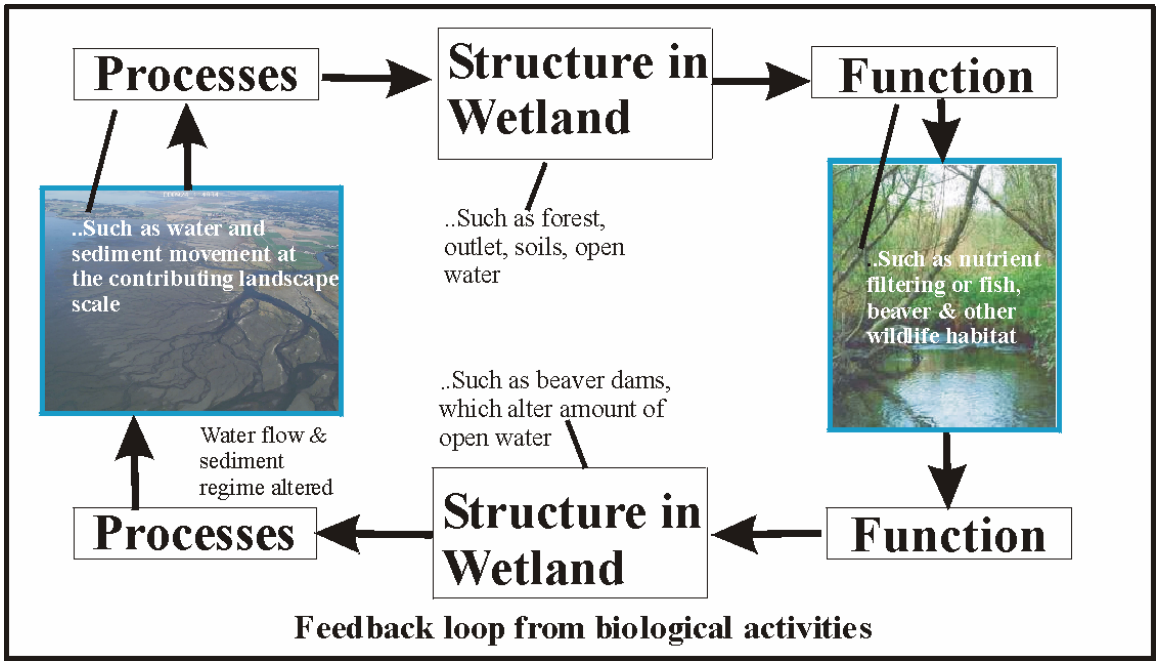


Figure 5-2. Wetlands and their functions are an expression of landscape processes. Wetland functions can in turn modify the landscape processes.

As an example, a wetland may function to support a rich food web in the aquatic ecosystems downstream by exporting large quantities of plant material. In order to provide this function, the wetland needs to have the following:

- Water with adequate nutrients coming into the wetland,
- Good exposure to sunlight, and
- A way for the plant material to pass from the wetland into downstream aquatic ecosystems.

The major processes that control the export of food that supports the aquatic food web are the movement of water to and from the wetland, and the movement of nutrients into and within the wetland. Thus, human alterations in the movement of water and nutrients into the wetland from the contributing landscape may change how the wetland supports the food web downstream.

5.3 Goals and Objectives of Analyzing the Landscape (Landscape Analysis)

The primary goal of a landscape analysis is to develop an understanding of where landscape processes occur and where they are particularly sensitive to human disturbances. As mentioned previously, changes to landscape processes will often result in changes to the functions in wetlands. An understanding of the geographic locations

where processes are most sensitive to change is needed to identify appropriate and effective solutions for protecting wetlands and their functions (these solutions are then developed in Step 2 of the framework). Understanding environmental processes in the landscape is basic to planning how humans should use the land in the future, where they should preserve it, or how they might restore it. For example, landscape analysis can support comprehensive planning because it provides a basis for understanding the future impacts of different zoning configurations and development scenarios. The following objectives help achieve this goal:

- Identifying which parts of the landscape provide essential environmental processes (landscape processes);
- Identifying the range of disturbances that affect landscape processes, and whether they are caused by human activities or natural disturbances;
- Identifying which geographic areas are most susceptible to these disturbances, and therefore pose environmental constraints to land uses in these settings;
- Determining how the landscape processes and the geographic areas that provide these processes influence wetlands and their functions.

By meeting these objectives it is possible to identify solutions (e.g., zoning designations restoration plans) to protect and restore or maintain landscape processes as well as wetlands and their functions. Understanding the environmental constraints on geographic areas is critical to planning for human activities that minimize ongoing or future impacts to wetlands. The questions posed in the following section can be used to meet these objectives.

These objectives apply to analyzing both the contributing landscape and the management area. Landscape processes are not geographically constrained by political boundaries. The reason for presenting a framework that separates the contributing landscape into two geographic units (the management area and the contributing landscape outside the management area) is to simplify the task of managing and protecting the wetland resources. Landscape processes and wetlands that occur within a jurisdictional boundary can be protected and managed by that jurisdiction. Protection outside the jurisdictional boundary will require a cooperative effort by several jurisdictions.

5.4 Questions that Can Be Used to Guide an Analysis of the Contributing Landscape and the Management Area

The questions listed below can be used to guide an analysis of the landscape and are phrased so the answers can be used to meet the goals and objectives described above. Each question is discussed in detail in the subsections that follow.

The questions that direct the analysis are similar for both the contributing landscape and the management area. The difference in the analysis for these two geographic scales is more an issue of resolution than a different approach. If the management area is smaller than the contributing landscape, the analysis of the management area can make use of more detailed information. Local jurisdictions can then develop more detailed plans and be provided a better assurance that the risks to their wetlands are minimized. The same tools and methods, however, can be used at either geographic scale.

- **Question 1.** What are the landscape processes in the contributing landscape and where were they located geographically before 1800 (pre-European colonization)?
- **Question 2.** What are the relationships between these original landscape processes and wetlands and their functions in the management area?
- **Question 3.** What alterations to landscape processes have occurred, and how have these changes affected wetlands and their functions?
- **Question 4.** What geographic areas are currently important for maintaining landscape processes and can be impacted by future activities and growth?
- **Question 5.** What potential measures are needed to protect and restore landscape processes in order to protect and restore wetlands and their functions?

These questions are focused on analyzing the contributing landscape and the management area (see the review of geographic scales below). This is the analysis that should be done by local jurisdictions prior to developing comprehensive plans, critical areas ordinances, and shoreline master programs. Although each question is directed toward wetlands and their functions, some of the landscape processes analyzed through answering these questions involve other aquatic resources and critical areas.

Question 1. What are the landscape processes in the contributing landscape and where were they located geographically before 1800 (pre-European colonization)?

The focus of this question is on processes that affect wetlands in the management area, but it can apply to all landscape processes in the contributing landscape because they are important factors for all critical areas. Understanding the landscape processes and functions that were present in the absence of human disturbances defines the baseline conditions against which changes can be compared. In addition, it helps to identify the aspects of processes that are essential to maintaining current functions of wetlands.

Understanding the environmental processes in the absence of human disturbance is important even if recreating the "undisturbed conditions" is not a goal of the planning process.

This question can be answered by identifying and mapping the landscape processes that support or maintain wetlands and their functions. In general, these processes will fall into the following categories: the movement of water, sediment, nutrients, energy, and

wildlife, as well as physical, chemical, and biological interactions that can occur at the watershed and subbasin scale. To identify these processes, the jurisdiction will need to consider the historic condition and location of the following:

- Surface water drainage patterns – how surface water reaches the wetlands (e.g., areas contributing water to the wetlands including streams, culverts, stormwater outfalls, and sheet flow)
- Groundwater flow paths – where groundwater is recharged and discharged
- Sediment inputs and flow paths – sediment sources, sediment depositional areas, and ways that sediment moves through the landscape to the wetlands
- Nutrient inputs and flow paths – likely sources of nutrient inputs, areas where nutrients would be removed, and pathways for nutrients reaching the wetlands
- Corridors along which wildlife moves and plants are dispersed

Sources for this information include soils maps, aquifer recharge maps, stream inventories, topographic maps, resource/habitat maps from state and federal agencies, zoning maps of active agricultural lands, or even environmental documents such as environmental impact statements. Note that some of these landscape processes may occur at a scale much larger than the extent of the historic wetlands and may extend throughout the contributing landscape.

Question 2. What are the relationships between these original landscape processes and wetlands and their functions in the management area?

Answering this question requires analyzing the connections between the location of landscape processes and existing and historic wetland resources. The most important process to consider is where on the landscape water surfaces, or where surface water is slowed down enough to be ponded. Generally wetlands will form in these locations. For example, extensive peat deposits at the base of a slope where groundwater surfaces would indicate a probable location of wetlands. Topographic depressions in a floodplain would indicate locations where floodwaters can be stored and where wetlands also often occur.

The connections between wetlands and landscape processes are very specific to the topographic, geologic, and climatic conditions of an area. In the absence of a geographically specific method such as that being developed by Ecology, local experts will need to be consulted to develop an understanding of the links between wetlands and landscape processes.

Question 3. What alterations to landscape processes have occurred, and how have these changes affected wetlands and their functions?

Answering this question will require understanding where the following alterations have occurred:

- Changes to water flow. For example, areas where:
  - Surface water flow has been diverted, channelized, or culverted
  - Subsurface flow has been converted to surface flow
  - Increased flooding occurs
  - Stormwater management facilities have been installed
- Changes in the sources and transport of sediment. For example, areas where:
  - Active land clearing, construction activities, or agricultural practices occur
  - Sediments are deposited
  - Streams are entrenched
  - There is excessive bank erosion
  - Sediment enters streams from roads and roadside ditches
- Changes in water quality. For example, areas with:
  - Increased input and transport of nutrients (may be associated with sediment sources)
  - Increased input and transport of toxic compounds and pathogens
  - Biological impacts such as closure of shellfish beds or an increase in harmful algal blooms
- Wetlands have disappeared (e.g., from filling or ditching and draining).

Answering this question provides an understanding of how landscape processes and wetland resources have been altered. It is not necessary to measure or quantify changes in landscape processes directly to answer this question. Instead this can be accomplished by comparing maps of the disturbed conditions (generated through the analysis for this question) to the undisturbed conditions as mapped in the analysis needed to answer Question 1. Changes in processes can be inferred from specific indicators of change listed in the bullets above.

For example, the most readily available information on changes in types of land use may be through comparison of historic aerial photographs to current conditions. Such a comparison can illustrate changes such as conversion of forested lands to agricultural or a built condition; conversion of agricultural lands to a built condition; changes in land use from low to high density or residential to commercial/industrial uses; and so on.

Additional data on water quality from monitoring reports, information from surveys of the numbers and types of road crossings on streams and rivers, and/or information on the physical alteration of streams and rivers (ditching, diking, etc.) can all serve as indicators of changes in processes.

Question 4. What geographic areas are currently important for maintaining landscape processes and can be impacted by future activities and growth?

Once a jurisdiction has identified the areas where landscape processes historically occurred and where they have been changed, it is possible to identify those areas where landscape processes still occur today. This information can be used to predict where additional changes to processes and wetlands might occur from future activities. The purpose is to identify areas where the movement of water, sediment, nutrients, energy, and wildlife are particularly sensitive to additional human activities and disturbances.

The following are some examples of areas that are particularly sensitive to certain types of human activities:

- Filling in floodplains alters the movement of water and especially flood storage. Floodplains are sensitive to filling.
- Paving areas where groundwater is recharged will reduce infiltration and baseflow to streams. Recharge areas are sensitive to paving.
- Building roads through the remaining vegetated corridors will reduce the movement of animals and increase the potential invasion of unwanted plant species. Vegetated corridors are sensitive to being fragmented.

Question 5. What potential measures are needed to protect and restore landscape processes in order to protect and restore wetlands and their functions?

Answering this question is primarily an analytical process that relies on data and information collected in the previous questions. There are two objectives associated with this question. The first is to identify areas that have not yet been altered but are critical to maintaining processes and functions—the sensitive areas identified in Question 4. These should be managed to minimize the potential impacts of human activities through regulatory and non-regulatory means. The second is to identify where landscape processes have been altered but can be restored. Chapters 6 through 8 of this volume discuss in detail the regulatory and non-regulatory approaches that can be used for protection and restoration.

5.5 Questions that Can Be Used to Guide an Analysis of Individual Wetlands

The questions listed below can be used to guide an analysis of individual wetlands. The questions are phrased so the answers can be used to meet both regulatory and non-regulatory needs to protect and manage wetlands. The landscape analysis described in the previous sections is appropriate for the development of land use plans. It does not, however, provide enough detail for making decisions about individual wetlands, either site-specific permit decisions or site-specific decisions about restoration or preservation. Questions 6 and 7 reflect analyses that are usually done during the planning process and in conjunction with the landscape analysis done for Questions 1-5. Question 8 addresses analyses that are most often done when proposals are submitted for altering wetlands.

- **Question 6.** What wetlands are currently performing functions that are associated with important processes identified in the landscape analysis?
- **Question 7.** What degraded wetlands or former wetlands are suitable for restoring landscape processes identified in Question 3?
- **Question 8.** What are the functions of individual wetlands that need to be protected, preserved, or managed?

Question 6. What wetlands are currently performing functions that are associated with important processes identified in the landscape analysis?

Answering this question is primarily an analytical process that relies on data and information collected in Question 4. The purpose is to identify specific wetlands where the movement of water, sediment, nutrients, energy, and wildlife are particularly sensitive to additional human activities and disturbances. These wetlands will be a subset of the sensitive areas identified in Question 4, and should be highlighted in any general plan to manage and protect wetlands.

For example, headwater wetlands are very important in desynchronizing flood flows in downgradient areas. This desynchronization maintains the landscape process of water flow, and protecting this function in headwater wetlands is important for the entire watershed.

Question 7. What degraded wetlands or former wetlands are suitable for restoring landscape processes identified in Question 3?

Opportunities for wetland restoration can be identified by developing a map of degraded potential wetlands using hydric soils, wetland inventories, and land use maps. The locations where these former or degraded wetlands intersect the areas where landscape processes occur (from Questions 1 and 4) are the areas best suited for restoration. This information is the basis for developing regional restoration plans, developing mitigation banks, and developing an understanding of the type of compensatory mitigation that is appropriate for permitted alterations to existing wetlands.

Question 8. What are the functions of individual wetlands that need to be protected, preserved, or managed?

The functions present in a wetland need to be understood in order to apply protective measures, such as buffers, that will adequately protect these functions, or to develop appropriate mitigation plans. Not all wetlands provide the same functions or function at the same levels (see Chapters 2 through 4 in Volume 1 for further discussion). The analysis of functions at individual wetland sites is usually done as part of permitting for actions that could affect wetlands.

In some cases, however, all the wetlands in a basin or sub-basin are analyzed in advance of any actions as part of a regional plan. This information is used to guide planning by identifying up front those wetlands that should not be altered because they perform important functions that cannot be replaced. Wetlands are also identified that do not function well; these can be identified as suitable for development with appropriate compensation. Potential or recommended mitigation sites can also be identified during this planning process. Examples from the Puget Sound area include the Mill Creek Special Area Management Plan or SAMP (U.S. Army Corps of Engineers 1997) and the Everett Snohomish Estuary Wetland Integration Plan or SEWIP (City of Everett 1997).

Most analyses of wetlands at the site scale use rapid approaches that assess a range of wetland functions and values. Many methods have been developed in the last decade to analyze wetland functions and values, and these have been summarized in numerous compilations (e.g. Hruby 1999, Bartoldus 1999, Army Corps of Engineers web information at http://www.wes.army.mil/el/emrrp/emris/emrishelp6/wetland_procedure_descriptions.htm).

Ecology has developed several methods that can be used for the analysis of functions at the site scale. The *Washington State Wetlands Rating Systems for Eastern and Western Washington* were developed to categorize wetlands based on their sensitivity to disturbance, how difficult they may be to replace through compensatory mitigation, the rarity of the wetland type, and the groups of functions they provide.

The *Washington State Wetland Functions Assessment Method* provides more detailed information on up to 15 specific functions that a wetland performs but does not address other values the wetland may provide. It is currently available for a subset of wetland types in both eastern Washington (Hruby et al. 2000) and western Washington (Hruby et al. 1999).

Other methods that have been developed for analyzing individual wetlands in Washington State include the *Wetland Functions Characterization Tool for Linear Projects* from the Washington State Department of Transportation, which characterizes functions as probably present or not present and as principal or secondary functions (Null et al. 2000). A brief description of these and other assessment methods that are often used in the state is provided in Appendix 5-B.

Chapter 6

Developing Plans and Policies: Landscape-Based Land Use Planning

6.1 Introduction

This chapter presents approaches to developing plans and policies that incorporate the information collected during Step 1 of the four-step framework—the analysis of the landscape and its wetlands—as described in Chapter 5. Developing plans and policies is part of Step 2 in that framework (Figure 6-1). Plans and policies are enhanced by information generated in Step 1, which involves analyzing the landscape processes as well as wetland functions. The results of this landscape analysis are applied in Step 2 to identify solutions that reduce the risk from human activities on the landscape.

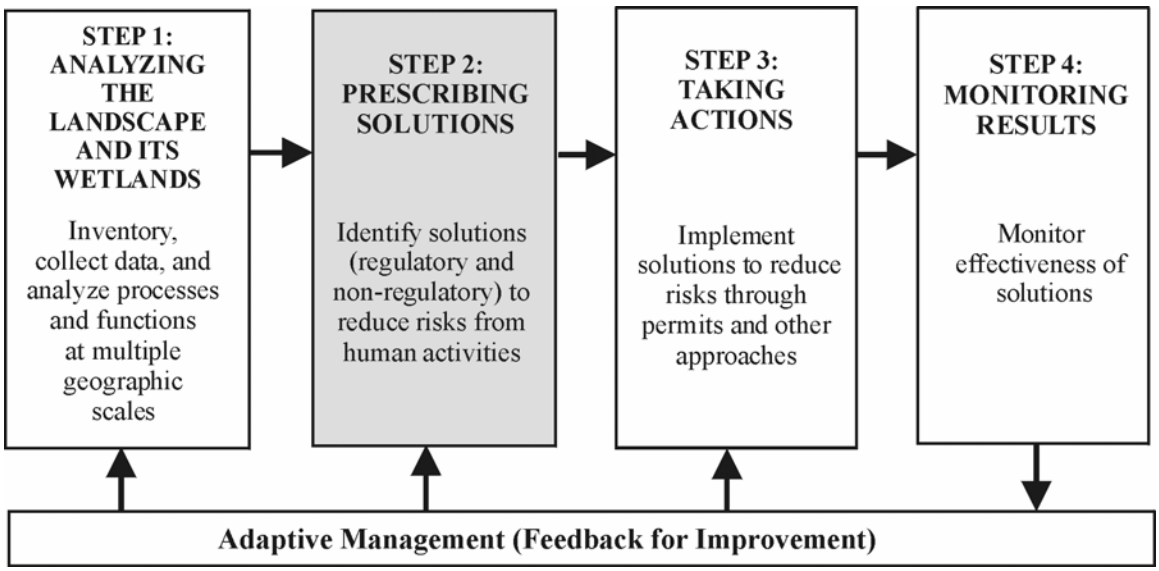


Figure 6-1. Developing plans and policies fits into Step 2 within the four-step framework recommended for protecting and managing wetlands.

This chapter begins with a brief overview of planning and the legal mandates of the Washington State Growth Management Act (Section 6.2). It then describes the importance of using a landscape perspective when planning (Section 6.3). Next, the concept of Smart Growth is introduced (Section 6.4); it is the umbrella for two complementary planning applications called Green Infrastructure and Alternative Futures, which are described in some detail. These approaches can be used as a foundation for the comprehensive planning process (described in Chapter 7). The chapter

concludes (Section 6.5) with a discussion of the fiscal benefits of protecting landscape processes and critical areas such as wetlands.

6.2 Overview of Planning and the GMA

Land use planning, in the context of resource management, is the formalized process by which jurisdictions identify what can or cannot occur on lands within their regulatory authority. In Washington State, land use planning is implemented at a local (county or city) level of government and is directed by the Growth Management Act (GMA), with state agency technical assistance and oversight.

In 1990 the Washington State Legislature passed the GMA (RCW 36.70A) to guide local jurisdictions in their land use planning efforts. The GMA dictates that counties and cities with certain characteristics must fully plan for future growth (RCW 36.70A.040). Chapter 2 of this volume provides an overview of the GMA, a review of Hearings Board and court cases relating to the GMA, and a discussion of critical areas and the use of best available science.

GMA identifies goals to be used by local governments to "guide" the development of comprehensive plans. A full range of actions is included, such as concentrating development to limit urban sprawl; coordinating transportation infrastructure; avoiding incompatible uses while maintaining the extraction of natural resources from forests and mines, and agricultural production on designated lands of long-term commercial significance; as well as a goal to protect the environment and the quality of life in the state. Cities and counties planning under GMA have responded to these mandates by developing or updating their comprehensive plans and the codes and ordinances that implement the plans.

The planning process should begin with understanding the landscape (as described in Chapter 5 and in the next section). Planning approaches and tools described in this chapter, such as Smart Growth, Green Infrastructure, and Alternative Futures, use landscape information to identify and incorporate different ways to minimize impacts and utilize the services (functions) provided by parts of the landscape such as wetlands, instead of building infrastructure to do so. These planning approaches also provide a way to incorporate community input into planning for future land use. These planning approaches can be used as a basis for revising comprehensive plans as well as other plans, regulations, and non-regulatory approaches. Good planning is therefore vital to the protection of critical areas such as wetlands.

6.3 The Importance of Incorporating a Landscape Perspective in Planning

Why is it important to incorporate a landscape approach in planning and to use planning approaches based on landscape information, thereby going beyond the comprehensive

planning process traditionally followed by many jurisdictions? Land use planning has traditionally focused on human-defined opportunities and constraints without always considering landscape processes. The synthesis of the research on wetland science and management (Volume 1) indicates that the current approach of "protecting wetlands" on a project-by-project basis does not protect or maintain the landscape processes that in turn affect the existence and functions of wetlands.

Cumulative effects on wetlands are one result of project-by-project decision-making and of regulatory programs that are inconsistent between jurisdictions. Multiple studies cited in Volume 1 found that project-based decision-making does not address cumulative effects (Johnston et al. 1990, U.S. Environmental Protection Agency 1999, Dale et al. 2000). This is especially significant for landscape processes that occur across jurisdictional boundaries (i.e., processes within the contributing landscape scale shown on Figure 4-2 in Chapter 4). Therefore, an analysis of the landscape should be reflected in the mandatory elements of comprehensive plans, policies, and regulations for a local jurisdiction.

Researchers recognize that planning at the landscape scale requires local jurisdictions to set management objectives and priorities that will dictate which resources will be most fully protected and which will be degraded or remain in a degraded condition. Chapter 7 of Volume 1 discusses literature that identifies the need for, and the challenges of, planning at the landscape scale for wetland management.

Despite these challenges, incorporating an analysis of the landscape into planning allows local governments to understand how landscape processes, and thereby the functions of wetlands, provide important services to communities such as improvements in water quality, reduced flooding, etc. With this knowledge comes the ability to modify and plan how we use the landscape to minimize impacts to those processes, functions, and resources. Minimizing the impacts of land use in turn prevents costly problems for communities associated with degradation of landscape processes. Using landscape analysis as a foundation for decision-making about land use is important for the maintenance of landscape processes over time: It therefore provides a fiscally responsible approach to sustaining development as well.

Local governments benefit from having an understanding of landscape processes and the functions of critical areas, where these processes and functions occur, the interaction between the landscape and critical areas, and how land uses may affect them. Such an understanding allows local governments to adopt appropriate land use zoning designations and make project permit decisions to maintain landscape processes and critical area functions. Science-based plans and regulations should also create a more efficient permitting process by reducing the need to complete complex environmental review and detailed studies at the permitting level.

Comprehensive planning based on landscape analysis, and thus grounded in the understanding of landscape processes and their interrelationships with wetlands, can also serve as the platform for integrating a broad array of protection measures such as critical areas ordinances, clearing and grading ordinances, zoning designations, Shoreline Master

Programs, and Endangered Species Act protections. Guiding policies and implementation tools can then reflect the provisions of the comprehensive plan to ensure long-term functions of wetlands through protection of landscape processes.

6.4 Smart Growth

The National Governors' Association promotes a concept and planning process called Smart Growth. Smart Growth can be defined as growth that protects open space, revitalizes neighborhoods, and makes housing more affordable while improving the quality of life in communities. Key to its definition are the concepts of:

- Fostering attractive communities with a strong sense of place,
- Preserving and restoring critical environmental areas,
- Reintegrating compatible uses in neighborhoods,
- Taking advantage of compact building design,
- Creating walkable neighborhoods, and
- Providing a variety of transportation choices.

Smart Growth is an alternative approach to managing growth that minimizes sprawl while maximizing landscape processes and is also fiscally beneficial. Smart Growth examines community development with the recognition that certain patterns of growth and decline are harmful to communities, undermining both their economies and the environment (Muro and Puentes 2004). In their paper *Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns,* Muro and Puentes (2004) review research on the effectiveness of Smart Growth. Their findings indicate that Smart Growth can reduce public costs of providing new infrastructure and delivering new services, improve a region's economic performance, and bring economic gains to suburbs as well as cities. (See Appendix 6-A for additional references and web pages about Smart Growth.)

Implementing this approach to managing growth places an emphasis on minimizing impacts to landscapes through application of two planning approaches associated with Smart Growth: "Green Infrastructure plans" and analysis of "Alternative Futures." Both of these very similar yet complementary approaches examine how the services and infrastructure provided by natural systems can be used to benefit communities and how these systems are best maintained into the future. These planning approaches can readily be used by local governments to determine the content of comprehensive plan elements, and they can help guide the structure of the implementing regulatory and non-regulatory programs.

By applying Smart Growth approaches, in conjunction with the landscape analysis, a local jurisdiction develops the most desired land use plan (i.e., the best greenprint or

alternative futures scenario). That desired or conceptual land use plan, often presented in the form of a map or maps, includes the location and type of all the open space areas desired for conservation, preservation, and restoration (including degraded open space that provides opportunities to restore processes and functions). It also includes transportation corridors and the desired land uses that will maintain and protect processes and functions. The implementation tools used to conserve, preserve, and restore the identified areas may be either regulatory or non-regulatory. Which protection measures work best at any location are determined by the functional attributes of the site, consideration of risk, and, ultimately, the desires of the community.

Land use policies under Smart Growth encourage mixed-use zoning, limited outward expansion, higher density development, reduced travel, revitalization of urban centers, and preservation of open space essential to maintaining critical areas and landscape processes. Regulatory development standards focus on low impact development (LID) practices, such as reduction in road widths and parking lot size, maintenance of tree cover, alternatives to impervious surfaces, compact building design, etc. Non-regulatory programs adopted using the Smart Growth approach emphasize preserving and restoring core greenspace areas. A local jurisdiction's effectiveness at preserving and restoring core greenspace areas is higher when both regulatory and non-regulatory tools are applied.

Smart Growth practices and the associated planning approaches can be applied at any time in the local planning review process. Whenever a local jurisdiction intends to update its comprehensive plan and implementing ordinances, or develop new subarea plans, it is an appropriate time to incorporate the landscape analysis and use Smart Growth principles. Implementing these analysis tools early in the process will result in greater benefit in terms of maintaining the services and infrastructure provided by the landscape and providing more livable and affordable communities.

A case study of Smart Growth benefits

A recent study by Preuss and Vemuri (2004) projected the effectiveness of Smart Growth practices implemented in Montgomery County, Maryland, in the 1960s. At that time Montgomery County implemented Smart Growth tools including transfer of development rights, cluster development, and open space acquisition into their land use planning practices.

Preuss et al. applied a dynamic model to predict future implications of Montgomery County's past growth management actions by reviewing three different scenarios: (1) traditional policies, (2) environmentally friendly or current Smart Growth, and (3) full development. They found that Montgomery's current Smart Growth practices reduced negative effects on water quality and preserved more open space than the other two scenarios. In addition, under Montgomery's existing Smart Growth practices, developable land would still remain into 2050 while being non-existent under the other scenarios.

6.4.1 Green Infrastructure Planning

Green infrastructure or GRIST is defined as an interconnected network of protected land and water that supports native species, maintains landscape processes, sustains air and water resources, and contributes to the physical and economic health and quality of life of communities. This network of lands includes a wide variety of both relatively undisturbed and restored ecosystems and landscape features that make up a system of hubs and links. The integrated network of hubs and links helps sustain landscape processes while also providing corridors for wildlife movement. (Conceptual illustrations of "hubs and links" are provided in Section 6.4.1.2, which discusses the typical steps in developing and implementing a GRIST plan.)

The resulting network of ecologically important lands integrates:

- Waterways, wetlands, forests, wildlife habitats, and other natural areas;
- Greenways, parks, and recreation lands;
- Working farms, ranches, and forests; and
- Wilderness and other open spaces that support native species and maintain landscape processes.

GRIST plans are an important element in the Smart Growth package because they help local planners identify and prioritize resources to be preserved, ensure the economic viability of working landscapes, and orient development in a manner that is compatible with sustaining landscape processes and the character of the community. GRIST plans provide a "greenprint" (similar to a blueprint for transportation) for accommodating land

use patterns while preserving critical areas, native species, cultural assets, and natural resource lands.

The President's Council on Sustainable Development identified **green infrastructure** as a key strategy for achieving sustainability in the report *Towards a Sustainable America – Advancing Prosperity, Opportunity and a Healthy Environment for the 21st Century* (Williamson 2003.) Additional references on green infrastructure and Smart Growth topics are provided in Appendix 6-A.

6.4.1.1 The Greenprint Approach

When developing a GRIST plan (or "greenprint"), conservation of landscape processes and critical areas establishes the foundation on which the rest of the local comprehensive plan is built.

Integrating the results of landscape analysis (as described in Chapter 5) into the GRIST plan ensures that the functions and processes necessary to ensure long-term protection of wetlands and other resources are thoroughly understood and considered to avoid future impacts or loss. For example, areas where significant groundwater discharge/recharge and groundwater storage occur would not be appropriate to zone for uses that would result in a high percent of impervious surfaces (roofs, driveways, roadways, parking lots). These areas would be more appropriate to zone as open space or for other low-density uses, rather than being designated for high-density development. The local jurisdiction might want to consider preserving such areas from development altogether so that the community's water supply infrastructure is assured into perpetuity.

A GRIST plan can also identify areas that provide important landscape processes but that need restoration. For example, this might include areas where construction of levees has separated rivers from their floodplains, or where drainage channels are conveying subsurface waters away from wetlands.

Thus, integrating the results of the landscape analysis allows a jurisdiction to direct human activities to locations that avoid or minimize impacts to critical areas, sustaining them over time while supporting the community's needs for adequate water supplies, water quality, flood attenuation, etc.

Green infrastructure planning tracks the pace and location of land use in relationship to sustaining natural environments, critical areas, and the services they provide. By integrating the benefits of landscape processes and services, GRIST plans assess current conditions and guide future land uses in a manner similar to how a transportation plan provides a blueprint for existing and future travel needs.

Communities at any stage of planning or development can incorporate green infrastructure into their planning processes:

- **GRIST planning for areas with little urban development.** When applying the results of a landscape analysis through a GRIST plan for a jurisdiction (or portion

thereof) that has experienced little human development, a network of critical areas and resource lands can be identified for conservation. This network can be coordinated with plans for the built infrastructure such as essential transportation corridors. Essential green infrastructure can be preserved and/or restored while transportation corridors and built environments are accommodated. This clearly identifies where both public and private development will be better suited, thereby planning land uses that are compatible with the landscape.

- **GRIST planning for areas that are largely developed.** In jurisdictions where the landscapes have already been largely developed, applying the results of the landscape analysis through GRIST plans can designate and protect the remaining natural systems and linkages while considering the existing roads, urban centers, etc. The results of the landscape analysis also allow the jurisdiction to identify those portions of the landscape where essential processes and functions could be restored.

Implementing GRIST planning begins with incorporating the GRIST plan into the Land Use Element of the comprehensive plan (as well as the Shoreline Master Program). Other relevant elements of comprehensive plans should also include policies and directives for successfully implementing GRIST planning. The comprehensive plan elements are then followed with establishment of both regulatory and non-regulatory programs and tools.

Which tools are used, and where and how they are applied, will depend on the goals and needs of the GRIST plan in relation to landscape processes, their level of degradation, their sensitivity to disturbance, and development pressures. For example, in a particular subbasin it might be more critical to protect and maintain wetlands because the quality of the water is threatened by non-point pollution. Thus, policies in that basin may direct agricultural uses to provide limited access to aquatic resources and encourage restoration of aquatic habitats and their buffers, while zoning designations could reflect strict wetland protection standards. Policies and regulations may recommend low-impact development practices or even land acquisition as the preferred tool for protection of an undeveloped area that provides aquifer recharge.

6.4.1.2 Typical Steps in Developing and Implementing a GRIST Plan

While each local jurisdiction might need to develop a GRIST plan in its own way, there are some key steps that each should address (discussed below). Some of these steps may overlap with the landscape analysis discussed in Chapter 5. For detailed guidance on GRIST planning, please reference the four-volume workbook titled *Local Greenprinting for Growth* (Trust for Public Lands and National Association of County Officials 2002).

Step - Develop the Overall GRIST Approach and Define Its Geographic Scope

Developing an approach requires (1) defining the scope of the project, (2) establishing a means of engaging the community through education and public input and providing a forum for group decisions on the plan, and (3) understanding fiscal costs and benefits.

Decisions will need to be made regarding the geographic scope of the GRIST plan and the resources that will be examined. The geographic scope is the portion of the landscape under consideration: Is it at the scale of the contributing landscape involving several jurisdictions, or a management area such as a county, city, or subbasin? Defining what areas should be part of a greenprint should ideally be examined in light of the sensitivity of different areas identified during the landscape analysis.

GRIST planning is a process of community visioning and decision making; the community must be informed and engaged early in the process. Public understanding and involvement are essential to the success of the greenprint design. A communication plan should be created early in the process, identifying how the local community will be engaged, what committees will be used to make planning decisions, what will be their composition and decision-making power, etc.

The fiscal savings that accrue as a result of protecting landscape processes must be clearly articulated from the start. Some local jurisdictions conduct fiscal analyses comparing the cost of building infrastructure to the cost of protecting green infrastructure, including the revenue benefits that green infrastructure provides to communities. Other fiscal benefits worth considering are those enabled by the cultural amenities of attractive landscapes, which include greenspaces such as parks and recreation lands and open spaces provided by greenbelts and working farms; these values are increasingly important in attracting the creative workforce that can add economic growth potential to communities (Florida 2002). This is important information since the fiscal value of open space will need to be communicated to policy-makers as well as the community. (See Section 6.5 of this chapter for further discussion of fiscal benefits.)

Step 2 - Inventory Resources

Inventorying resources might consist of the landscape analysis discussed in Chapter 5 or another method that is appropriate to assess the characteristics of the green infrastructure in the planning area. Using a landscape analysis ensures an understanding of the relationship of landscape processes and wetland functions and how they have been altered. Landscape data can be used in conjunction with additional information such as other resource features, detailed ownership patterns, and current or projected zoning overlays. Together this information can assist with deciding how landscape processes and wetland functions should be protected and the type and location of preservation and restoration measures needed.

Figure 6-2 provides a simple, conceptual illustration of a landscape that has been inventoried as part of developing a GRIST plan. This graphic serves as the base for Figures 6-3 and 6-4 which illustrate subsequent steps in GRIST planning. Examples of

more detailed landscape analyses that have been completed by Ecology are provided in Appendix 5-C.

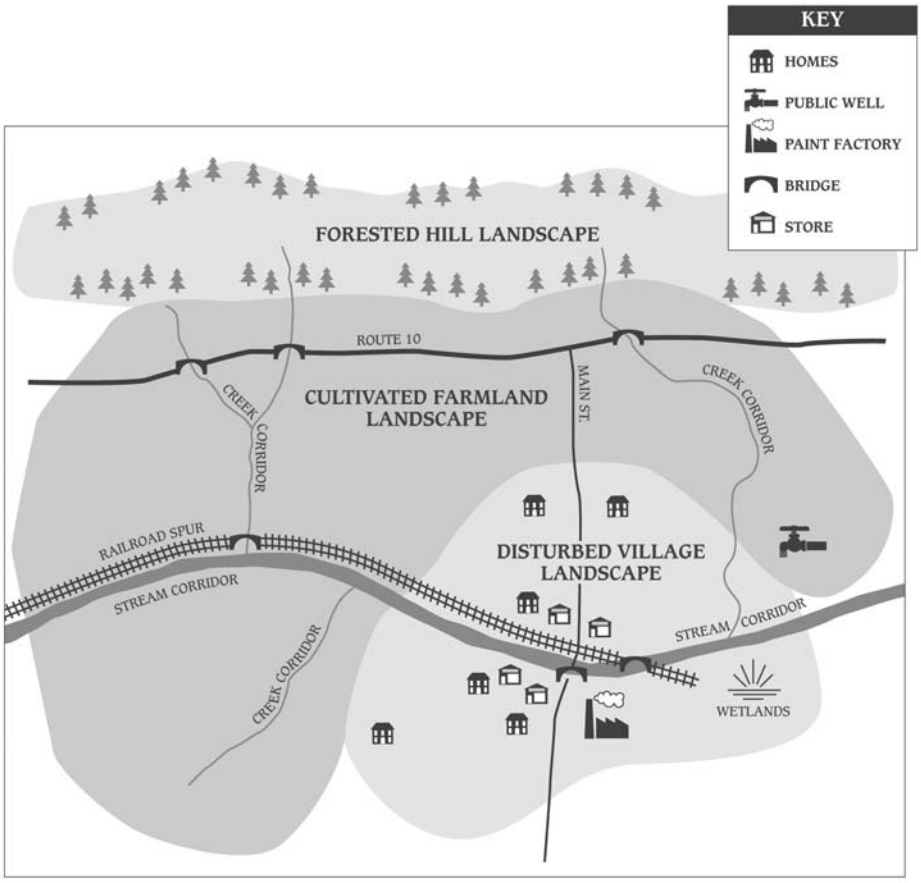


Figure 6-2. Conceptual representation of a landscape that has been inventoried as part of creating a GRIST plan. *(Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA.)*

Step 3 - Envision the Future

Envisioning the future is when the community establishes overriding principles that guide the development of the GRIST plan. These are the goals for the greenprint and may include preserving critical areas within each landscape type, maintaining and/or restoring landscape processes that sustain the ecosystem, restoring lands, creating or enhancing open space corridors, and so on. The envisioning process of the GRIST plan also inherently needs to include discussion and identification of the least sensitive lands that are most appropriate for development for a range of uses that are prioritized by the community.

Step 4 - Finding the Hubs and Links

Finding the hubs and links requires a detailed examination of key ownership and land use patterns and defining how they will be addressed in the GRIST plan. After the landscape

analysis process, the identification of existing or potential hubs and links will become more readily apparent. For example, cultivated lands, forest cover, and existing preserves will be obvious "hub" points from which to examine retaining or recreating corridor "links" between the "hub" sites (see conceptual illustration in Figure 6-3). As this network is envisioned, steps to round out as well as implement the plan—such as purchasing parcels of land to connect habitat areas or restoring wetlands or riparian areas—will become apparent.

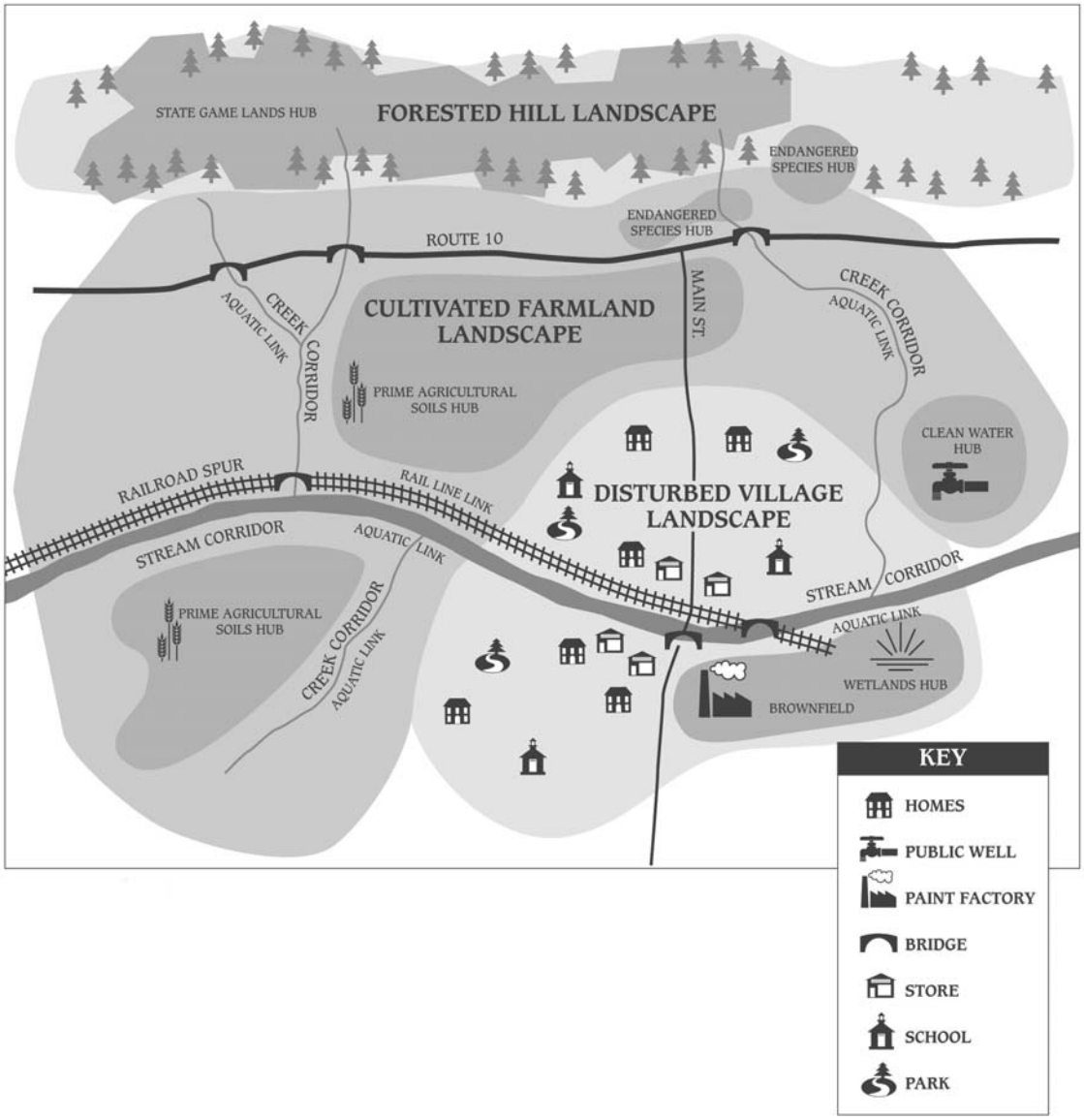


Figure 6-3. Conceptual representation of how hubs and links are identified as part of creating a GRIST plan. *(Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA.)*

Defining what areas need to be part of the greenprint should be examined in light of the landscape processes identified during the landscape analysis. Areas that require

specialized protection because of their sensitivity can then be accommodated in the greenprint, whether by using regulatory provisions, preservation, or restoration actions.

Step 5 - Creating the GRIST Plan

Creating the GRIST plan involves using the data from the landscape analysis to guide the greenprint with its hubs and links as a base to design potential land use scenarios. Alternative scenarios can be examined using mapping and different policy and zoning applications. Then the community's goals for the future are applied, and the appropriate course of action can be identified.

This stage in GRIST planning focuses on what provisions are needed in various portions of the landscape to effectively protect, preserve, and restore core areas of concern. At this stage of the process, a clear understanding of the direction for further development of the comprehensive plan, implementing policies and regulations, and non-regulatory tools should be apparent. Figure 6-4 provides a conceptual illustration of a completed GRIST plan.

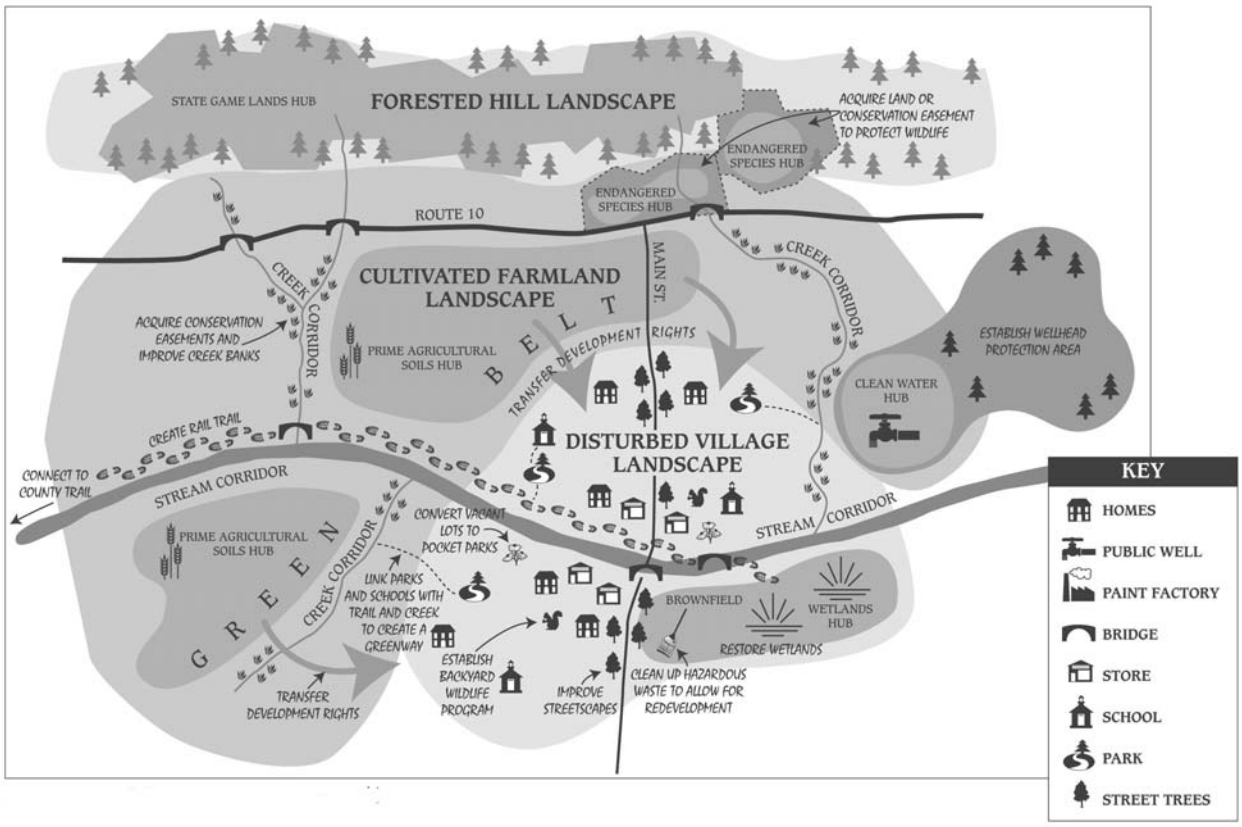


Figure 6-4. Conceptual representation of a completed GRIST plan. *(Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA.)*

Step 6 - Implementing the GRIST Plan

Several means can be used to implement a GRIST plan, beginning with integrating it into the Land Use Element of the comprehensive plan. Comprehensive plan policies are followed by revised zoning designations, revised critical area or other regulations, and development of non-regulatory programs with landowner incentives, acquisition funding, and restoration programs.

6.4.2 Alternative Futures

Alternative Futures is another complementary planning approach that can be used as part of an overall Smart Growth effort. Alternative Futures is a process through which a community makes informed land use decisions based on different future scenarios for human activities and their effects on the environment. The approach consists of creating a series of scenarios that depict what the landscape might look like in the future with various options for land use in place. Each scenario is analyzed for its effect on water quality, water quantity, fish and wildlife habitat, or other landscape processes of concern to the community. The analysis also assesses the potential benefits and impacts of the scenarios. When the preferred option is selected, the result is a land use plan based on protection of natural resource lands and critical areas, and designed with the community's vision of future ecologically sustainable development in mind.

Community meetings are held to provide the public with maps showing examples of what their planning area will look like using the different scenarios. Instead of a political boundary, a watershed or other boundary based on the features of the landscape can be used to analyze the effects of land use changes on landscape processes. These maps compare the different scenarios using current policies and regulatory provisions, as well as alternatives that are both more and less stringent regarding protection of resources. Often, examining these scenarios helps the public to better understand what is at stake, thus helping communities shape informed goals and plans for their future. Alternative Futures analysis provides an outstanding tool for visually capturing the effects of land use policy decisions on the landscape, so that more informed choices can be made.

Like GRIST planning, Alternative Futures relies heavily on involving an interested and informed citizenry in the planning and design of a desired future. Again, a strong emphasis is placed on setting up the process such that communication, education, and participation are engaged early on.

A Local Example of Alternative Futures Planning

In January 2001, the Kitsap County Department of Natural Resources used the Alternative Futures process to examine different scenarios in the Chico Creek watershed for developing a subarea plan amendment to the County's comprehensive plan. The project was funded as a pilot project by the U.S. Environmental Protection Agency under a grant to the Puget Sound Action Team. The Chico Creek watershed drains 16.3 square miles of land west of Dyes Inlet in Kitsap County. Information regarding the details of the project can be found at: www.psat.wa.gov/programs/LID/LID_futures.htm.

The County found the Alternative Futures approach to be a unifying process that integrates land use planning with other regional processes such as watershed planning, salmon recovery, clean water plans, and other regulatory directives such as GMA. Using the Alternative Futures process, the county developed the preferred alternative by:

- Conducting a technical assessment of current conditions,
- Involving citizens and interested parties in developing and selecting scenarios,
- Testing the scenarios using GIS and scientific analyses, and
- Making an informed selection of the preferred scenario for future land use.

To accomplish these tasks they established assessment goals, analysis goals, and planning goals.

A strong component of Kitsap County's approach was public involvement. Five subcommittees were established, including an education work group, a public involvement work group, a technical work group, a restoration work group, and a watershed advisory committee. From these they constructed an effective education campaign and public involvement process.

Four scenarios were examined: (1) the current regulatory condition, (2) a strong development scenario, (3) a strong conservation scenario, and (4) a moderate scenario falling between development and conservation. A suite of analyses, using natural resource indicators, were conducted to identify the impacts of each alternative. The current regulatory condition scenario was dropped early on due to the severity of impact. The end result was selection of the "moderate" development scenario incorporating conservation practices.

Kitsap County officials were pleased with the benefits of the Chico Creek project and propose using the Alternative Futures approach to develop subarea plans for other watersheds throughout the county.

6.4.3 Combining Complementary Approaches

Each type of planning approach discussed here—landscape analysis, Green Infrastructure planning, and Alternative Futures—is complementary to the others. Applying the core elements of these three approaches in combination can offer a strong analytical package for making decisions regarding land use that will benefit the community and incorporate consideration of landscape processes.

Landscape analysis (described in Chapter 5) provides a strong foundation for Alternative Futures analysis because it highlights the essential landscape processes that should be considered prior to selecting a preferred scenario for future land use. Landscape analysis and Alternative Futures together provide a very useful tool for visually displaying the effects of land use decisions on the maintenance of landscape processes.

GRIST planning also assists with the Alternative Futures process by:

- Reinforcing the benefit of using the results of a landscape analysis as the basis for planning so that landscape processes can be sustained,
- Recognizing the role of landscape processes and wetland functions as "infrastructure" and therefore worthy of protection for fiscal reasons,
- Adding hubs and links as functionally important to the maintenance of landscape processes, and
- Integrating working landscapes (natural resources lands such as agricultural and forest lands) as valued green space.

Likewise, the application of Alternative Futures can be an integral part of creating a GRIST plan. Alternative Futures helps the GRIST process by applying "metrics" to quantify the impacts of disturbance on the landscape. Metrics are environmental indicators of stresses within an ecosystem. These metrics are usually selected based on a significant statistical correlation with environmental data (e.g., a correlation between impervious surface and species richness). The metric also undergoes a calibration process using environmental data within the watershed where it will be applied. Several metrics are typically used in order to improve the accuracy of the evaluation. The use of metrics is an important tool for evaluating alternative land use scenarios. Current research in the Puget Sound lowlands is building our understanding of key stresses that affect landscape processes. Calibration of various metrics such as impervious surfaces, road density, number of stream crossings, and riparian connectivity is currently being conducted by local researchers (for example: Alberti et al. 2003).

Checklist of factors to be considered in making land use decisions while looking toward the future

In the paper "Ecological Principles and Guidelines for Managing the Use of Land" by V.H. Dale et al. (2000), a collaboration of scientists from around the country provide a checklist of factors to be considered in making land use decisions while looking toward the future. These factors include: (1) examine the impacts of choices in a regional or landscape context, (2) plan for long-term change and unexpected events, (3) preserve rare landscape elements, critical habitats, and associated species, (4) avoid land uses that deplete natural resources over a broad area, (5) retain large contiguous or connected areas that contain critical habitats, (6) minimize the introduction and spread of non-native species, (7) avoid or compensate for the effects of development on ecological processes, and (8) implement land use and land management practices that are compatible with the natural potential of the area.

V.H. Dale et al. (2000) provide guidance for applying each of these factors to the planning process. They note that the mobility of human activities is more flexible (within limits) than the mobility of processes and resources that provide important landscape processes. Therefore, ecological constraints (the need to manage landscape processes for the long term) can be used as the primary consideration in land use planning. The planning sequence they suggest is to first plan for maintaining water and biodiversity; then for cultivation, grazing, and the harvesting of wood products; then for managing sewage and other wastes; and finally for the placement of homes and industry. (Note: These goals are also listed in Chapter 1 and should be considered throughout the four-step framework for protecting and managing wetlands and other critical areas.)

6.5 Fiscal Savings and Other Benefits

Protection of landscape processes and wetland functions can provide important fiscal savings as well as other benefits. Many people assume that revenue will be lost as a result of land protection, while the costs of constructing infrastructure to provide necessary services once green space is gone and landscape processes are degraded are often overlooked.

Several recent papers have documented the costs associated with losing systems that provide landscape processes and wetland functions. In *Taking its Toll: The Hidden Costs of Sprawl in Washington State*, Mazza and Fodor (1999) point to water quality and quantity impacts, smog and health issues, habitat and species losses, overall watershed decline, and general quality of life concerns. All of these losses can affect the economic viability of communities.

A report by the Trust for Public Land and The National Association of County Officials (2002) presents the numerous benefits of recognizing that certain lands are necessities, not just amenities:

- Fiscal savings, which are demonstrated when purchased open space more than pays for itself,
- Economic benefits, when the quality of life improvements attract business investment,
- Free infrastructure, as green space provides services that avoid the expense of building infrastructure, thus saving taxpayer money,
- Environmental benefits, through linking land use planning to the protection of landscape processes and ecosystem biodiversity, and
- Health and social amenities, such as recreation opportunities that are constructive alternatives to deter adolescent antisocial behavior while contributing to the health and wellness of communities.

The following paragraphs discuss and provide examples of four general types of fiscal savings resulting from protection of landscape processes.

Use of Green Infrastructure Instead of Building Infrastructure

As demonstrated in the examples that follow, communities around the country that conduct a fiscal analysis of their revenues versus expenditures are finding that conservation of green infrastructure saves money in the long term. Purchasing and preserving land results in cost savings by avoiding the need to build infrastructure later. The green spaces also improve quality of life for citizens and add economic vitality to communities.

When New York City was faced with the need to spend $8 billion on new water filtration and treatment plants, they instead purchased 80,000 acres of watershed land in the Catskill Mountains for $1.5 billion. The land functions to filter and purify drinking water. The land purchase saved the city $6.5 billion by not building a treatment plant and another $300 million a year in forgone costs of operating the plant.

In the 7-million-acre Willamette/Lower Columbia region of the Pacific Northwest, the tree canopy has been reduced from 46 to 24% between 1972 and 2000 due to the expansion of roads, buildings, and pavement in general. This significant canopy loss in 28 years has imposed $2.4 billion in costs for managing the increased stormwater runoff, according to a Regional Ecosystem Analysis by American Forests (2001). Each year this lost canopy of trees would have also absorbed 138 million pounds of pollutants and saved $322 million in related cleanup costs. According to the study, the region's remaining trees are still detaining and purifying a massive quantity of stormwater that would have otherwise required construction of a $20.2 billion treatment plant to manage runoff. The trees also absorb 178 million pounds of pollutants annually, whose potential cleanup would cost $419 million a year.

Increase in Local Tax Base

Protecting areas that provide landscape processes, including retaining green spaces and wetlands, improves the quality of life. Quality of life is a determining factor in real estate values and economic vitality. The green spaces of Portland, Oregon, for example, have helped build this city's reputation as one of the country's most livable cities. "The real estate market consistently demonstrates that many people are willing to pay a larger amount for property located close to parks and open space areas than for a home that does not offer this amenity," writes John L. Crompton, a professor at Texas A&M University (Sherer 2003.) A study in Portland found that residential property values increased if they were in closer proximity to a wetland, increasing by $436 for every 1,000 feet (Barclay and Batker 2004.) The higher value of these homes means that their owners are paying higher property taxes. In some instances, the additional property taxes are sufficient to pay the annual charges on bonds used to finance the acquisition and development of a park.

This has also been demonstrated in a study examining residential proximity to greenbelts conducted in Boulder, Colorado. Here the average values of homes next to the greenbelt

were 32% higher than those just 3,200 feet away. The study showed that the greenbelt added $5.4 million to the total property values of one neighborhood, generating $500,000 per year in additional property taxes. This was enough to cover the $1.5 million purchase price of the greenbelt in only 3 years (Sherer 2003.)

It is also important to note that value is not fixed in time: The values of many ecological services are growing as they become increasingly scarce. Barclay and Batker (2004) note that environmental quality today plays a pivotal role in the ability of a region to attract workers and new firms. A community with a degraded environment is more likely to suffer economically (Barclay and Batker 2004.)

Costs of Building in the "Wrong Place"

The town of Pittsford, New York, commissioned a fiscal model from Behan Planning Associates to determine the costs of expanded urban development versus the costs of land protection. The fiscal model could predict future tax rates based upon the costs and revenues associated with future land use patterns. The model estimated that land purchases under a greenprint plan would cost the average taxpayer $1,400 more in property and school taxes over 20 years, whereas the cost to fully develop the land under their existing policies would cost $5,000 more. This analysis revealed that it would be much less expensive to implement the greenprint plan than allow development in the wrong locations (Trust for Public Land and National Association of County Officials 2002).

Costs of Providing Services

A study by the American Farmland Trust (cited in Mazza and Fodor 1999) showed that for every $1 generated in tax revenue, the median cost to provide services to residential areas was $1.15, while only $0.37 was spent on agricultural or natural resource lands. A study in Washington showed that the added expense for off-site facilities serving a typical new home is $20,000 to $30,000, which does not match the tax revenue generated to cover these costs (Mazza and Fodor 1999). Additional information on this topic can be found in a paper on the *Three Myths of Growth* (Fodor 1996), which addresses the belief that growth builds a tax base that provides enough revenues to cover the necessary services.

Additional Resources

Many resources are available for local governments that wish to pursue Smart Growth, Green Infrastructure, Alternative Futures, and associated concepts discussed in this chapter. Published and online resources for further information are listed in Appendix 6-A.

Chapter 7
Developing Plans and Policies: Comprehensive Planning

7.1 Introduction

This chapter builds on the discussion in Chapter 6 about planning approaches that can be used to establish a framework for developing policies in a comprehensive plan. The planning tools discussed in Chapter 6, such as Green Infrastructure and Alternative Futures, allow jurisdictions to use the data generated from a landscape analysis to create a vision of their communities for the future, integrating landscape processes with land use priorities at the scale of the management area.

Developing or revising a comprehensive plan, and the other processes discussed in Chapter 6, are all part of Step 2 (prescribing solutions) in the four-step framework this volume describes for protecting and managing wetlands (Figure 7-1). Using the landscape-analysis tools described in Step 1 (Chapter 5) can help guide the development or revision of a comprehensive plan, shoreline master program, or other planning effort. Regulatory and non-regulatory solutions, discussed later in Chapters 8 and 9, are also part of Step 2 and can be used to implement plans and policies.

By integrating landscape analysis and public involvement into the planning process, effective policies and regulations can be developed that reflect land use choices that will maintain, protect, and restore landscape processes. (The reader is referred to Chapter 6 for a thorough discussion of the importance of using information generated by a landscape analysis to inform planning, including comprehensive planning.) Therefore, the results of landscape analysis should be incorporated into the goals and policies of the relevant mandatory and/or optional elements included within comprehensive plans. Because comprehensive plan goals and policies establish the basis for much of the regulatory language, codes, and zoning developed by a jurisdiction, the information in a comprehensive plan could then reflect what is needed to maintain landscape processes and protect wetland functions and values.

Doing a landscape analysis is not a recommendation to implement an entirely new process. Aspects of a landscape analysis, as described in this volume, are already a required part of developing or amending/updating a comprehensive plan.

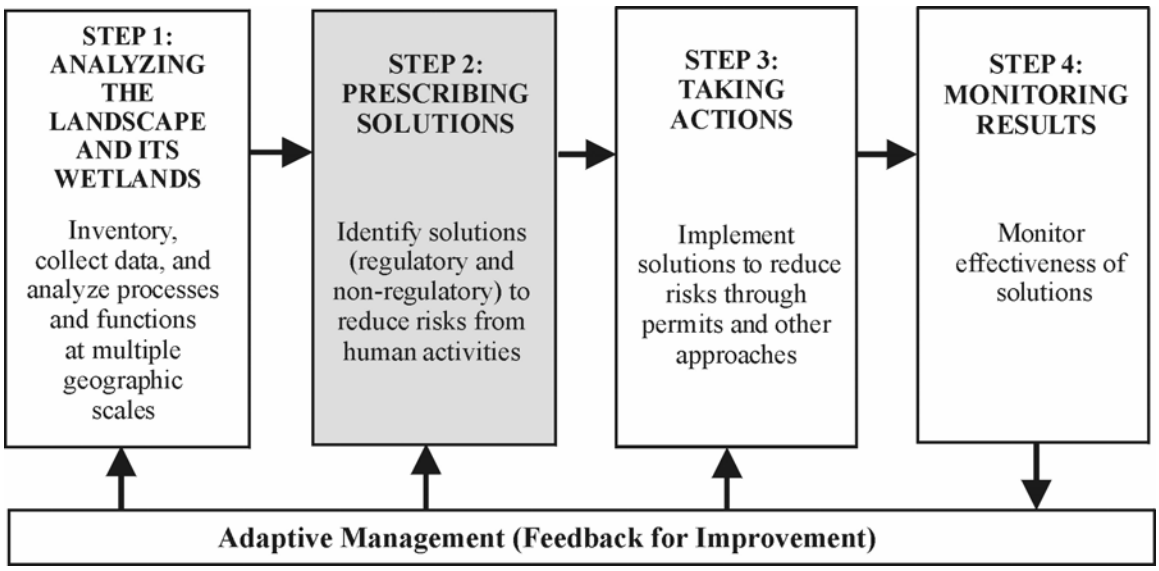


Figure 7-1. Comprehensive planning is part of Step 2 in the four-step framework recommended for protecting and managing wetlands.

Although it is important to use information that includes data from the scale of the contributing landscape, comprehensive planning is conducted at the scale of the management area. This usually means for all lands over which a jurisdiction has authority, because the boundaries for planning are political, not driven by the landscape. Green Infrastructure and Alternative Futures analysis are also conducted at the scale of the management area and may be used for the entire jurisdiction or for a smaller area such as a basin, a subarea, or a community planning area.

This chapter provides a brief overview of comprehensive planning (Section 7.2), followed by a discussion of the mandatory and optional elements of comprehensive plans as established by the GMA (Sections 7.3 and 7.4). The chapter includes examples of how typical comprehensive plan language can be modified to incorporate landscape analysis. It then discusses how subarea plans can be used by jurisdictions that would like to incorporate landscape information within a smaller planning area (Section 7.5). The chapter concludes (Section 7.6) with a brief discussion of using landscape analysis in the context of the Shoreline Management Act and planning for shoreline areas.

7.2 An Overview of Comprehensive Planning

As discussed in detail in Chapter 2 and summarized briefly in the introduction of Chapter 6, the GMA dictates that counties and cities that meet certain provisions must plan for future growth (RCW 36.70A.040). They must develop comprehensive plans and development regulations, including critical areas ordinances, to meet the intent and requirements of the GMA (RCW 36.70A.020). Comprehensive plans and regulations are subject to continuing review and evaluation by the county or city that adopted them. The GMA also requires local jurisdictions to include best available science in the

development of policies and development regulations used to protect the functions and values of critical areas, including wetlands (RCW 36.70A.172).

The key GMA requirements are as follows:

- Identify and protect critical areas and resource lands;
- Designate county-wide planning policies and Urban Growth Areas (for counties and cities fully planning under the GMA);
- Prepare and adopt comprehensive plans;
- Adopt development regulations to implement the comprehensive plan; and
- Evaluate and update the comprehensive plan and development regulations.

Comprehensive planning, as the name implies, is a planning process that encompasses all the activities that occur or may occur on the land over which a local government has jurisdiction. Typically, a comprehensive plan consists of a "map or maps and descriptive text covering objectives, principles and standards" used for its development (RCW 36.70A.070). A comprehensive plan is a document that provides direction for land use decisions in a local jurisdiction. As described in the introduction to the Spokane County Comprehensive Plan:

> *A Comprehensive Plan is a set of goals, policies, maps, illustrations and implementation strategies that states how the County should grow physically, socially, and economically. The plan emphasizes innovative and flexible strategies to guide growth and development. One of the central themes of the Plan is the promotion of economic development that occurs in harmony with environmental protection and preservation of natural resources. The Plan recognizes the interests of the entire community and promotes cultural and ethnic diversity. The Comprehensive Plan establishes a pattern of land uses to shape the future in desirable ways.*

A comprehensive plan is composed of elements that address typical issues for a jurisdiction. Elements such as transportation and capital facilities (e.g., domestic water sources, sewage treatment, essential public facilities, stormwater facilities) are incorporated into the planning process to ensure that adequate infrastructure is provided for existing and future land uses. In addition, there are elements that address the protection of natural resource lands, such as agricultural areas, and critical areas such as wetlands.

Under the GMA, comprehensive plans must contain the following elements:

- Land Use,
- Transportation,
- Housing,

- Capital Facilities,
- Utilities,
- Shorelines, and
- Rural Lands (for counties).

Economic Development and Parks and Recreation Elements are also required to be included in plans, but only if state funding is provided.

Optional elements may also be included in comprehensive plans, such as conservation, energy, recreation, and subarea plans, where appropriate. Some jurisdictions include additional elements that consider the environment. For example, Skagit County includes an Environment Element that specifically focuses on the influences of wetlands, streams, wildlife habitat, and other environmental factors on planning and land use, whereas Yakima County includes a Natural Setting Element. Overall, the plan "shall be internally consistent and all elements shall be consistent with the future lands use map" (RCW 36.70A.070) and shall be coordinated with the comprehensive plans of jurisdictions with common borders or related regional issues (RCW 36.70A.100).

The Legislature also set forth goals to guide the development of comprehensive plans. Application of a landscape analysis and low-impact development principles would assist in meeting the following of those goals:

- Encouraging development in existing urban areas;
- Reducing sprawl;
- Ensuring that adequate public facilities are in place for new development;
- Retaining, enhancing, and conserving open space, recreation, and habitat areas;
- Protecting the environment and enhancing water and air quality and availability of water;
- Meeting the goals and policies of the Washington State Shoreline Management Act as set forth in RCW 90.58.020; and
- Encouraging economic development that is within the capacity of the state's existing natural resources.

The Legislature also directed local governments to include innovative land use management techniques in their comprehensive plans, including density bonuses, cluster housing, planned unit developments, and transfer of development rights (RCW 36.70A.090). Landscape analysis and low-impact development principles will assist local governments in meeting this provision.

7.2.1 County-Wide Plans and Policies

The GMA establishes counties as the primary units for regional land use planning. An important aspect of planning under the GMA is the requirement for counties to adopt county-wide planning policies under RCW 36.70A.210. County-wide planning policies are adopted in consultation with the municipalities in the county, to support and guide cross-jurisdictional cooperation between the county and the municipalities located within it.

At a minimum, a county-wide planning policy needs to address the development of Urban Growth Areas and joint planning for those areas, siting public capital facilities of a county-wide or state-wide nature (such as transportation facilities), providing for affordable housing, economic development and employment, and analyzing the fiscal impact of those policies. These county-wide policies are binding on state agencies. Specific adjacent large urbanizing counties (those with population greater than 450,000 people) are required to adopt multi-county planning policies.

Plans and policies may need to be amended to create the basis for critical areas regulations that include best available science across jurisdictions. Because critical areas such as wetlands and the landscape processes that support them often span multiple jurisdictions, local governments should consider whether their current policies and regulations are consistent with the programs of neighboring jurisdictions.

In fact, managing natural resources at the larger geographic scales of contributing landscapes or watersheds has become recognized internationally as an important approach to protecting aquatic resources, including wetlands (United Nations 1997). While planning at this scale may be beyond the purview of comprehensive planning for some local jurisdictions, it is possible for local jurisdictions to join existing programs to develop plans and actions at larger geographic scales. Examples of regional planning efforts being conducted by state and federal agencies related to aquatic resources are provided in Appendix 7-A.

7.2.2 Tools for Implementing Comprehensive Plans

The policies of comprehensive plans can be implemented through a variety of means. The most common and effective is when policies are included in development regulations adopted through ordinance and become mandatory. In some jurisdictions, policy language can be implemented through provisions of the State Environmental Policy Act (SEPA). However, policy language is often viewed as more discretionary than adopted development regulations.

Under the provisions of the GMA, development regulations have to be consistent with the comprehensive plan that the jurisdiction has adopted. This is one of the key provisions of the GMA related to comprehensive plans and regulations: Ensure consistency between plans, policies, and regulations, and provide coordination between contiguous jurisdictions.

The policies, goals, and values identified in the comprehensive plan are implemented through these regulations. Regulations are adopted through ordinances to prescribe general and permanent rules. In conflicts concerning development activity, the development regulations are the primary means for resolving disputes and carry more legal weight than the comprehensive plan policies. Regulatory tools are discussed in Chapter 8.

A comprehensive plan can also be implemented through non-regulatory tools, as discussed in Chapter 9 of this document.

7.3 Mandatory Elements of Comprehensive Plans

Under the GMA, comprehensive plans must contain certain mandatory elements. Many of the mandatory elements of a comprehensive plan (RCW 36.70A.070) can incorporate the results of a landscape analysis and the Smart Growth planning processes described in Chapters 5 and 6. The mandatory elements that are the most applicable to wetlands protection and management include:

- Land Use Element,
- Capital Facilities Plan Element,
- Rural Lands Element (for counties), and
- Transportation Element.

Optional plan elements, especially conservation plans and subarea plans, may also be important in order to create an effective program to protect and manage landscape processes and wetland functions. These optional elements are discussed in greater detail in Sections 7.4 and 7.5.

Described below are each of the mandatory elements that can most appropriately be used for managing and protecting the landscape processes that maintain wetlands and their functions. Examples of policy text that incorporate landscape analysis are provided for each element.

7.3.1 Land Use Element

The Land Use Element is the heart of the comprehensive plan. It determines the "proposed general distribution and general location and extent of the uses of land" including population densities, building intensities, and future population growth estimates (RCW 36.70A.070).

The tone of the Land Use Element is set by the text of the Introduction and Framework, which identify key guiding values and the priorities of the community. For example, as noted in the opening paragraphs of the City of Cheney Land Use Element:

> *The Land Use Element of Cheney's Comprehensive Plan is central to the entire planning process. The land use patterns are what determine the character of the community and dictate the types and locations of future development. This element of the plan determines the traffic patterns and the ability or inability to effectively alter those patterns over time. It can be sensitive or insensitive to the natural and physical characteristics existing within a community and, overall, it is the primary element which will determine the quality of life for the citizens of Cheney.* (http://cityofcheney.org/planning/comp_plan/comp_plan7.pdf)

In Skagit County, the Land Use Element focuses almost exclusively on human uses of the land in current and future conditions. The County's Land Use Element assesses the condition, location, and distribution of existing land uses and identifies the appropriate intensity and density of land uses for the future based on development trends in the county and surrounding areas. The Land Use Element includes guidance for the development of commercial and industrial land uses as well as residential, agricultural, and other uses.

In some comprehensive plans, the Land Use Element begins by describing in some detail the natural history and ecological conditions of the landscape within the jurisdiction. This information is then used to plan land use on the landscape. The City of Bainbridge Island, for example, uses this approach to establish a "sense of place" before designating land use types. (The Table of Contents for the City of Bainbridge Island Land Use Element is used as the example in Section 7.3.1.2). Other comprehensive plans do not include an extensive natural history section, but limit their descriptions to the existing and proposed land uses within the jurisdiction.

The Land Use Element must specifically provide for the protection of groundwater used for potable water, and where applicable, must review drainage, flooding, and stormwater runoff and provide guidance for corrective actions to mitigate or cleanse those discharges that pollute waters of the state.

Most comprehensive plans state one or more **goals** which are vision statements that attempt to identify the priorities and values of the community. Following the goals may be a series of one or more **policies** related specifically to each identified goal. Sometimes the policies overlap or are even repeated from one goal statement to the next, or from one element of the comprehensive plan to another.

7.3.1.1 Incorporating Landscape Analysis into the Land Use Element

Logically, landscape data, or any environmental information, should be collected and analyzed prior to drafting the Land Use Element of the comprehensive plan. Examples of applying the landscape analysis process described in Chapter 5 are provided in Appendix 5-C. The analysis outlined in Chapter 5 identifies landscape processes as well as wetlands and their functions, which areas need special management because they

provide important processes such as groundwater recharge, and how wetlands function and contribute to the larger landscape processes. This type of analysis can also identify areas that, if restored or preserved, could improve functions.

The Land Use Element can identify:

- The location and type/intensity of development consistent with protecting critical resources;
- Areas critical to maintaining processes that support wetlands (e.g., infiltration and recharge areas, areas of critical subsurface and surface flow, discharge areas, areas of potentially high runoff);
- Areas that require restoration of landscape processes; and
- Areas that require protection (i.e., no development) in order to maintain critical landscape processes.

The results of the landscape analysis described in Chapter 5 and additional planning approaches, such as Green Infrastructure or Alternative Futures analysis discussed in Chapter 6, can be used to guide the choices of land use designations within a jurisdiction. Conducting a landscape analysis identifies critical locations within the management area where key landscape processes or wetland functions are provided. Integrating that information into a Green Infrastructure plan or an Alternatives Futures analysis allows the community to make informed land use decisions that incorporate both human needs and landscape processes. The resulting land use choices, priorities, and goals can then be included in the policies of the Land Use Element. Such an approach can help ensure long-term maintenance of landscape processes and reduce the deficiencies of case-by-case permitting decisions.

7.3.1.2 Using Landscape Analysis in Different Sections of the Land Use Element

The policies in the Land Use Element provide the foundation for developing subsequent elements of the comprehensive plan, other plans, regulations, and non-regulatory programs. The Land Use Element of a comprehensive plan may typically be divided into Overviews and Goals and Policies. The shaded box on the next two pages provides an example of the Table of Contents of a typical Land Use Element (the example is from the City of Bainbridge Island Land Use Element). The major sections of a Land Use Element are then discussed in detail following the shaded box. For specific portions of the Land Use Element, modifications are suggested regarding where to incorporate landscape analysis. Explanatory text and policies for the relevant portions, and in some cases, examples of text that could be used directly, are provided.

EXAMPLE TABLE OF CONTENTS FOR A LAND USE ELEMENT

INTRODUCTION

Framework of the Plan

NATURAL ENVIRONMENT EXISTING CONDITIONS – OVERVIEW

Note: This section describes the biological, physical, and geographic conditions of the jurisdiction. The same combination of data can be used in the landscape analysis (described in Chapter 5) to establish baseline conditions. The results of the landscape analysis would be woven through each of these sections, identifying the physical and biological linkages and areas that are critical for maintaining landscape processes and wetland functions.

Geography

Climate

Geologically Hazardous Areas

Watersheds

Wetlands

Streams

Groundwater

Aquifer Recharge Areas

Fish and Wildlife

BUILT ENVIRONMENT EXISTING CONDITIONS – OVERVIEW

Note: This section describes the human-made conditions and land uses currently present in the jurisdiction.

Residential Development

Commercial Development

RESOURCE LANDS EXISTING CONDITIONS – OVERVIEW

Note: This section describes the resources that humans use for economic purposes.

Agriculture

Forest Land

Mining

GOAL AND POLICIES/PRINCIPLES OF THE BUILT ENVIRONMENT

Note: This section outlines the overriding intent and values of the jurisdiction for the built environment. Each subsection below contains the policies or principles that create the framework on which subsequent Community Plans and/or regulations are developed.

Framework of the Plan

General Land Use

Neighborhood Service Centers

Light Manufacturing

Residential Open Space

Environment

EXAMPLE LAND USE ELEMENT (CONTINUED)

GOALS AND POLICIES/PRINCIPLES OF THE NATURAL ENVIRONMENT

Note: This section outlines the intent and values of the jurisdiction for the natural environment.

Fish and Wildlife Policies

Aquatic Resources

Frequently Flooded Areas

Geologically Hazardous Areas

Atmospheric Conditions

Greenways

GOALS AND POLICIES/PRINCIPLES OF NATURAL RESOURCE LANDS

Note: This section outlines the intent and values of the jurisdiction for managed natural resource lands.

Agricultural Lands

Forest Lands

Mining

The **Introduction to the Land Use Element** provides an overview of the Land Use Element and how information was obtained. If landscape analysis, or other environmental data, Green Infrastructure planning, or Alternative Futures analysis are incorporated, there should be a brief description of the methods used to generate the information.

The **Natural Environment Existing Conditions Overview** is where the results of a landscape analysis can be presented. It can also be where the criteria for establishing priorities for proposed land uses are described. The existing condition and the criteria for priorities set the stage for the future and would benefit from incorporating information about the location and condition of areas that perform landscape processes, including wetlands. This would also be the location to describe the findings of Green Infrastructure planning or Alternative Futures analysis (discussed in Chapter 6), particularly in reference to establishing priorities. In this section it would be reasonable to present the conclusions from any public process used to create criteria or priorities for land use designations, as well as recommendations for preservation or restoration.

The **Built Environment Existing Conditions Overview** provides a summary of the relevant conditions of the developed lands within the jurisdiction. The character and extent of housing and lands zoned for various levels of residential use are described and contrasted with expected demands. Depending upon the jurisdiction, the section may contain descriptions of commercial and industrial lands, infrastructure (domestic water and public sanitary sewer systems), and transportation in sufficient detail on which to base the planning process. The overview of infrastructure and capital facilities is usually brief to illustrate existing conditions; detailed discussions are contained in the appropriate elements of the comprehensive plan. This section may include a description and

discussion of existing housing stock and residential zoning designations. If the results of a Green Infrastructure planning or Alternative Futures analysis include recommendations or criteria for housing considerations, this is the location for those findings.

The **Resource Lands Existing Conditions Overview** focuses on lands used for commodities: agricultural lands, commercial timberlands, and mining and mineral extraction. Depending upon the jurisdiction, the overview may or may not describe lands zoned for commercial resource use. The results of Green Infrastructure planning or Alternative Futures analysis may identify some of these lands as critical hubs or links from the perspective of maintaining or restoring landscape processes. It is appropriate to discuss those findings in this section.

The next sections of the Land Use Element are the **policies for the Natural Environment, Built Environment, and Resource Lands**. Polices are statements that guide more detailed planning documents conducted at a management scale, such as community plans, basin plans, or neighborhood plans, as well as Green Infrastructure or Alternatives Futures plans. These policies also form the basis of the regulatory program of the jurisdiction. The policies have to reflect the priorities for the jurisdiction. The policies should reflect the findings of a landscape analysis (or any environmental analysis) and the priorities of the community.

7.3.1.3 Landscape Analysis in Policy Language of the Land Use Element

Policies can be modified to reflect the need for analyzing and protecting landscape processes that are necessary for the long-term protection of wetlands and the functions they provide. Specifically, a statement in the Introduction or opening section of the Land Use Element can provide the foundation for subsequent policies and regulations.

A policy statement can be created that directs the jurisdiction to use landscape analysis to identify lands that are critical to maintaining landscape processes, then to use this information in determining land use designations. Example policy statements include:

- A landscape analysis shall be conducted for each [subarea plan/planning area/subbasin] to identify lands that are critical for the maintenance or restoration of the landscape processes that maintain wetland functions.
- Green Infrastructure planning or an Alternative Futures analysis will be conducted within each [subarea plan/planning area/subbasin] to establish criteria and set priorities for land use designations and protection of the landscape processes that maintain wetland functions.

Below are two examples of typical policy statements that have been modified to include landscape analysis (new language is shown in *italics*):

- ~~Identified~~ Critical areas, *critical habitats,* shorelands, aquatic resource areas and natural resource lands *identified through a landscape analysis* shall be protected by restricting conversion *or rezoning to a buildable designation*; encroachment by incompatible uses shall be prevented by maintenance of adequate buffering between conflicting uses *and habitat function shall be maintained by establishing connective linkages between critical habitats identified in the landscape analysis*.

- Open space corridors within and between urban growth areas shall be identified *based on the landscape analysis of critical habitats and linkages*; these areas shall include lands useful for recreation, fish and wildlife habitat *including corridors for movement between habitats,* trails, and connection of critical areas *to essential habitats to avoid future fragmentation.*

Many existing policies in typical planning documents already include language that suggests identification and protection of environmentally sensitive lands. Examples of policy language that could be used to revise the Land Use Element of a comprehensive plan follow. These are only examples; there are many ways that the intent of these examples can be incorporated into a Land Use Element.

General Land Use

General Land Use goals and policies provide more detailed guiding principles for overall land use within a jurisdiction. The general goals for land use listed below have been revised (new text in italics) to show that little modification may be required to incorporate protection of landscape processes and wetland functions based on the results of landscape analysis.

- Support land use development patterns which protect public, health, safety and welfare, *and the long-term protection of the landscape processes that support the functions of critical areas, including wetlands;*

- Encourage dedication of open space *that is identified as critical for maintaining landscape processes or for providing habitat linkages based on a landscape analysis,* preserve *existing upland forest to the extent feasible,* and encourage the restoration of trees and vegetation to maintain the feel of the community;

- Guide future development into concentrated urban growth areas where adequate public facilities, utilities and services can be provided;

- *Use appropriate development techniques to minimize impervious surface and maximize infiltration of surface runoff;*

- Protect and conserve long-term, commercially viable forest, agricultural, and mineral natural resource lands;

- Retain rural landscape features and lifestyles;

- Maintain open space, recreation, fish and wildlife habitat, scenic and significant historic archeological cultural lands *by identifying, through a landscape analysis, the critical habitat areas and linkages across the landscape to ensure their protection*;

- Enhance the community character, natural beauty, and environmental quality *by ensuring protection of critical habitats and linkages through appropriate land use designations;*

- Help preserve rural economies;

- Foster opportunities for rural-based employment, self-employment, and economic diversification; and

- Permit the operation of rural commercial businesses, natural resource-related industries, recreation and tourism activities, cottage industries and small-scale businesses, and home occupations that are consistent with existing and planned land use patterns and are of an appropriate size and scale to maintain rural character.

Residential Open Space

The Residential Open Space section can be the location for a goal that creates flexibility in lot configurations or density through such mechanisms as transfer of development rights (TDR), discussed in Chapter 9. The following are examples from typical policies for Residential Open Space that have been modified (in italics) to incorporate landscape analysis:

- Protect open space, *assure the long-term protection of* critical areas *and the landscape processes that sustain them*, and *assure sustainable* agricultural uses through public and private initiatives, including open space tax incentives, cluster development, PUDs, transfer and purchase of development rights, public land acquisition, greenways, conservation easements, landowner compacts, down-zoning, limiting the amount of lot coverage, and other techniques.

- *Encourage preservation of key habitat linkages between critical areas, allow* the aggregation of nonconforming lots of record and undeveloped subdivisions and short plats, so as to achieve ~~consistent with goals of the Plan~~, a development pattern that provides affordable housing, preserves open space, protects *critical areas and landscape linkages*, and protects water resources.

- *Establish and maintain* vegetated buffers *around critical areas* to preserve the community's rural character *and maintain upland habitat adjacent to aquatic resources. To assure the presence of forest buffer over the long term, require the planting of native conifer seedlings within the margins of forested buffers left when adjacent upland forest is cleared for the creation of lots.*

- New development should be responsive to the natural landscape conditions and should *reflect the results of a landscape analysis* so as to have the least environmental impact on the community's landscape.

- *Forested steep slopes*, particularly ridge lines, shall be protected for their visual, aesthetic, *and habitat-linkage* benefits, *including* their functions as wildlife habitat, and *for control of* erosion and *sedimentation*.

- A Flexible Lot Design Subdivision process will be created to encourage more creative development *that has the flexibility to reflect site conditions including the results of a landscape analysis.* Flexible lot design *can* integrate use of open space and placement of buildings and infrastructure to reflect site conditions. It will include a cluster zoning requirement in the subdivision process and ensures that the approval process is timely and efficient. The following criteria shall be considered for Flexible Lot Design:

  – Suitable soils for individual, on-site septic systems *or the presence of a community treatment facility*.

  – *The findings from the landscape analysis to identify key habitats, and appropriate habitat linkages across the landscape. Flexible lot design shall incorporate a perimeter buffer to the development which also provides visual screening of the site from public roadways, and maintains public viewsheds.*

  – *Where feasible, grading should be minimized and trees should be maintained as much as possible throughout the project area.*

  – Land that is designated as permanent open spaces within Flexible Lot Design Subdivisions shall be used either for recreational, conservation, or *ongoing* agricultural uses. *Lands designated for conservation shall not be used for active recreation or initiating agricultural uses.* Recreation or agricultural lands shall *be* dedicated to the community, or to a private, non-profit organization.

  – Revise the planned unit development (PUD) section of the zoning ordinance to provide greater flexibility in design and provide density bonuses for imaginative design, preservation *of identified* environmentally sensitive areas *including aquifer recharge, floodplain, critical wetlands and habitat linkages identified through a landscape analysis*, and include a broad range of housing alternatives.

Environment

Within the Environment Element, a variety of goals and policies can be established to implement the intent of the guiding policies. For example, the following three goals are stated in the opening text of the Environment Element of the City of Olympia comprehensive plan:

- Long-term economic progress and environmental protection are mutually dependent,
- Future generations have a right to an environment which has greater environmental assets than today, and
- A healthy environment contributes to the economy no less than do roads and other public services.

Examples of typical Environment policies that have been modified to include recommendations from this volume are:

- Whenever there is *a proposed rezoning* or subdivision of land, the community *shall use the information from a landscape analysis to help assess and* consider the impact of the proposed project on critical areas.
- *Identification and prioritization of lands for protection or reduced zoning shall be based on the results of a landscape analysis or a Green Infrastructure plan or equivalent.*
- The number and design of lots shall be based on minimizing impact to critical areas and protecting natural systems. Development shall *incorporate the findings of the landscape analysis during development of the* objectives of the Critical Areas policies rather than maximizing the number of lots. In order to protect critical areas, the full density permitted under the zoning ordinance may not be achieved.
- Creative solutions (such as flexible lot design, TDRs, and *purchase of development rights* [PDRs]), which may allow the maximum number of lots while protecting critical areas, should be explored.

Fish and Wildlife Policies and Aquatic Resources

Policy language for fish and wildlife and aquatic resources may be the easiest to modify. Modifications to typical policy language may simply incorporate the requirement for conducting the landscape analysis, prioritizing lands for protection based on clearly identified criteria, and directing zoning to result in lower impact on high-priority habitats and critical areas. The following are examples of modifications of existing policy language:

- The protection, ~~and~~ enhancement, *or restoration* of wildlife habitat shall be an integral component of the land use planning process.
- The protection, ~~or~~ enhancement, *or restoration* of critical wildlife habitat *and linkages identified through landscape analysis* shall be ~~one of the criteria~~ *a primary criterion* used when evaluating the preservation of open space as part of development techniques, such as clustering, flexible lot design subdivisions, and creation of transfer of development rights (TDRs).

- Protect critical wildlife habitat and limit fragmentation of habitat that isolates wildlife populations (physically and genetically) by developing an interconnected system of corridors which link critical wildlife habitat *based on a landscape analysis*.

- Evaluate wildlife habitat and *linkages based on a landscape analysis, and* develop a classification system which will identify ~~priority~~ habitat to be preserved. The *analysis* shall consider watercourse areas, wetlands, shoreline, riparian areas, tidelands, public open space, forested areas, topography, *aquifer recharge areas, WDFW Priority Habitats and Species data,* and intensity of adjacent development.

- Structure regulatory processes and permitting decisions so that they reasonably balance natural values with the use of the land *by utilizing a landscape analysis to prioritize lands for protection.*

- Collect and analyze information relevant to the function of natural systems *by conducting a landscape analysis.*

- Develop a community-wide program to educate the public about alternatives to using and disposing of herbicides, pesticides, and other household chemicals to reduce impacts *to aquatic resources* and other environmentally sensitive areas.

- New development, using flexible lot design, should include any *aquatic resources, prioritized habitats and linkages, and regulated buffers* in separate tracts or easements to remain in common ownership.

Frequently Flooded Areas and Geologically Hazardous Areas

Through the landscape analysis, frequently flooded areas (FFAs) and geologically hazardous areas can be identified as lands requiring particular zoning limitations in order to protect public health and safety. Policy statements that are "standard" for these types of lands are appropriate to use.

However, frequently flooded areas (FFAs) and the processes that occur in these areas such as sediment transport, recruitment of large woody debris, nutrient cycling, and seasonal habitat linkages are protected under GMA. *Diehl V. Mason County* (95-2-0073) states, "An FFA designation must be clearly mapped and must include buffer sufficient to protect critical area functions and values." These areas can also function as wetlands and wildlife habitat and provide linkages between landscape processes. Therefore, policy language can be modified to protect the processes and functions of FFAs and geologically hazardous areas, and the wetlands that occur within them, based on landscape analysis.

Natural Resource Lands

Natural resource lands are designated for resource production and may include wetlands and other critical areas, as well as areas in which important landscape processes

occur. Development regulations should require buffers to protect the critical areas within these resource lands.

Typically these areas have already been designated; however, a landscape analysis may identify the linkage between these areas and landscape processes as well as the role that wetlands (and/or restored wetlands) play. For example, protection of shellfish areas is often related to water quality downstream of these resource lands. Wetlands and/or restored wetlands can provide important improvements in water quality. Shellfish growing areas are candidates for designated agricultural lands.

7.3.2 Capital Facilities Plan Element

A Capital Facilities Plan Element includes the analysis and planning for public water, sewer, transportation, and recreation facilities. A jurisdiction has the responsibility to provide water and sewer services, parks and recreation, public safety, transportation facilities such as adequate streets and roads, plus other basic public services and facilities. The Capital Facilities Plan Element includes a requirement to reassess the Land Use Element if funding falls short of meeting existing needs for public services and utilities.

The Capital Facilities Plan Element can address regional water drainage needs, planned parks and recreation facilities, and other capital expenses needed for critical areas protection. Funds to support open space tax assessments, transfers of development rights, conservation easements, and similar needs can be identified in the Capital Facilities Plan Element.

In addition, policies in the Capital Facilities Plan Element can provide guidance on the appropriate conditions and geologic settings in which to use low-impact development (LID) practices, referencing such policies in the Land Use Element. The Capital Facilities Plan would state the costs to implement the policies over time, along with alternatives that offer potential cost savings through measures such as LID. LID practices address the control of stormwater and surface water runoff, which is important in protecting wetland hydrology. Traditional and regional stormwater management facilities can also be assessed through the landscape analysis to identify how to minimize adverse impacts of runoff.

Policy language for the Capital Facilities Plan Element in a comprehensive plan can be readily modified to reflect these issues. For example (new language below is in italics):

- Designate utility corridors *using landscape analysis to ensure that placement of facilities does not result in permanent impacts to critical areas, their buffers, or habitat linkages.*

- Promote the placement of underground utility distribution lines *using information from a landscape analysis to minimize or eliminate permanent or temporary impacts to critical areas.*

7.3.3 Rural Lands Element

The Rural Lands Element in county comprehensive plans addresses lands that are not designated for urban growth or lands used for agriculture, forest practices, or mining. It implies land uses at lower densities with the intention of maintaining the locally defined rural character of unincorporated areas. Protection measures used to manage rural lands include clustering, density transfer, design guidelines, conservation easements, and innovative techniques designed to accommodate appropriate rural population densities and land uses.

One of the most significant impacts in rural zones is the increasing tendency to clear residential lots for pastures or viewsheds. The removal of forest cover, as discussed in Volume 1, has a significant effect on hydrologic patterns within the contributing landscape. Thus, guidance and policy language within the Rural Lands policies of a comprehensive plan can address site clearing and provide recommendations or requirements for retaining forest cover on lots of certain dimensions.

Typical examples of modified policies for Rural Lands are provided below (new text is in italics). Note that many of these examples of polices from existing comprehensive plans already incorporate many of the goals in Chapters 5 and 6 of this volume:

- Land use regulations and development standards shall protect and enhance the following components of the Rural Area:
  - The natural environment, particularly ~~as evidenced by the health of~~ wildlife and fisheries (especially salmon and trout), *shellfish resources, habitat areas including linkages between habitats as identified as a result of landscape analysis,* aquifers used for potable water, surface water bodies, *wetlands and* natural drainage systems and their riparian corridors;
  - Commercial and non-commercial farming, forestry, fisheries *including shellfish aquaculture*, mining, and *home-based and* cottage industries;
  - Historic resources, historical character, and continuity including archaeological and cultural sites important to tribes;
  - Community small-town atmosphere, safety, and locally-owned small businesses;
  - Economically and fiscally healthy rural cities and unincorporated towns and neighborhoods with clearly defined identities compatible with adjacent rural, agricultural, forestry, and mining uses;
  - Regionally significant parks, trails, and open space *including corridor linkages identified through landscape analysis*;
  - A variety of low-density housing choices compatible with adjacent farming, forestry, mining, *and open spaces,* and not needing urban facilities and services.

- The Rural Area designations include areas that are rural in character and meet one or more of the following criteria:
  - Opportunities exist for significant commercial or non-commercial farming and forestry (large-scale farms *or more intensive small-scale farms* and forest lands are *usually* designated as Natural Resource Lands);
  - The area will help buffer nearby Natural Resource Lands from conflicting urban uses;
  - The area is contiguous to other lands in the Rural Area, Natural Resource Lands, *aquifer recharge areas* or *lands identified as critical habitats, habitat linkages or aquatic resources based on a landscape analysis*;
  - There are major physical barriers to providing urban services at reasonable cost, or such areas will help foster more logical *outer* boundaries for urban public services and infrastructure;
  - Significant environmental constraints make the area generally unsuitable for intensive urban development.

7.3.4 Transportation Element

The Transportation Element is focused on implementing the Land Use Element and addressing intergovernmental coordination of regional transportation facilities and strategies. It is important that the environmental impacts of existing and planned transportation strategies and facilities be addressed in a comprehensive way.

By using the results of a landscape analysis, additions or revisions to existing transportation facilities can be planned to avoid or minimize additional impacts to critical areas and areas that support landscape processes. Addressing regional transportation issues within the context of landscape information can (1) identify areas that should be avoided, (2) limit habitat fragmentation, and/or (3) facilitate linkages along rights-of-way. In addition, an Alternative Futures analysis can identify the logical consequences of configuring transportation corridors in various ways. It is possible to anticipate long-range impacts and plan for the compensation for unavoidable effects in advance of the impacts.

One of the requirements for the Transportation Element is financial planning. The Transportation Element has to ensure that, when combined with the Capital Facilities Plan Element, the true costs of planned public works are known in advance of rezoning and commitments to build. This type of analysis can be conducted through an Alternative Futures assessment, where various costs (economic, community, as well as ecological costs) are determined and compared to help a community make informed choices.

7.3.5 Parks and Recreation Element

This element addresses active parks and recreation opportunities within the community and must be consistent with the Capital Facilities Plan. It may incorporate assessment of the need for organized sports fields, athletic fields, pools, beaches, skateboard parks, etc. It can incorporate passive recreation such as hiking or mountain biking as well, or those elements can be contained within a separate Recreation Element.

7.3.6 Economic Development Element

Many jurisdictions are including an Economic Development Element. Some communities are drawing the links between a healthy environment and attracting tourist recreation spending, or building on the "watchable wildlife" program of the Department of Fish and Wildlife.

7.4 Optional Elements of Comprehensive Plans: Conservation Element

As noted in the beginning of this chapter, a jurisdiction may choose to add optional elements to its comprehensive plan that go beyond the mandatory elements, in order to more fully reflect the values and goals of the community. The GMA is expansive regarding potential elements that can be included as optional.

One optional element that can address the protection of critical areas is a Conservation Element. It can provide an alternative for jurisdictions that are not able to approach all of their comprehensive planning from the foundation of a Green Infrastructure or Alternative Futures analysis (discussed in Chapter 6). This can be an element within a comprehensive plan or it can take the form of an independent Conservation Plan. Unlike an Open Space Plan that protects resources through acquisition, the Conservation Element or Plan establishes a method or mechanism to protect and/or restore resource lands through incentives (such as tax credits). Whenever possible, lands to be managed in this way should be identified through landscape analysis or a Green Infrastructure plan.

A Conservation Element is different from the open space approach traditionally used in local planning. The difference is that Open Space Plans typically focus on protecting lands that are valued for aesthetic, recreational, and habitat features primarily through the acquisition of properties by the local parks department. The open space approach can fall short by (1) not including a broader definition of important features worthy of preservation for their contributions to landscape processes, and (2) not including sites that could be restored or enhanced to return processes and improved functions to the landscape.

During the development of a Conservation Element or Plan, both potential acquisition and restoration sites can be identified. Appropriate sites, such as wetlands in key

locations with high performance of functions or support of landscape processes, can be located using information generated during landscape analysis. Specific sites can be assessed using function assessment tools such as the *Washington State Wetlands Rating System* and the *Washington State Wetlands Function Assessment Method.*

A Conservation Plan should be implemented through both regulatory and non-regulatory programs to preserve and restore landscape features identified within the plan. Together, Conservation Plans and a non-regulatory program are important additions to comprehensive planning and regulatory programs in providing protection for wetlands and other important landscape features. The tools a local jurisdiction needs to consider using for developing and implementing a non-regulatory program are discussed in Chapter 9.

Natural Setting Element Used in Yakima County

Yakima County has a Natural Setting Element that could be considered as part of a Conservation Element or Plan. The text below is taken from Yakima County's Natural Element. The text has been modified to incorporate the recommendations of this volume (edits are shown in italics and strikeout):

- The Natural Setting Element serves ~~two~~ *three* purposes. The first is to clarify the relationship between the natural environment and our built-out surroundings. The second is to secure a balanced or sustainable approach to future development. *The third is to ensure that balanced and sustained economic growth is planned to ensure the existence of long-term landscape processes that sustain the natural environment and help define our community.* To help complete these purposes, the following guiding principles and assumptions were used:
  - Our cultural landscape "where we work, live and play" is shaped by our natural surroundings. *Therefore our future landscape must include the space and configurations needed to sustain the natural surroundings.*
  - Our economic base of agriculture and forest products is dependent upon the County's natural setting and its resources.
  - In order to protect the long-term capacity of the environment to support growth, we need to understand the limits of natural systems *and we need to understand how our choices influence the processes that limit those natural systems*.
  - Responsible growth requires us to work with and within our natural setting. We must work with nature rather than against it. *Thus we must analyze, at a landscape scale, the processes that sustain the natural system and plan our future growth by working with nature.*
  - We must recognize our limits. Humankind's problems, especially in regards to the natural setting, cannot always be solved with better science or a technological fix.
    (Source: http://www.co.yakima.wa.us/planning/pdf/plan2015.pdf)

7.5 Subarea Plans

RCW 36.70A.080 allows for the development of a subarea plan as an optional element of a comprehensive plan. A subarea plan is essentially a more detailed land use plan for a specific area and must be consistent with the comprehensive plan.

A subarea plan provides local governments the opportunity to fully incorporate the results of a Smart Growth and landscape analysis (Green Infrastructure or Alternative Futures) into the comprehensive plan.

Some jurisdictions have adopted subarea plans that emphasize plan elements important to that specific area, whether for reasons of economic development or environmental protection. Planning at the subarea can include much more site-specific detail and increased opportunities for citizen participation. For example, Kitsap County's Chico Creek Alternative Futures planning (discussed in Chapter 6) resulted in a detailed subarea plan that addressed many of the issues covered in this chapter.

For jurisdictions that are not currently considering amending existing comprehensive plans to reflect the recommendations of this volume throughout their entire management areas, it may be more timely and equally effective to incorporate the recommendations within subarea or community plans. This is particularly true for areas within the jurisdiction with a known or assumed high density of critical areas.

The same process identified in this volume could be carried out at the subarea or community planning level. However, planning only for a subarea reduces the geographic area that could effectively be incorporated into the analysis. In order to plan effectively, it would be advisable to have at least a cursory understanding of the landscape and its processes beyond the subarea, as well as their interaction with the subarea.

7.6 Shoreline Planning

On December 17, 2003, Ecology adopted new Shoreline Management Program (SMP) guidelines that incorporate the "best available" scientific knowledge on the physical, chemical, and biological processes and functions that drive coastal ecosystems. These guidelines contain many of the same landscape principles that are outlined in this volume. Local governments are required to update their existing SMPs based on a legislatively adopted schedule, with four "early adopters" (Whatcom and Snohomish Counties and the Cities of Port Townsend and Bellingham) updating their SMPs by 2005.

The new guidelines implement the policy of the Shoreline Management Act (SMA) on protection of shoreline natural resources through the protection and restoration of ecological functions (and processes) necessary to sustain these natural resources. The guidelines specifically state that effective management of shorelines depends on sustaining the functions provided by: (1) ecosystem-wide processes (i.e., flow and movement of water, sediment, and organic materials and movement of fish and wildlife); and (2) individual components and localized processes such as those associated with

shoreline vegetation, soils, and water movement through the soil and across the land (RCW 173.26.201(2)(c)).

Further, the new guidelines require that SMP policies and regulations ensure "no net loss" of ecological functions necessary to sustain shoreline natural ecosystems. Updated SMPs must regulate new development in a manner that is protective of existing ecological functions and provide policies that "promote restoration of impaired ecological functions" (RCW 173.26.201(2)(c) and (f)).

Through the use of existing information and data, the process for preparing an updated SMP includes (RCW 173.26.201(3)):

- Comprehensive inventory of shoreline conditions;
- Characterization and analysis of functions and ecosystem-wide processes;
- Development of shoreline policies, regulations, and environment designations; and
- Development of goals, policies, and actions for the long-term restoration of impaired shoreline ecological functions.

Though new development is not intended to implement the "restoration planning" provisions, local governments must identify alternative means to implement these provisions since they are required to achieve overall improvements in shoreline ecological functions over time.

Relative to comprehensive planning guidance, the new shoreline guidelines contain detailed examples of (1) environment designations and their criteria and management policies; and (2) development standards for critical areas, including use regulations for wetlands, critical saltwater habitat, and frequently flooded areas.

The new SMA guidelines, therefore, will allow for the application of the landscape principles outlined in this volume. The examples of environment designations and development standards for critical areas can be readily used as models for developing similar standards for critical areas under both comprehensive plans and SMPs.

For more information on the updated SMP guidelines, see the web site at: http://www.ecy.wa.gov/programs/sea/SMA/index.html.

Chapter 8
Developing Regulatory Tools

8.1 Introduction

Regulating activities that have the potential to impact wetlands is the "backbone" of any local government's wetland protection program. Clearing trees and other vegetation, disturbing the soil, changing the movement of surface water and groundwater, and constructing industrial, commercial, or residential developments, together with their supporting infrastructure and their accompanying noise and light, can all significantly affect adjacent and nearby wetlands (see Volume 1, Chapters 2 through 4).

As described in Chapter 2, the Washington State Growth Management Act (GMA) specifically requires that local governments adopt development regulations that include the best available science to protect the functions and values of critical areas (RCW 36.70A.172). Development regulations are one of the primary means of implementing the goals and policies in a comprehensive plan.

The information presented in this chapter is intended to assist local governments in developing a regulatory program for protecting wetland functions and values. Critical area regulations fit into Step 2 in the four-step framework described in this volume (Figure 8-1). They are one part of the package of solutions recommended to protect existing wetland functions and values from future human impacts.

Historically, most local governments have relied upon regulation as the sole means of protecting wetlands. A regulatory permitting program can be very effective at limiting some of the adverse impacts associated with new development based on our understanding of the scientific literature in Volume 1. However, the synthesis of the science makes it clear that reliance upon a regulatory approach to case-by-case decision-making as the sole means of protecting wetlands will result in significant loss of wetland functions. Wetland regulations are most effective in preventing direct physical loss of wetland area and functions resulting from a change in land use, but regulations that focus on the site scale are not effective in addressing the cumulative impacts from larger scale changes in landscape processes.

Using the landscape analysis information described in previous chapters can help in developing regulations that protect not only the functions of individual wetlands, but protect some landscape processes as well. This is best done at a subbasin or subarea scale, where specific regulations can be developed to prevent degradation of water flow processes and to target protection of connected habitats.

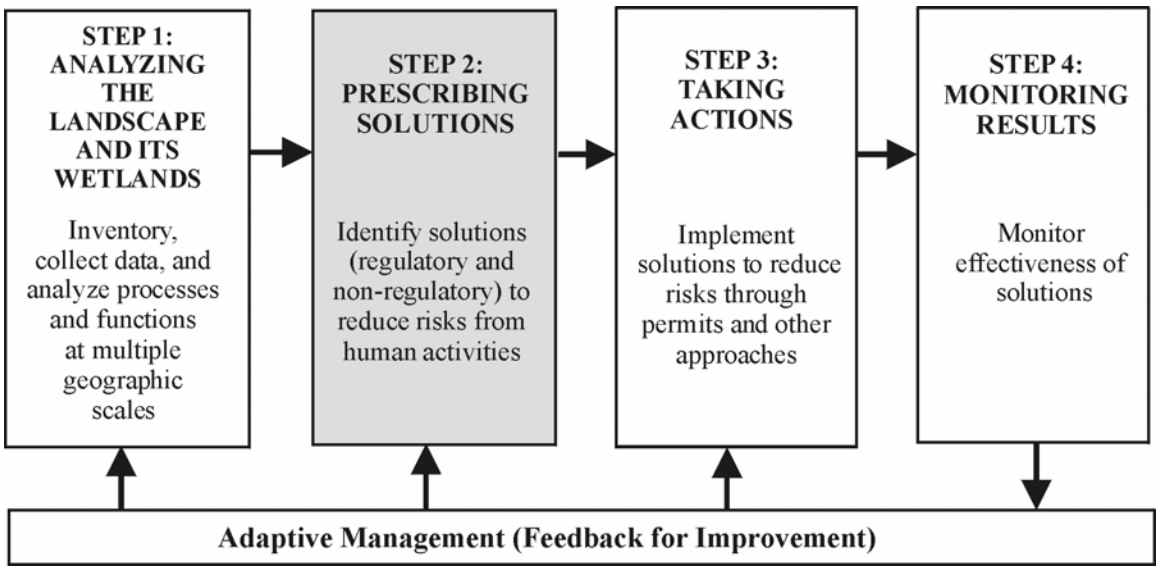


Figure 8-1. Developing regulations is part of Step 2 in the four-step framework discussed in this volume.

Section 8.2 of this chapter discusses several factors that should be considered when establishing the goals of regulations, such as balancing predictability with flexibility, the expertise of in-house staff to review wetland reports and permits, the assessment of risk, and the use of a separate critical areas permit vs. incorporating provisions for critical areas throughout a jurisdiction's code. Section 8.3 discusses the specific elements that need to be addressed in local critical area regulations, such as identifying wetlands, the applicability of regulations and permitting schemes, regulated activities and exemptions, wetland ratings, buffers, etc. The last section of this chapter (Section 8.4) briefly describes how to monitor regulatory programs.

The appendices listed in the shaded box below contain examples of implementing language (e.g., for regulations, buffers, wetland ratings, criteria for technical experts, etc.) and other information.

Important information is provided in appendices

Supporting information and additional detail for the topics discussed in this chapter are provided in a series of appendices (8-A through 8-G), listed below. *Chapter 8 and all of these appendices should be reviewed before a local jurisdiction decides to adopt any of the recommendations presented in Volume 2 into its critical area regulations.*

Appendix 8-A: Protecting Wetland Functions – An Overview of Considerations for Management synthesizes the information available on what is needed to protect or replace wetland functions. The discussion is organized by the three major groups of functions (water quality, hydrology, wildlife habitat) and by the different types of wetlands with special characteristics used in the *Washington State Wetlands Rating System* (bogs, Natural Heritage wetlands, etc.).

Appendix 8-B: Recommendations for Elements of a Wetland Regulatory Ordinance contains specific recommendations for ordinance language in a format similar to that used in many local critical area ordinances. This appendix revises the wetlands regulatory code language found in Appendix A of CTED's *Critical Areas Assistance Handbook* (November 2003).

Appendix 8-C: Guidance on Widths of Buffers and Ratios for Compensatory Mitigation to be Used with the Western Washington Wetland Rating System provides detailed guidance on buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetlands Rating System for Western Washington*.

Appendix 8-D: Guidance on Widths of Buffers and Ratios for Compensatory Mitigation to be Used with the Eastern Washington Wetland Rating System provides detailed guidance on buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetlands Rating System for Eastern Washington*.

Appendix 8-E: Rationale for Draft Guidance on Buffers and Other Protection for Wetlands explains the rationale for the recommendations about buffers presented in Appendices 8-C and 8-D. It discusses why buffers of certain widths are recommended for wetlands with different levels of functions or for special wetland types (bogs, etc).

Appendix 8-F: Rationale for the Draft Guidance on Ratios for Compensatory Mitigation to be Used with the Wetland Rating System explains the rationale for the recommendations about compensatory mitigation ratios presented in Appendices 8-C and 8-D. It describes how mitigation ratios are established based on risk of failure and temporal loss of functions, further refined to reflect the category and type of wetland.

Appendix 8-G: Hiring a Qualified Wetlands Specialist provides guidance on hiring a specialist to provide wetlands services such as delineations, functions assessments, permit preparation, etc. It discusses the basic qualifications that should be considered and suggestions for locating a specialist.

8.2 Establishing the Goals of Regulations

Establishing the goals of a regulatory program is the first step in determining what regulations make sense for a local jurisdiction. Some of the key questions a local government should ask include:

- Has a landscape analysis been conducted and have plans, policies, and zoning regulations been revised to reflect that information at the landscape scale?
- Are regulations the sole means of protecting wetlands, or are there non-regulatory approaches that will help in protecting wetland functions?

- How much is known about the types and extent of wetlands in the jurisdiction and how they function?
- How well do the current zoning and critical area inventory maps incorporate reliable information on where wetlands and other critical areas are located?

Generally, a regulatory program should aim to prevent any further loss or degradation of wetland area or functions, thereby helping to maintain landscape processes as well. Realistically, however, even a very stringent regulatory program will not completely prevent all impacts to wetlands because some impacts occur as a result of land use changes distant from wetlands. Thus, it is important to complement a regulatory permitting approach with both planning based on landscape analysis and non-regulatory elements (these are discussed in Chapters 6, 7, and 9 of this volume).

8.2.1 Balancing Predictability with Flexibility

Among the more common complaints about regulatory programs is that they are either too unpredictable or too inflexible. Generally, these two characteristics are at odds with one another. A very predictable (prescriptive) approach provides clear, consistent standards that applicants can rely on. However, such an approach may not allow for flexibility to address site-specific or unique situations from the perspective of the resource or from that of the landowner. On the other hand, a more flexible approach may fail to provide the degree of specificity that allows applicants to make decisions with some certainty of the outcome.

In developing or revising a wetland regulatory program, one must consider how to balance these two competing needs. A balanced approach may set “sideboards” with criteria for selecting within the range of allowable options, or a general standard with criteria for deviating from the standard. A more flexible approach implies more discretion on the part of local staff and managers and, thus, requires more staff time and a higher level of staff training and expertise in wetland ecology.

8.2.2 Staff Expertise and the Role of Third-Party Review

An important consideration in determining the appropriate regulatory approach is the capacity of local staff to exercise independent judgment in applying protection standards. As described above, a more flexible, less prescriptive approach requires more staff time and staff who are well versed in wetland ecology and management in order to make consistent and defensible decisions based on site- or situation-specific factors. Many local jurisdictions cannot afford to have this expertise on their staff and rely upon third-party review by a consultant who is retained by the local jurisdiction (usually at the applicant’s expense), or through technical assistance from state or federal agencies.

8.2.3 Risk Management for Wetland Resources

In the end, the primary decision regarding the appropriate type and stringency of a regulatory approach for protecting wetlands is one of risk management. The key question is: *How much risk of loss or degradation of wetland functions and values is reasonable given what is known about the types of wetlands and their functions, the types of land uses and their impacts, and the other, complementary components of protection, including planning based on landscape analysis and non-regulatory programs?* The scientific literature does not and cannot say what the appropriate level of risk should be; it can only assess the potential consequences of this type of policy decision. The final determination of the level of risk that is appropriate is made at the local level. Risk assessment is discussed in greater detail in Chapter 10 of this volume.

8.2.4 Types of Regulations Used to Manage Wetlands

Although critical areas ordinances are most often assumed to be the sole source of regulation for wetlands and other critical areas, other code provisions may be directly relevant to the management and protection of critical areas. Some jurisdictions adopt critical areas provisions that establish a distinct permit that is required for any proposed activity within that type of critical area or its buffer. Other jurisdictions place provisions for consideration of critical areas and their buffers throughout their code, wherever consideration of the effects on critical areas is appropriate. For example, language requiring assessment of wetland/buffer provisions may be adopted into clearing and grading regulations.

Section 8.3.2 discusses in more detail the distinctions in applicability (that is, where and when critical area regulatory provisions are applicable). Section 8.3 discusses the considerations for establishing a wetland permit based regulation. If a local jurisdiction decides to utilize critical areas provisions linked to other existing regulations and permits (such as clearing and grading regulations), the same considerations described below should be considered, as applicable.

8.3 Important Elements of a Regulatory Program

The current general approach to wetland regulation at the local level can be summarized as: *Avoid - Buffer - Compensate*. This means:

- **Avoid** direct impacts to a wetland or its buffer to the extent practicable by allowing impacts only when there is no reasonable alternative;
- **Buffer** wetlands from indirect impacts through the retention of adjacent vegetated upland; and

- **Compensate** for unavoidable impacts by requiring the replacement of wetland and/or buffer area and function through the restoration, creation, enhancement, and/or preservation of wetlands and/or their buffers.

This approach has been used in areas of the Puget Sound lowlands since 1984 and throughout Washington for the past 10 years. With appropriate protection standards and consistent implementation, such provisions can go a long way toward protecting wetland functions and values that are not strongly linked to landscape processes. However, the review of the science in Volume 1 indicates that site-specific regulations alone will not protect all wetland functions, particularly those that are linked to landscape processes.

Following is a discussion of the recommended key elements that should be addressed in any local government's wetland regulatory program. For examples of recommended code language for each of these elements, please refer to Appendix 8-B.

8.3.1 Designating, Identifying, and Mapping Wetlands

The GMA requires that local governments designate and protect critical areas including wetlands (RCW 36.70A.170 and 172). The first step in regulating wetlands is to define what is being regulated and specify how these areas will be identified. The GMA provides the definition of wetlands and specifies how to identify and delineate them.

In designating wetlands for regulatory purposes, counties and cities are required to use the definition of wetlands in RCW 36.70A.030(20):

> *"Wetland" or "wetlands" means areas that are inundated or saturated by surface water 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. Wetlands do not include those artificial wetlands intentionally created from non-wetland 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 non-wetland areas created to mitigate conversion of wetlands.*

Wetlands are subject to a local government's regulatory authority if they meet the criteria in this definition. The GMA does not allow flexibility in adopting a modified definition of wetlands.

State legislation (RCW 36.70A.175) also requires local governments to use the *Washington State Wetlands Identification and Delineation Manual* (WAC 173-22-080) in implementing the GMA. The manual is used to identify the actual boundary of a wetland. The manual is based on the 1987 Corps of Engineers wetlands delineation

manual and incorporates changes made by the Corps since 1987. Since the Washington State manual and the Corps manual rely upon the same criteria and indicators for hydrology, soils, and vegetation, proper use of either manual should result in the same wetland boundary.

It is helpful to landowners and to regulatory staff to provide reliable information about the location and extent of wetlands in a local jurisdiction. This provides greater predictability for landowners and helps ensure that wetlands are accurately identified for regulatory purposes. However, many local governments do not have reliable maps of wetlands within their jurisdiction. Accurate inventories that have been checked on the ground can be time consuming and expensive to conduct. Although we recommend that local governments conduct field inventories, existing information can be used to produce a useable, if less accurate, map of wetland locations.

The National Wetlands Inventory (NWI) can be combined with local soil surveys to produce a map that shows the approximate location and extent of wetlands and their distribution in the jurisdiction. The NWI was completed by the U.S. Fish and Wildlife Service and the soil surveys by the Natural Resources Conservation Service (formerly called the Soil Conservation Service). For many areas of the state, the NWI and hydric soil maps are available in digital format.

When superimposed, the NWI and soil survey maps can serve as a useful starting point for mapping the general location of likely wetlands in a planning area. However local field-based maps are superior because of the potential inaccuracy of the NWI and soil surveys, which are based on interpretation of aerial photographs (some 15 to 20 years old). This makes the existence of some wetlands as well as the extent of others hard to identify. Typically, the hydric soils maps have more field verification than the NWI maps, although aerial photography is the main source of information for mapping. In addition, this overlay map cannot replace the need for site- or parcel-scale delineations when activities are proposed that might affect wetlands.

To ensure the protection of wetlands, the code should contain language that clearly gives the authority to regulate wetlands as they are defined, not as they are mapped. In other words, areas that meet the criteria to be defined as wetlands are regulated even if they are not mapped in an inventory. Further information on methods that local governments can use to analyze wetland resources is provided in Chapter 5 of this volume.

8.3.2 Applicability of Regulations

The applicability section of a code states what types of activities the code is intended to regulate. There are two general ways in which protection measures for wetlands and other critical areas can be triggered through code provisions: (1) wetland provisions are integrated throughout various applicable elements of the development code, or (2) a specific critical area (or wetland) permit is established which is required for activities that may influence critical areas. These two approaches are discussed below, along with code language that can be used to address applicability and the pros and cons of each approach.

Critical Areas Provisions Triggered by Development Permits

Provisions to protect wetlands or other critical areas can be initiated when any development permit (e.g., a grading, rezone, building, subdivision, short-plat permit, etc.) is required by the local jurisdiction. Whenever an applicant submits an application for a development permit, the code can be written to automatically allow the wetland provisions of the code to be applied to that permit. Thus, the code is written such that each development permit application allows staff to review and condition the application with the regulatory protection standards for wetlands from the code.

Applicability language: The applicability section of the code should state that the critical areas provisions of the jurisdiction apply to "any permitted activity if a wetland or its buffer is present on the subject property, or the proposed actions could result in adverse impacts to offsite wetlands and/or their buffers." The language can specify that "all development permits" are included, or the code can specify which development permits trigger the critical area provisions. Such language makes it clear that any action within the jurisdiction that requires a permit (e.g., grading, rezoning, building permit, subdivision, etc.) will be subject to the protection measures in the critical areas code.

For example, some jurisdictions apply critical area provisions to all newly formed lots created *after* implementation of the revised critical area provisions (i.e., the applicability language cites the date of the adoption of the new provisions). The jurisdiction requires all short-plats and subdivisions to utilize the new wetland protection standards AND they may exempt single-family building permits from wetland review for such new lots. This means that the new lots have the required critical area setbacks and buffers embedded into them, so the review of single-family building permits is not necessary to assure that they meet the provisions of the code. It also means that lots that were created *prior* to implementation of the current critical area standards (i.e., "grandfathered in") *may* not be subject to the new provisions (e.g., wetland rating, buffers and setbacks, etc.) if it would deny all reasonable use of the parcel. This is one means to address reasonable use provisions when new standards could possibly influence the reasonable use of an existing lot that was created under less restrictive standards. Although this may seem like a lessening of regulatory standards, it is a pragmatic approach to deal with the issue of reasonable use. This language also makes it implicit that any proposal to create new lots (e.g., a short-plat or long subdivision) requires implementation of the new standards.

Applicability language for development permits can also be modified to reduce the triggering threshold to zero for actions that pose a risk to wetlands and/or their buffers. For example, clearing of vegetation that falls below a minimum threshold square footage established for a clearing and grading permit does not trigger the requirement for the clearing and grading permit provisions. However, the applicability section of the clearing and grading code language can readily be amended to note that, "There is a zero threshold for any activity which may pose an adverse impact to wetlands and/or their regulated buffers; such activities will trigger the requirements of a clearing and grading permit." By this means, existing code language can simply be modified to extend the provisions for wetland review and conditioning to actions that would otherwise not trigger the underlying permit requirements.

Pros and cons: A benefit of this approach is that no new permitting mechanism needs to be established; review and conditioning for critical areas is linked directly to existing permit processes that applicants are already familiar with. Many jurisdictions are already employing this method in their codes, and thus major code revisions and changes in processes used to review permits would not be required. Some development permits (e.g., subdivisions and some rezones) trigger SEPA determinations that may provide a mechanism for greater analysis and public input in the decision-making process than a wetland-only permit process.

Initiating critical area provisions through development permits requires coordination between wetlands staff and the staff who condition and issue development permits (if they are different people). Such coordination is needed to ensure consistency in the provisions of approval for permits. The option of not having a separate wetland permit may require additional review fees for fee-supported staff (as would a distinct wetland-only permit), and may or may not require additional review time compared to a distinct wetland-only permit.

For an application to be subject to wetland review and conditioning, some type of development permit (clearing, grading, filling, etc.) must be triggered. If no development permit is required for an action, no wetland review process can be legally initiated, unless the applicability language is modified as noted above.

Separate Critical Area Permit

A separate critical areas permit process means that an applicant would be required to obtain a separate and distinct wetland (or critical area) permit whenever a wetland or its buffer is located on the site of a proposed action. This is a distinct permit that would be required *in addition* to any other development permit for a parcel. The applicability of this permit is linked to the presence of the critical area or its buffer on a site. The standards for when a permit would be required should be the same as the provisions for the development-related permits, including zero thresholds for actions such as grading, clearing of vegetation, or other physical alterations.

Applicability language: Code language is drafted for a wetland permit that identifies the activities that trigger the need to obtain the wetland permit. The language would have to specify actions, development permits, and/or thresholds of actions that would trigger the provisions of critical area review and obtaining a permit. Unlike the previous option, this applicability section would have to include *all* actions or thresholds that would trigger the wetland permit. (In the previous option, the applicability language of each existing development permit/action is modified to include wetland provisions.) A discussion and description of suggested regulated and exempted activities follows in the next section.

Pros and cons: Using a distinct wetland or critical areas permit involves many of the same issues described above for the first option. The advantage of a wetland-specific permit is that it allows staff to clarify conditions of approval, and perhaps, if the mechanism is established, to provide clarity to wetland permit monitoring and enforcement provisions. If the jurisdiction sets up a subsequent monitoring program, which is staffed to ensure that approved wetland permits are tracked and the conditions

implemented, then perhaps a wetland-specific permit would facilitate such tracking and response.

A wetland-specific permit requires wetland staff to coordinate all conditions from all development permits for a particular project to ensure consistency for wetland protection. A wetland-specific permit could possibly result in higher permit and review fees. It should be assumed that a jurisdiction would either hire technical staff to implement a distinct permit program, or require an applicant to pay for third-party review/conditioning of a wetland permit. Whether such fees would be higher than staffing for the other option may depend upon the fee structure of the jurisdiction.

There is a risk that the timing of multiple permit approvals may protract an applicant's timeline. Although state law requires a 120-day "clock" for permit review, in a worst-case scenario other development permits could be approved and issued prior to the wetland permit approval if wetland staff is backlogged or delayed.

8.3.3 Excepted Activities, Allowed Activities, and Exemptions

Critical areas ordinances are adopted to protect wetlands and their functions from the many types of activities that can adversely impact wetlands as described in Volume 1. Specifically, the GMA directs local governments to regulate all activities with a potential to affect the functions of a critical area and its buffer. At a minimum, it is important to regulate all activities that would directly impact a wetland and its buffer such as filling, draining, excavation, clearing, flooding, and tilling. Other activities that should be included are herbicide application, stormwater discharges, and water diversions and withdrawals.

However, some activities pose little threat to wetlands and can be exempt from regulatory review or can trigger a lower level of review. Exempt activities should be limited to those that will not have a significant impact on a wetland's structure and function (including its water, soil, or vegetation) and those which are expected to be very short term. Local governments should also consider the cumulative impacts from exempted activities.

A local government needs to demonstrate that there is scientific support for a given exemption. Likewise, a local government should not assume that an exemption is appropriate in the absence of science to refute the exemption. The scope, coverage, and applicability of a critical areas ordinance should capture the full range of activities that are detrimental to wetland functions. Therefore, exemptions should be supported by the scientific literature and be carefully crafted to minimize the potential for adverse impacts. The language should clearly state whether a given exemption is from applicable standards in the code or whether it is exempt from needing a permit but still must comply with the code.

Activities Excluded from Regulation

The types of activities that are excluded from wetland regulation are grouped in three categories in the example code provided in the *Critical Areas Assistance Handbook*, Appendix A (CTED 2003). They are **exempted activities, allowed activities, and exceptions.** These three categories allow varying degrees of activities or uses either without review, or in a way that avoids the regulations associated with critical areas, as explained in the following paragraphs.

The first category, **exempted activities**, are those activities that are excluded from critical areas regulations on the premise that they would have little or no effect, or that the activity is an emergency and delay of the action could result in threats to public health or safety. In addition to emergencies, these activities can include passive outdoor activities, forest practices regulated by the state, as well as specific operation, maintenance, or repair activities.

The second category, **allowed activities**, are those activities that, due to other regulations or previous reviews, are unlikely to result in critical areas impacts. Since these activities are not exempt, the wetland standards continue to apply and the underlying permit could be conditioned to ensure that the activity complies with critical areas protection.

The third category, **exceptions**, are granted in limited circumstances where a reasonable use permit is issued to only allow the minimum "reasonable" use of the property and avoid a constitutional taking. Refer to Section X.10.150 of CTED's example code provisions for additional guidance on reasonable use exceptions.

The sections below discusses the following types of wetlands and the types of activities that are often considered for exemptions in local critical area regulations. For each, we discuss the relevant scientific findings and provide recommendations for how they should be treated.

- Wetland size exemptions;
- Size of minimum wetland impact;
- Isolated wetlands;
- Prior converted wetlands;
- Irrigation-induced wetlands;
- Clearing, grading, and placement of fill;
- Ongoing agriculture;
- Conversion of wetlands to new agriculture;
- Conversion of agricultural lands to other uses;
- Noxious weed removal;

- Forest practices and conversions;
- Hazard tree removal;
- Non-compensatory restoration and enhancement; and
- Stormwater management and wetlands.

8.3.3.1 Wetland Size Exemptions

While recognizing that local governments have to make difficult choices about where to expend their efforts, we do not believe it is appropriate to recommend a threshold for exempting small wetlands because the scientific literature does not provide support for such a general exemption. Volume 1 (Chapter 5) documents the relationship between the lower levels of protection afforded to small wetlands and the resulting fragmentation and increase in distance between wetlands on the landscape as well as the important functions provided by small wetlands. The loss of small wetlands is one of the most common cumulative impacts on wetlands and wildlife in Washington.

If a local government, however, wants to consider exempting some wetlands under a certain size, this should be done in a context of the potential cumulative implications to justify the exemption (e.g., how many acres of wetlands would be affected, what functions would be most affected, how such impacts would be compensated, etc.). Consideration and documentation of the potential implications is critical to protecting wetland functions as well as landscape processes. The decision, therefore, is best made after reviewing the information generated from a landscape analysis (as outlined in Chapter 5 of this volume) for the geographic area that would be affected by the exemption.

Limiting the exemption to certain areas (such as Urban Growth Areas or specific subbasins) and to certain wetland types (e.g., Category IV wetlands, those with non-native species, non-riparian wetlands) will help minimize the risk of losing important functions. Additionally, it may be important to limit the total acreage of wetlands exempted on a project basis or within a subbasin.

A more appropriate way to deal with small wetlands would be to exempt projects from the need to avoid small wetlands. This type of exemption should still require that the loss of wetlands be compensated either directly or through an in-lieu fee program.

8.3.3.2 Size of Minimum Wetland Impact

As with exempting a certain wetland size, there is no scientific basis for exempting wetland impacts under any particular size without an analysis of the cumulative effects of the exemption. A study of the management area is needed in order to measure the net result of the exemption as applied over time. If a local government chooses to move forward with an exemption for small area impacts, a restoration program and/or in-lieu fees program should be created to offset the net impacts.

8.3.3.3 Isolated Wetlands

There is absolutely no scientific justification for exempting isolated wetlands from regulation (Volume 1, Chapter 5). Isolated wetlands are generally defined as those wetlands that are hydrologically isolated from other aquatic features. Hydrologic isolation is not a determinant factor in the function of wetlands. Isolated wetlands in Washington perform many of the same important functions as other wetlands, including recharging streams and aquifers, storing flood waters, filtering pollutants from water, and providing habitat for a host of plants and animals. Many wildlife species, including amphibians and waterfowl, are particularly dependent on isolated wetlands for breeding and foraging.

The current lack of federal regulation of many isolated wetlands is the result of very different statutory language in the federal Clean Water Act that ties federal regulation to navigable waters and interstate commerce. No such restriction exists under the GMA or any other state laws.

8.3.3.4 Prior Converted Wetlands

There is no scientific basis for exempting prior converted wetlands—also known as prior converted croplands (PCCs)—from wetland regulation under the GMA. PCCs function the same as other similarly degraded wetlands. The scientific information on prior converted wetlands is discussed below, following a description of these wetlands, and also in Volume 1, Chapter 5.

Prior converted wetlands are defined in federal law. They are wetlands that were drained, dredged, filled, leveled, or otherwise manipulated, including the removal of woody vegetation, before December 23, 1985, to enable production of an agricultural commodity, and that:

1. Have had an agricultural commodity planted or produced at least once prior to December 23, 1985;

1. Do not have standing water (ponding) for more than 14 consecutive days during the growing season; and

2. Have not since been abandoned.

However, many of the wetlands meeting these criteria are still biological wetlands (i.e., they still meet the three criteria for hydrology, soils, and vegetation) and provide important functions.

Local governments cannot rely on the federal exemption for PCCs to satisfy the best available science requirement in the GMA. Although activities in prior converted wetlands are not regulated under Swampbuster provisions of the federal Farm Bill or Section 404 of the federal Clean Water Act, the GMA requires local governments to regulate wetlands that meet the definition of biological wetlands. The GMA definition of wetlands includes PCCs that meet the three criteria in the *Washington State Wetland*

Identification and Delineation Manual. It therefore does not distinguish prior converted wetlands from other wetlands.

The original assumption behind exempting PCCs from federal regulation was the belief that these wetlands had been so altered they were no longer wetlands or no longer provided important wetland functions. However, PCCs in Washington perform similar functions as other wetlands, including recharging streams and aquifers, storing flood waters, filtering pollutants from water, and providing wildlife habitat. In some cases, PCCs have been significantly altered so they provide only minimal functions. However, in many cases, PCCs provide important hydrologic functions and may provide significant wildlife habitat or important linkages between habitats. For example, in western Washington, many PCCs used for agricultural production are ponded during the winter, when overwintering waterfowl are highly dependent upon flooded agricultural fields for resting and feeding areas. Overwintering bald eagles and other raptors, in turn, depend on the waterfowl attracted to these flooded areas. Even highly altered PCCs continue to provide important functions.

Local governments that rely on the Corps of Engineers to verify wetland delineations need to ensure that wetland delineations are conducted and verified using the state wetland delineation manual to determine if they are wetlands regulated under the GMA. Once these wetlands are delineated properly, a function assessment can be conducted to evaluate the functions being provided by the wetlands. We recommend that PCCs be regulated similarly to other wetlands (i.e., commensurate with the functions they provide). Most PCCs will be Category III or IV wetlands under the state wetland rating systems.

8.3.3.5 Irrigation-Induced Wetlands

Some confusion exists as to whether wetlands that have expanded or have been formed due to the influence of irrigation are considered “jurisdictional”—that is, regulated under federal, state, or local laws. Many of the native habitat types with deep soils in eastern Washington have been converted to agriculture. A large portion of this land, particularly in the Columbia Basin, is under irrigation. Additionally, some agricultural areas in western Washington are also irrigated. In many irrigated areas, the groundwater table is higher than it was prior to implementation of irrigation. Many wetlands have expanded or formed adjacent to irrigation conveyance systems and in low-lying areas where irrigation occurs and downslope of irrigated lands.

The definition of wetlands comes into play when trying to clear some of the confusion. The same definition of wetlands is used in the three state laws that regulate wetlands: the Growth Management Act (RCW 36.0A.030(20)); the Shoreline Management Act (RCW 90.58.030 2(h)); and the Water Pollution Control Act (WAC 173-201A.020). This definition reads:

> *Wetlands means areas that are inundated or saturated by surface water 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. 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 created to mitigate conversion of wetlands,*

Basically, this definition means:

1. A wetland must have indicators of three features: water (wetland hydrology), plants (hydrophytic vegetation), and soils (hydric soils). It must have enough water to support water-dependent plants, so the water must be present during the growing season. The presence of water creates low-oxygen conditions that support those specialized plants and also creates unique soil characteristics.

2. The demarcation between "natural" (jurisdictional) and "artificial" (non-jurisdictional) wetlands is also made under the definition. The definition requires that, for a wetland to be non-jurisdictional ("artificial") it must meet both of the following characteristics:

   a. Be intentionally created; and

   b. Be located in a non-wetland (upland) site.

The term "intentionally created" and the examples given in the definition require that the artificial wetland not be the result of an accident or an unexpected byproduct of some other intentional act. Therefore, the types of situations where artificial, non-jurisdictional wetlands are found are where someone intentionally creates a water feature such as a ditch or pond. The only situation where an artificial, non-jurisdictional wetland results from an unintentional action is when construction of a road (after July 1, 1990) inadvertently creates a new wetland.

The term "non-wetland" means an area where wetland characteristics are lacking—that is, an upland area. Thus, if someone intentionally creates a new water feature, such as a ditch or pond, in an area that was already wetland, the new water feature is still under jurisdiction as a wetland.

The following examples may help illustrate real world situations.

1. A ranch pond was built on a dry hillside to supply water to livestock, and wetland conditions have formed over time. Clearly the pond meets both criteria for being an artificial, non-jurisdictional wetland: It is an intentionally created water feature in an upland site.

2. Wetland vegetation is found along the edge of an irrigation canal. The canal is an intentionally created water feature. If the canal was dug through uplands, then the wetland within the canal is non-jurisdictional per GMA (though it may be subject to federal regulation). If the canal was dug through an existing wetland, then the wetlands within the canal are jurisdictional.

3. A wetland is found downgradient of a leaking irrigation canal or pipe. The wetland is jurisdictional because it is an unintentional result of digging the canal. However, the canal (or a leaking irrigation pipe) can be repaired or lined to improve water conservation. If the wetland disappears as a result of the improvement, the loss of the wetland is not regulated. If wetland conditions persist, then the wetland cannot be further altered without a permit.

4. A wetland is found within a field that is irrigated. The wetland is jurisdictional because it was not intentionally created. Although filling the wetland would be regulated, changes in irrigation practices (such as changing from flood to drip irrigation) that would dry up the wetland would not be regulated.

5. A wetland is found in a field that is not irrigated, but irrigation water from a field higher up has raised the groundwater table. The wetland is jurisdictional because it was not intentionally created as part of a water feature.

6. Wetland indicators (water, plants, and soils) are found within a stormwater pond. The wetland is not jurisdictional if the stormwater pond was created in an upland. However, if the stormwater pond was created within a wetland, then it is jurisdictional.

8.3.3.6 Clearing, Grading, and Placement of Fill

The scientific literature does not support blanket exemptions for clearing, grading, and placement of fill in wetlands or their buffers without first understanding the direct and cumulative effects of such an exemption. Critical area regulations should be crafted to address these activities because of their significant and direct impacts to wetlands and their functions.

If a local jurisdiction believes it is important to exempt small amounts or areas of filling or grading in wetlands or their buffers, they should provide some analysis to document the potential cumulative impacts of such an exemption and provide some means of offsetting the expected cumulative impacts. This could include in-lieu fee and/or non-regulatory restoration programs to restore wetlands or increase wetland functions,

provided that non-regulatory programs are evaluated to ensure that the "no net loss" goal is met.

To address cumulative effects of multiple small fills or clearings in the same wetland, the threshold for clearing, grading, or filling a critical area or its buffer should be reduced to zero.

8.3.3.7 Ongoing Agriculture

One of the goals of the GMA is to protect critical areas. Equally important is that the GMA seeks to maintain and enhance natural resource-based industries, encourage the conservation of productive agricultural lands, and discourage incompatible uses. Designated agricultural lands are one of the three types of natural resource lands defined in GMA for which local governments need to plan.

Volume 1 synthesized the effects of agricultural activities on wetlands. The purpose of this volume is not to further evaluate or frame the issue of agricultural impacts. It is important, however, to recognize that different types of agricultural practices result in different types of potential impacts. Local governments should consider the types of agriculture being practiced in their watersheds and craft their critical area protection programs to address impacts from agriculture accordingly.

However, given that existing, ongoing agricultural activities take place in already drained and/or actively manipulated wetlands, impacts from bona fide ongoing agricultural activities are most effectively managed through best management practices. **Ecology and Fish and Wildlife recommend the use of best management practices (BMPs) and/or conservation plans for farming activities.**

There are two basic approaches that local governments should consider:

1. **Voluntary with monitoring.** Encourage the use of BMPs, farm conservation plans, and incentive-based programs to improve agricultural practices in and near wetlands. Rely on Conservation Districts or county staff with agricultural expertise to provide technical assistance to willing landowners. Set up and implement a monitoring program to determine if the voluntary approach is effective. If problems are detected, require the use of specific BMPs and the approval of farm conservation plans in order to correct identified problems.

   OR

2. **Required BMPs and/or farm conservation plans.** These could be approved by an agency or organization with expertise in agricultural practices (such as a Conservation District), with appropriate local government oversight and monitoring. This type of approach is outlined in the 2003 CTED *Critical Areas Assistance Handbook* where it describes how Whatcom County has approached this issue:

> *Some agricultural uses are regulated by state or local government, usually because of a particular environmental concern related to ground or surface water or air quality. For example, Whatcom County regulates pre-existing agricultural activities that impact wetlands, fish and wildlife habitat conservation areas, and aquifer recharge areas or their buffers in conformance with an adopted conservation program. The conservation program is developed to be consistent with the Whatcom Conservation District's best management practice manual and requires the containment of livestock waste. The plan is then filed with both the conservation district and the county, to ensure that the agricultural practices are being implemented. Periodic monitoring of farm activities ensures that the management objectives are being met.*

The CTED handbook acknowledges that while regulations provide certainty, they can be difficult and costly for agricultural activities, particularly without the understanding and cooperation of the landowners.

8.3.3.8 Conversion of Wetlands to New Agriculture

Conversion of wetlands that are not currently in agricultural use to a new agricultural use should be regulated by the same regulations as any new development. The scientific literature does not support the conversion of wetlands to new agricultural uses without review and conditioning through a critical areas ordinance.

8.3.3.9 Conversion of Agricultural Lands to Other Uses

A change in use from agriculture to non-agricultural uses should trigger review under the critical areas ordinance. Exemptions and special considerations for wetlands (such as targeted implementation of best management practices) crafted for agricultural activities should not be "grandfathered" when the land use changes from agriculture to another form of development. A change in use from one type of agricultural activity to another type of agricultural activity should be addressed through best management practices and farm plans.

Of particular concern is that a change in land use may be preceded by an activity that may be exempted by a local government because alterations may occur to the wetland before adequate review takes place. A common example is the exemption in many critical areas ordinances for the maintenance of existing drain tiles and ditches on drained agricultural lands. Ditches and drain tiles require maintenance from time to time in order to keep the water table low enough during the growing season for agricultural production. As long as the lands are being maintained for ongoing agricultural use, the maintenance exemption makes sense, provided that the original depth and dimension of ditches and tiles is maintained.

The conflict arises when the land is evaluated for a change in use. Often the ditch and tile system is enlarged or upgraded to effectively drain the farmed wetlands so they no longer meet the definition of a wetland. Such a change in management is the point where

the local government has an interest in reviewing the change in use. Many agricultural areas often provide important habitat and other hydrologic functions (previously discussed in the section on "prior converted wetlands"). Therefore, a critical areas ordinance should specify what constitutes "maintenance," what does not, and what documentation is necessary to prevent wetland draining activities conducted under the guise of maintaining ongoing agriculture.

8.3.3.10 Noxious Weed Removal

Many current critical areas ordinances do not require a permit for the control and removal of noxious weeds in wetlands and buffers (as well as other critical areas), provided that the control is done by hand or with light equipment and does not involve the use of hazardous substances. Local governments should retain some oversight authority when more extensive control methods are proposed to make sure that wetland functions are adequately protected.

8.3.3.11 Forest Practices and Conversions

Forest practices on commercial woodlots and forest lands are regulated by state law. The Forest Practices Act (RCW 76.09 and WAC 222) contains less stringent wetland protection standards (for commercial forestry) than are required under the GMA for non-forest lands. The Forest Practices Act does not protect forested wetlands from harvest and has weaker avoidance, buffer, and mitigation standards than most local regulations. It provides buffer protection standards for certain non-forested wetlands and bogs. The assumption in the Forest Practices Act is that forested wetlands recover many of the affected functions during the time that they regenerate for another timber harvest cycle.

However, the GMA requires that local governments protect the functions provided by forested wetlands. It is appropriate for critical areas ordinances to recognize the regulatory gap between the GMA and the Forest Practices Act and provide a framework to ensure compliance with the stricter standard when forest lands are converted in the urbanizing interface. The jurisdiction should regulate the conversion of lands when they will no longer be considered under the rules of forest practices. The ordinance should provide guidance on how this issue will be managed in jurisdictions that interface with forest practices. It is important to note that the provisions should apply only to lands converted out of forest practices and are not intended to make the Forest Practices Act consistent with the stricter requirements in the GMA for forested wetlands.

8.3.3.12 Hazard Tree Removal

Provisions for the trimming or removal of hazard trees in buffers are legitimately addressed through an exemption to a critical areas ordinance. Public safety considerations are an important element in balancing exemptions with the goal of protecting critical areas. The needs for limits on the exemption are obvious: The exemption should be limited to situations where the "offending" tree is clearly a hazard, and removing the tree would not adversely affect the functions of a wetland or its buffer.

One option is for the local government to involve consultation with a qualified arborist who has an understanding of the functions of wetlands and buffers to evaluate a request to remove a hazardous tree.

The qualified arborist should establish that the hazard tree presents an imminent hazard and is threatening a structure. Some local governments use the definition in the Forest Practice Rules (WAC 222-21-010(4)) which define a "danger tree" as "any qualifying timber reasonably perceived to pose an imminent danger to life or improved property." This applies to any tree within 1.5 tree-lengths of the structure. The Washington State Department of Natural Resources (DNR) is not, however, charged with administering the requirements in the GMA. A local government should not therefore defer the determination of what constitutes a hazard tree, or the review of hazard tree cutting proposals, to DNR or DNR standards.

The exemption process should not allow for the creation of "view corridors" and the removal of healthy trees in a buffer under the pretext of hazard tree control. When trees are removed, a restoration plan should be required. In some instances, pruning (not topping) of trees to maintain (not create) a limited view corridor may be considered by a jurisdiction as appropriate. A management plan for a view corridor, prepared by a certified arborist, should be required by the jurisdiction. The plan should also be reviewed by qualified staff or an on-call arborist, paid for by the applicant. This approach is recommended to reduce the cases of illegal clearing to create a view, leaving the jurisdiction to deal with a code enforcement action.

8.3.3.13 Non-Compensatory Restoration and Enhancement

As discussed below, provisions for non-compensatory restoration and/or enhancement activities may legitimately be addressed as exemptions through a critical areas ordinance, provided that limits are defined so that proposals narrowly focused or managing for a single function are not allowed to occur at the expense of other wetland functions.

Restoration and enhancement activities are considered non-compensatory when they improve wetland functions (and/or increase wetland acreage) and are not meant to compensate for impacts caused by development. Many restoration activities are by definition "self mitigating" in that they may cause temporary impacts (during construction) that are ameliorated by the significant increase in function resulting from the activity.

Some non-compensatory activities are not beneficial from a landscape perspective because they are narrowly focused or do not fit the hydrogeomorphic setting in which they are carried out. Narrowly focused activities are those that provide benefits to single species at the expense of other wetland functions. For example, in the past some waterfowl management projects have been constructed to significantly increase waterfowl production, while reducing habitat for non-waterfowl species. An extreme example would be the clearing of a forested wetland for the construction of an impoundment to attract waterfowl.

Local governments should not assume that restoration activities supported by other agencies won't result in a tradeoff of functions and should carefully look at the merits of the proposal. Beneficial projects should be encouraged as a means to offset net losses in the regulatory arena, provided that they result in wetlands of the appropriate hydrogeomorphic class and are supported by landscape processes.

Local governments may also consider relaxing some of the procedural requirements typically reserved for compensatory mitigation projects. For example, a requirement for the recording of a restriction on an easement or deed for a "native growth protection area" may only serve to needlessly frustrate a legitimate non-compensatory project. It may be appropriate for a local government to set up a separate review process for non-compensatory projects that is focused on facilitating legitimate projects while still complying with requirements of the GMA.

8.3.3.14 Stormwater Management

The use of wetlands for stormwater management should be included in the list of regulated activities. Most wetlands are adversely affected when they are modified to treat and/or detain urban stormwater. The literature, much of it based on research done in the Puget Sound area, suggests that there are very narrow circumstances under which wetlands can be managed to meet the stormwater requirements of new (and retrofitted) development. While it may be appropriate in some situations to allow a low-quality wetland to be used as part of a stormwater management facility, local review and permitting should be required.

Guidance on stormwater management

Ecology has published a manual to provide local jurisdictions a commonly accepted set of technical standards and guidance on stormwater management measures based on the current state of the science and the best technical information available. The 2001 revision to the *Stormwater Management Manual for Western Washington* reflects the current state of the science on best management practices to minimize stormwater impacts on receiving waters, including wetlands, on the west side of the Cascades. The manual is used to address the issues of water quality and water quantity effects on downstream receiving waters such as wetlands. In western Washington, the 2001 Ecology manual should be used by local governments to implement best available science for the protection of functions in wetlands driven by hydrologic processes. Ecology is currently working on a stormwater management manual for eastern Washington.

Details about changes to and requirements of the western Washington stormwater manual are available on the internet at:
http://www.ecy.wa.gov/programs/wq/stormwater/manual.html.

The final draft eastern Washington stormwater manual is available at
http://www.ecy.wa.gov/programs/wq/stormwater/eastern_manual/index.html.

8.3.4 Wetland Rating

A wetland rating system is a useful tool for dividing wetlands into groups that have similar needs for protection. The scientific literature makes clear that wetlands in Washington are incredibly diverse (see Volume 1, Chapter 2). Wetlands occur in a wide variety of locations as a result of very different influences (geomorphology, geology, water source, etc.) and have a wide range of characteristics that contribute to different types and degrees of functions.

Wetland rating systems allow for tailoring of protection standards to the specific needs of different types of wetlands. They offer a scientifically defensible approach to assigning protection standards as well as providing a significant degree of predictability for applicants. For example, buffer widths and mitigation replacement ratios can be determined based upon a wetland rating in addition to other factors.

A wetland rating system should divide wetlands into categories based on an understanding of how wetlands function and how they are affected by human activities. A rating system should use clear criteria for determining wetland categories and include methods for making category determinations. Without detailed methods it is not possible to consistently apply rating criteria. The primary factors that should be used to rate wetlands are:

- The **rarity** of the wetland type;
- The **irreplaceability** of the wetland type;
- The **sensitivity** of the wetland type to adjacent human disturbances; and
- The **functions** performed by the wetland type.

Ecology has revised the wetland rating systems that were previously developed for eastern and western Washington based on the best available science. These rating systems were developed by interdisciplinary teams that included local planners and have been field tested across the state. If a local government wants to revise one of these updated rating systems or develop its own, it should do so based on the best available scientific information and should include a detailed method for making site-specific decisions about categorization.

Approaches for applying protection measures by incorporating the wetland rating are discussed in Appendices 8-C through 8-F.

The *Washington State Wetlands Rating Systems* are available at http://www.ecy.wa.gov/programs/sea/wetlan.html.

8.3.5 Requirements for Wetland Reports

To limit the need for comprehensive review of all project submittals, some jurisdictions may choose to implement a two-tiered review process to segregate projects with minor or *de minimus* impacts from those requiring more in-depth review and analysis. To facilitate a tiered approach, the local jurisdiction would collect all readily available information about the project site to make an initial determination. The CTED *Critical Areas Assistance Handbook* (Appendix F) includes a "critical area identification form outline" that lists a series of indicators and project information that can be included on a form to help identify the likelihood of an impact to wetlands and other critical areas. Often, a determination about the likelihood of impacts to a critical area can be determined with some basic information. In most circumstances, a jurisdiction would need to have a wetland inventory that is based on a certain amount of ground-truthing of National Wetland Inventory and hydric soils data.

For projects that will likely involve impacts to wetlands and will require mitigation, the example code provisions in Appendix A of the CTED handbook include language on what local governments should ask for and require in a wetland report. Considerations for wetland report requirements in a critical areas ordinance include, but are not limited to:

1. Preparation by a qualified professional;
2. Use of scientifically valid methods and studies in the preparation of the report;
3. Minimum report contents, which set the threshold for determining whether the report is complete;
4. Study area limits; and
5. Compensation requirements, performance standards, construction plans, monitoring and maintenance, contingency plans, financial guarantees, and other details.

Ecology and Fish and Wildlife recommend that the requirements for wetland reports, as outlined in the CTED handbook, be included in a local jurisdiction's critical areas code or the administrative rules adopted for implementing the code. The importance of local staff capacity in reviewing report submittals is covered in Section 8.2.2 of this chapter.

8.3.6 Sequencing

Sequencing (often referred to as mitigation sequencing) is the process of working through a series of steps to determine what types of impacts may be permitted and what types of compensatory mitigation may be appropriate. Generally, this sequencing process is described as follows:

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 to the conditions existing at the time of the initiation of the project;

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 required compensation and taking remedial action when necessary.

The primary decision to be made with respect to avoidance is one of risk management. For example, impacts to Category I wetlands (which are rare, sensitive to disturbance, irreplaceable, or perform a high level of functions) are higher risk and should have to pass a higher avoidance threshold than impacts to a Category IV wetland. Category IV wetlands are usually significantly degraded, provide a low level of functions, and may be more readily replaced. If the goal is to protect existing functions, it makes sense to apply more stringent protection to those wetlands that are rated higher in the rating system. See Appendices 8-A through 8-F for further discussion of incorporating the wetland rating into regulations.

8.3.7 Compensatory Mitigation Requirements

Mitigation is defined legally as the six-step sequencing process described in the previous section. Wetland impacts can be significantly reduced or avoided altogether by following the first four steps in the sequence (avoiding, minimizing, rectifying, and reducing or eliminating impacts). When wetland impacts are unavoidable, the fifth and sixth steps in the sequence are engaged (compensating for impacts and monitoring compensation actions).

Step five is commonly referred to as compensatory mitigation. Implementing this step requires considerable attention to detail because the issues are complex and the current track record of compensatory mitigation is variable (see Volume 1, Chapter 6). Local regulations on compensatory mitigation need to address the issue of how best to replace the wetland functions and values that will be lost due to the proposed impacts.

Based on the review of the scientific literature in Volume 1, compensatory mitigation regulations need to address the following issues:

- The training and funding of regulatory staff to review, implement, and follow through with proposed compensation plans;

- Standards for the type, location, amount, and timing of the compensatory actions; and
- Clear guidance on the design considerations and reporting requirements for compensation plans. This requirement allows the local agency to make a decision about the adequacy of the proposed compensatory mitigation.

A two-part joint report on compensatory mitigation was recently published by Ecology, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency. It is titled *Guidance on Wetland Mitigation in Washington State: Part 1 - Laws, Rules, Policies, and Guidance Related to Wetland Mitigation* (Ecology Publication 04-06-013a, April 2004); and *Part 2 – Guidelines for Developing Wetland Mitigation Plans and Proposals* (Ecology Publication 04-06-013b, April 2004).

Part 1 of this joint document outlines the general mitigation policies and requirements of federal and state agencies. Part 2 provides detail on what information should be included in a compensatory mitigation plan. Local governments are encouraged to adopt mitigation policies consistent with Part 1. This will help ensure consistency between levels of government and streamline the permitting process for applicants. The language in Appendix 8-B is consistent with Part 1. Local mitigation regulations should reference Part 2 as the standard for what should be included in a mitigation plan.

8.3.7.1 Compensatory Mitigation Standards

The review of the scientific literature makes clear that compensatory mitigation has frequently failed to adequately replace wetland area and functions (see Volume 1, Chapter 6). The reasons for failure, among others, include:

- Poor site selection;
- Poor site design;
- Inappropriate or inadequate goals, objectives, and performance measures;
- Lack of sufficient water;
- Inappropriate water regime;
- Poor implementation;
- Inadequate maintenance; and
- Lack of regulatory follow-up.

The reasons listed above point to a need for rigorous standards to address the type, amount, and location of mitigation projects that are permitted, and the type and extent of information that must be provided in a mitigation proposal. An adequately trained and

funded regulatory staff is also vital for performing permit review, compliance monitoring, and enforcement.

Standards for compensatory mitigation should specifically address the following issues:

Goals of compensatory mitigation: The standards need to include a statement about the primary intent of compensatory mitigation. Is it to replace the functions being lost by the permitted impact? Is it to achieve greater area or functions? Are tradeoffs in functions allowed (i.e., allowing replacement with different functions than the functions being lost)? Generally, the goal of compensatory mitigation should be to achieve equivalent or greater area and functions.

Types of mitigation actions: Compensatory mitigation typically includes five basic types of activities:

- Creation or establishment of new wetlands where none previously existed;
- Restoration of new wetland area and functions where wetlands previously existed (also called re-establishment);
- Restoration of wetland functions in an existing wetland area that is significantly degraded (also called rehabilitation);
- Enhancement of some wetland functions in an existing wetland that may reduce other functions; and
- Preservation of an existing wetland that is otherwise likely to experience degradation (because it is not currently well protected by existing laws).

Standards for compensatory mitigation should specify whether any of these types of activities are preferred over others. Generally restoration is preferred because it is the most likely to succeed. Enhancement typically provides the least gain in functions, and preservation always results in a net loss of wetland area; thus, these types are usually the least preferred.

Replacement of function vs. area: Standards should address whether wetland area and function must be replaced on an individual project basis and to what extent tradeoffs in functions can be made. It is a good idea to require a minimum of 1:1 replacement of wetland area except in unique circumstances, such as when it can be clearly demonstrated that a lesser area of wetland can provide greater functions than are being lost. It is reasonable to require that compensatory mitigation replace the same functions as are lost except when tradeoffs in functions are identified as desirable in a regional plan. As a general rule, replacement of the same functions on a project basis will help ensure that significant tradeoffs are not made on a landscape or basin scale without fitting into clearly identified regional priorities.

Location of mitigation: Historically, most regulatory agencies required that mitigation activities be performed “on-site” (on or very near the same parcel where the impact occurred). This was based on the belief that the closer the mitigation was to the impact

site, the better chance it would have of replacing the functions that were lost. However, recent studies have concluded that this requirement too often has forced applicants to try to fit a mitigation project into an area that makes little ecological sense and is not sustainable. Mitigation standards should emphasize that mitigation activities must occur in a location where the targeted functions can reasonably be accomplished and be sustainable. For example, the site needs to have an appropriate source of water and allow for control of invasive species. Adjacent land uses need to be compatible with the long-term functioning of the site. It makes no sense to create a new wetland for amphibian habitat in a location surrounded by dense urban development.

Amount of mitigation: The issue of how much mitigation area needs to be provided to compensate for lost wetland area is one of the most important and most contentious aspects of compensatory mitigation. The review of the science indicates that compensatory mitigation frequently fails to produce the targeted wetland area and/or function, and that it can take as long as 20 years to more than 100 years for a newly created or restored wetland to perform some functions. Mitigation ratios are a tool that is commonly used to equalize the tradeoffs between the wetland lost and the mitigation wetland.

While the overall goal is to replace lost functions with equivalent new functions, the reality is that it generally takes greater acreage and considerable time to provide equivalent functions. Additionally, some types of compensatory mitigation actions (enhancement, preservation) provide no new area and only a few new functions. Mitigation ratios provide a means of equalizing the disparities inherent in compensatory mitigation and act as a kind of "interest rate" to address the temporal loss of function associated with the difference between when the permitted wetland impact occurs and when the compensatory wetland is fully functioning.

However, every mitigation project is unique and it is possible to create or restore a wetland and provide greater functions than those that are being lost if the impacts are to a significantly degraded wetland. Additionally, some types of mitigation projects are more likely to succeed than others, particularly if good hydrologic information is available. Thus, mitigation ratios need to be flexible to address the wide range of situations that are encountered.

The recommended approach is to establish general mitigation ratios based on the wetland category and the type of mitigation activity, and then adjust the ratio on a case-by-case basis to account for project-specific factors. Criteria for increasing or reducing ratios should be specified in the standards. This provides some degree of predictability for applicants while retaining the flexibility to make site-specific adjustments.

Suggested code language for mitigation ratios is provided in Appendix 8-B. Guidance on compensatory mitigation ratios for use with the western and eastern Washington wetland rating systems is provided in Appendices 8-C and 8-D, respectively. Appendix 8-F provides the rationale behind these mitigation ratios.

Timing of mitigation: Generally, mitigation actions are conducted concurrently with or soon after when the wetland impact occurs. Standard ratios are typically established

based on this assumption. If mitigation is conducted in advance of the impacts, then the risk and temporal loss are reduced and the ratio should be reduced commensurately. If the mitigation is conducted well after the impact, the ratio should be increased.

8.3.7.2 Special Types of Compensatory Mitigation

In addition to addressing the more common mitigation activities (creation, restoration, and enhancement), local jurisdictions should consider including language specifying the circumstances under which special types of compensatory mitigation may be used, such as preservation, mitigation banks, in-lieu fee programs, and programmatic mitigation areas. These types of programs are discussed below.

Preservation

The preservation of existing wetlands as a means of compensating for wetland impacts is highly controversial because it always results in a net loss of wetland area and is perceived as trading one wetland for another one that is already protected. The reality is that some wetland types are not adequately protected under existing laws and can benefit from being placed in public ownership or protected by a conservation easement.

For example, many forested wetlands can be logged under current laws, and wetlands with significant habitat value are very difficult to protect without large buffers and corridors to connect them to other habitats. Preservation of large tracts of wetlands and uplands can provide benefits that are impossible to achieve using typical regulatory approaches. One way to think about the issue of "net loss" with respect to preservation is that some wetlands are going to experience unmitigated impacts unless they are preserved. In that sense, preservation provides a "net gain" over what would otherwise occur.

Preservation has the following basic advantages as a compensatory mitigation tool:

- Larger mitigation areas can be set aside due to the higher mitigation ratios required for preservation.
- Preservation can ensure protection for high-quality, highly functioning aquatic systems that are critical for the health of the watershed and aquatic resources that may otherwise be adversely affected.
- Preservation of an existing system removes the uncertainty of success that is inherent in a restoration, creation, or enhancement project.

Generally, the use of preservation to compensate for impacts is appropriate only in very limited circumstances. The preservation of a high-quality wetland in the same watershed where a wetland loss has occurred, however, is often an acceptable form of compensation when done in combination with restoration, creation, and enhancement.

The use of preservation of wetlands as compensatory mitigation should not allow applicants to circumvent the standard mitigation sequence of avoiding and minimizing

impacts first, followed by compensating for unavoidable losses. Additionally, preservation projects should be subject to the same requirements as other types of wetland mitigation: monitoring, long-term protection, and stewardship. Preservation of wetlands generally requires significantly higher ratios to offset impacts than wetland creation or restoration projects.

Preservation of at-risk, high-quality habitat may be considered as part of an acceptable mitigation plan when the following criteria are met:

1. Preservation is used as a form of compensation only after the standard sequencing of mitigation (avoid, minimize, and then compensate); and

2. Creation, restoration, and enhancement opportunities have also been considered, and preservation is proposed by the applicant and approved by the permitting agencies as the best mitigation option; and

3. The preservation site is determined to be under imminent threat; that is, the site has the potential to experience a high rate of undesirable ecological change due to on-site or off-site activities. This potential includes permitted, planned, or likely actions; and

4. The area proposed for preservation is of high quality or critical for the health of the watershed or basin due to its location.

Mitigation Banks

Mitigation banks offer an opportunity to implement compensatory mitigation at a regional scale and provide larger, better connected habitat in advance of impacts. Mitigation banking involves the generation of "credits" through restoring, creating, enhancing and, in exceptional circumstances, preserving wetlands and other aquatic resources. These credits can then be sold to permit applicants who need to offset the adverse environmental impacts of projects that would occur within the "service area" of the bank. A bank's service area is akin to its "market area" or the geographic area in which credits may be sold or used. Projects that use bank credits as compensation are called "debit projects."

Wetland mitigation banks have two basic components:

- The physical site where mitigation bank credits are generated by restoring, creating, enhancing, and/or preserving wetlands and associated natural resources.

- An organization operating under the provisions of a mitigation banking instrument that markets and sells credits, maintains a bank ledger, monitors and reports on the development of the bank site, and provides perpetual protection, management, and other services for the bank site.

Bank sites are normally protected in perpetuity by a legally binding protective covenant such as a conservation easement held by a long-term manager. Bank sponsors must also provide one or more temporary financial assurances to ensure the successful ecological

development of the bank and an endowment to fund long-term management of the bank site(s).

Once released for sale, wetland bank credits are sold to permit applicants to compensate for wetland impacts that occur within the service area of the bank. As credits are sold, bankers debit them from the bank's ledger so they cannot be resold. Once all credits in a bank have been sold, the bank is closed.

Mitigation banks benefit the aquatic environment by consolidating numerous small wetland mitigation projects into larger, potentially more ecologically valuable projects. This results in economies of scale that benefit the regulated public, regulatory agencies, and the environment. Another important feature of mitigation banks is that they are developed in advance of the adverse impacts for which they compensate, which ensures that the bank is ecologically successful before it is used to offset adverse impacts at other sites. Properly implemented mitigation banks offer improved ecological performance, lower mitigation costs to permit applicants, and a more streamlined permit process.

To date, few mitigation banks have been approved in Washington. However, as the regulatory agencies develop and implement bank review and approval processes and gain experience in evaluating mitigation bank proposals, mitigation banks are likely to become more common in Washington.

As with any form of compensatory mitigation, the use of mitigation bank credits to offset impacts to the aquatic environment should not be considered prior to completing the two mitigation sequencing steps of avoidance and minimization. Then, the regulatory agency must determine whether purchasing credits from a particular bank would provide appropriate and practicable compensation for a proposed impact. In making its determination, the regulatory agency should consider whether any environmentally preferable compensatory mitigation opportunity (e.g., on-site mitigation) is available, how closely a bank's credits correlate with the particular wetland functions that would be destroyed by a proposed action, and whether using a bank to compensate for a proposed action would be in the best interest of the aquatic environment, particularly the affected watershed.

In-Lieu Fee Programs

In-lieu fee (ILF) mitigation occurs when a permittee pays a fee to a third party in lieu of conducting project-specific compensatory mitigation, purchasing credits from a mitigation bank, or conducting some other form of compensatory mitigation. This fee represents the expected costs to a third party to replace the wetland functions that would be lost or impaired as a result of the permittee's project. ILFs are typically held in trust by a non-profit conservation organization until they can be combined with other ILFs to finance a project that replaces the lost and impaired functions represented by those ILFs. The entity operating the trust is typically an organization with demonstrated competence in natural resource management, such as a local land trust, private conservation group, or government agency that manages natural resources.

ILF mitigation is used primarily to compensate for minor adverse impacts to the aquatic ecosystem when more preferable forms of compensation are not available, practicable, or in the best interest of the environment. Compensation for projects that result in more substantial adverse impacts is usually provided by project-specific mitigation or a mitigation bank. ILF mitigation may be appropriate when:

- The amount of compensatory mitigation required for a project is too small to justify the cost of designing and implementing project-specific mitigation;
- Practicable opportunities to conduct appropriate project-specific mitigation or purchase credits from an approved mitigation bank are not available;
- Project-specific mitigation that could be implemented would likely result in a low-performing aquatic system, have a high risk of failure, be incompatible with adjacent land uses, or fail to address the needs of the watershed; or
- A minor amount of additional mitigation is needed to supplement project-specific mitigation that would not, by itself, fully compensate for a project's adverse environmental impact.

ILF mitigation and mitigation banking share many similarities. For example, both types of mitigation allow permittees to fulfill their compensatory mitigation responsibilities by paying a fee to a third party who will accept responsibility for the required mitigation. Also, mitigation banks and ILF-funded projects must both fully comply with existing federal mitigation guidance and policy, including a requirement for a written implementing agreement that normally includes construction plans, performance standards, monitoring and reporting provisions, a long-term management plan, financial assurances, protective real estate agreement (e.g., conservation easement), and other measures, as appropriate, to ensure the ecological success of each project.

The fundamental difference between mitigation banking and ILF mitigation is the relative timing of the activities that offset the adverse environmental impacts for which they compensate. With mitigation banks, the environment-enhancing activities are conducted in advance of the adverse impacts, whereas with ILF mitigation, those activities normally are not conducted in advance of the adverse impacts. While specific ILF-funded mitigation projects may not always be identified in advance of project-related impacts, quickly expending collected ILFs to fund mitigation projects should be a high priority for any ILF program. However, regulatory agencies may adjust the size of ILFs to compensate for anticipated delays in expending them.

Programmatic Mitigation Areas at the Local Level

Another approach for consolidating compensatory wetland mitigation involves directing compensation projects to a programmatic mitigation area. Simply defined, a programmatic mitigation area is a site (or series of sites) that have been identified by the local jurisdiction or a state or federal agency as the preferable site for wetland compensation. Wetland compensation projects are constructed separately on the site but are all part of a common design. The programmatic mitigation sites are subject to the

same minimum requirements as other compensation sites such as permanent protection, monitoring, restrictions on other activities on the site, etc.

The goal of programmatic mitigation sites is to allow the restoration of larger wetland areas that are important to the functioning of a stream basin or watershed because of their position in the landscape. Since many projects require relatively small areas of compensatory wetland mitigation, the programmatic mitigation area program allows the consolidation of these small compensation sites into a larger project.

How would a programmatic mitigation area program work?

1. The lead regulatory entity (county or city jurisdiction, state or federal agency) identifies an area or areas as priority restoration areas.

2. The regulatory entity develops a site development plan for the entire site and may either purchase the site or purchase an easement on the site.

3. As projects needing compensation arise, the applicants are directed to perform either certain activities on the site (to aid in the completion of the plan) or directed to implement the site design on specific areas within the overall site.

This approach has not been used much in Washington. The closest example available is Kitsap County's work along Clear Creek where several mitigation projects have been completed adjacent and complementary to each other. The county has actively directed compensation projects to the Clear Creek area. Another example is along Mill Creek in Auburn where the Emerald Green Race Track and WSDOT located their compensation sites in an area identified in the draft Mill Creek Special Area Management Plan.

8.3.8 Buffers

Buffers are defined in many ways (see Volume 1, Chapter 5) but generally include relatively undisturbed vegetated areas adjacent to critical areas such as wetlands and streams. The review of the scientific literature in Volume 1, Chapter 5, indicates that the protection of buffers around wetlands is necessary to protect wetland functions. The scientific literature also provides considerable guidance on buffer characteristics, including widths, that are necessary to protect specific wetland functions. The literature does not provide clear direction on how to structure buffer protection and management programs. However, in addition to providing technical information on buffer effectiveness, the literature provides information that should help guide the development of buffer protection policies and regulations. This information can be summarized as follows:

- Four primary factors should be considered in determining the appropriate width and character of buffers:
  - The quality, sensitivity, and functions of the aquatic resource;

  - The nature of adjacent land use activity and its potential for impacts on the aquatic resource;
  - The character of the existing buffer area (including soils, slope, vegetation, etc.); and
  - The intended functions of the buffer.

- Site-specific information is needed to determine the characteristics and width of the buffer that will make it effective.
- It is important to manage surface water discharges to wetland buffers to ensure effective treatment of pollutants.
- Generally, buffer widths "shrink" over time as a result of infringement from adjacent activities.

Ideally, this guidance should be incorporated into any local government's buffer regulations. There are, however, many different ways to incorporate this information into a buffer protection program. The challenge for local governments in Washington is to develop buffer protection and management approaches that incorporate the best available science and provide a reasonable and defensible means of establishing and maintaining effective wetland buffers.

Suggested code language for buffers is provided in Appendix 8-B. Guidance on buffers for use with the western and eastern Washington wetland rating systems is provided in Appendices 8-C and 8-D, respectively. Appendix 8-E provides the rationale behind the suggested buffer widths.

8.3.8.1 Components of Wetland Buffer Regulations

Regulations for the protection of wetland buffers should address a number of issues:

1. Standards for buffer characteristics and width;
2. Criteria and procedures for varying from a standard;
3. Allowable uses within buffers;
4. Best management practices to enhance and ensure effective buffer function; and
5. Provisions for the delineation and demarcation of buffers and their maintenance over time.

In most cases, the primary concern will be "how wide does the buffer need to be?" This issue dominates any discussion of buffer regulation and generates the most conflict. However, before determining appropriate standards for buffer widths, a local government needs to decide how best to balance the need for a predictable and cost-effective approach with the desire for a flexible approach that is responsive to site-specific situations.

The options for buffer regulatory approaches range from variable-width buffers that are determined case-by-case based on multiple site-specific factors, to fixed-width buffer standards. Between these two extremes, there are many intermediate options that combine some elements of each.

Variable-Width Approach

The case-by-case, variable-width approach is probably the most consistent with what a review of the scientific literature says about buffer effectiveness. This approach usually requires the development of a detailed formula and methodology for the consideration of site-specific factors such as wetland type, adjacent land use, vegetation, soils, and slope. By taking into consideration all relevant site-specific factors prior to determining the appropriate buffer width, this approach helps ensure that the buffer is adequate to protect wetland functions without being any larger than is necessary.

However, this approach is time-consuming, costly to implement, and provides a less predictable outcome. It requires either that the applicant hire a consultant to conduct the necessary analysis, or that the government agency staff conduct the analysis. In either event, the local government staff must have appropriate training and expertise to conduct or review the analysis. In addition, this approach requires considerable effort up front to develop the formula and methodology for site-specific evaluation. This approach also does not provide any predictability for applicants. They have no idea how large a buffer may be required until considerable time and money are invested in the analysis. Using a case-by-case, variable-width approach can also result in attempts to manipulate the site-specific data, lead to frequent haggling with applicants, and create the perception that buffer widths are determined in an arbitrary and capricious manner.

Fixed-Width Approach

By contrast, a fixed-width approach provides predictability and is inexpensive to administer. The downside of this “one-size-fits-all” approach is that it results in some buffers being too small to adequately protect wetland functions, and some buffers being larger than necessary to protect wetland functions. Over time, this inequity may erode public and political support for the buffer program. Frustrated landowners can point to the “over-regulation” of those buffers that are larger than necessary, while environmentally minded citizens can point to those buffers that are smaller than needed to protect wetland functions. It also is difficult to determine an appropriate standard width, because no single size buffer can be demonstrated to protect all wetland types adequately in all situations unless that standard width is very large. Furthermore, it is difficult to argue that a fixed-width approach includes the best available science since the scientific literature clearly recommends different buffer widths based on a variety of different factors. While no local governments in Washington currently use a single, fixed-width approach, there are several states that do (e.g., California, New Hampshire, New Jersey).

Combining the Fixed-Width Approach with Site-Specific Variables

There are several ways to modify a standard, fixed-width approach to incorporate some of the factors that contribute to buffer effectiveness. Some drawbacks of the fixed-width approach can be rectified by utilizing a wetland rating system that divides wetlands into different categories based on specific characteristics. Then, different buffer width standards can be assigned to each category. This approach provides predictable widths, yet allows some tailoring of buffer widths to wetland functions.

For example, the *Washington State Wetlands Rating System* divides wetlands into four categories based on the following wetland characteristics: rarity; sensitivity to disturbance; irreplaceability; and functions. This hierarchical rating system allows one to establish larger standard buffer widths for "more valuable" wetlands and smaller standard buffers for "less valuable" ones. Most local governments in Washington currently designate buffer widths based on the state wetland rating system or a similar approach.

Another way to tailor a fixed-width approach to address site-specific factors is to have different standard widths based on the type of adjacent land use, thus incorporating another of the four factors discussed earlier that are known to influence buffer effectiveness. A buffer regulation could require a larger buffer width for adjacent land uses with intense impacts and a smaller buffer width if the impacts from adjacent land uses are low. This approach can be combined with a wetland rating system to provide a more scientifically defensible approach.

Other critical factors, such as the characteristics of the buffer itself and the desired buffer functions, can be addressed by establishing criteria and procedures for varying from a standard width. This approach allows for some site-specific tailoring of the standard buffer width on a case-by-case basis without the need for developing a detailed formula or methodology for determining site-specific widths. In this approach, criteria for increases or reductions from the standard buffer width are developed, and the applicant or any other interested party is given the option of "making a case" as to why the standard buffer width should be increased or decreased. Agency staff then evaluate the proposal for deviation from the standard buffer width against the criteria, and decide if such a deviation is warranted.

The criteria for allowing a deviation from the standard buffer width should address the various site characteristics determined by best available science to be the most important. These include buffer characteristics such as slope, soil type, vegetative cover, and/or the habitat needs of particular wildlife species. For reducing standard buffer widths, an applicant should have to demonstrate that a smaller buffer will protect the functions and values of the wetland. This will generally require hiring a qualified expert and preparing a site-specific report for the local administrator's review and approval. It is also important to have a minimum buffer width below which the buffer cannot be reduced.

8.3.8.2 Reasonable Use Criteria

Another situation in which standard buffer widths may need to be reduced on a case-by-case basis is when protection of the buffer will result in a property owner being denied reasonable use of his/her land. For example, if a landowner has a one-acre parcel that was zoned for one single-family residence and a wetland covers 80% of the parcel, then protection of a buffer around the wetland might mean that the parcel is undevelopable. In this case, the landowner would have a strong case that protection of the wetland and buffer would deny him/her all reasonable use of the property. However, if the buffer were reduced, it may be possible to construct a single house on the property and avoid a "takings" claim.

Thus, critical area regulations should include a provision allowing for buffer reduction in situations where reasonable use would be denied. Such a provision should include requirements that the applicant demonstrate that there are no feasible alternatives to reducing the buffer such as revising the development design, that critical wetland functions or public health and safety will not be impaired, and that the inability to derive reasonable economic use of the property is not the result of the applicant's own actions, such as dividing the property in a way that created an unbuildable lot after the adoption of critical area regulations.

8.3.8.3 Buffer Averaging

Buffer averaging is a tool for balancing buffer protection with specific site development needs, or for tailoring a buffer to maximize protection of natural features in the wetland or surrounding upland. It allows a buffer to vary in width around a given wetland. For example, if the standard width for a buffer around a wetland is 100 feet, buffer averaging would allow the width to vary between a minimum and a maximum width but require that the buffer area average 100 feet in width. Typically this is done to allow development to occur closer than usual to the wetland in order to fit a particular development "footprint" onto a given site. However, it can also be used to protect a natural feature (such as a stand of trees or snags) that otherwise would fall outside of the standard buffer width. Buffer averaging can also be used to provide connectivity with adjacent habitat areas or to address those situations where pre-existing development has reduced a buffer area to a width less than the required standard.

Criteria for buffer width averaging typically require a minimum buffer width (either a designated width or a percentage of the standard buffer width) and documentation to ensure that the averaging of the buffer will improve, or at least, not impair overall buffer functions.

8.3.8.4 Uses within Buffers

Another critical issue that buffer regulations need to address is the type of uses that are allowed within buffers. Generally, buffers should be maintained in natural vegetation. However, uses that could be considered are stormwater treatment facilities (e.g.,

detention ponds and bioswales) in the buffer or trails to provide for some form of recreational use. In addition, over time, residents adjacent to the buffer might want to use it for some activity. Thus, it is essential that buffer regulations address which uses are allowed in buffers.

Generally, any use that results in the creation of impervious areas, clearing of vegetation, or compaction of soils will be incompatible with buffer functions. Typically, buffers need to be densely vegetated with appropriate native vegetation to perform water quality and habitat related functions. In most cases, this requirement precludes any human uses of the buffer. However, it may be necessary in some situations to utilize the outer area of the buffer for initial treatment of surface water runoff, via the construction of biofiltration swales or water spreading features to ensure sheet flow.

In other situations, it may be desirable to allow some focused use of the buffer for educational and recreational activities, and to prevent widespread disturbance of the buffer. If it appears inevitable that adjacent residents will use the buffer to gain access to a wetland for aesthetic or recreational enjoyment, then it may be preferable to concentrate that use in a smaller area and minimize disturbance of the soil and vegetation by constructing trails, viewing platforms, or similar facilities. Additionally, providing some educational or recreational developments in buffers may enhance the general public's understanding and appreciation of wetlands and their functions and values.

Many regulations include criteria for evaluating proposals for use of buffer areas. These criteria typically include general language about prohibited uses but allow for variances if certain conditions are met.

8.3.8.5 Enhancement and Restoration of Buffer Areas

Frequently, upland areas adjacent to wetlands have been altered by previous land use practices. In many cases, the vegetation has been cleared or significantly degraded and the soil has been disturbed. Also, it is not uncommon to find that the existing buffer area is composed of non-native vegetation. In these situations, simply "protecting" a set width of buffer area may fail to provide the necessary characteristics to protect a wetland's functions. It is usually desirable, therefore, to restore the buffer to a more naturally vegetated condition.

In other cases, a buffer area may be in relatively good condition but still be sparsely vegetated with trees and shrubs. It may be desirable in this case to improve the screening and habitat value of the buffer by planting additional trees and shrubs or other vegetation appropriate to the ecological setting.

Buffer regulations should be designed to ensure that buffers provide adequate protection of wetland functions. Standard buffer widths should be set based on an assumption that the buffer is well vegetated. In cases where the buffer is not well vegetated, it is necessary to either increase the buffer width or require that the standard buffer width be revegetated. Generally, a well-vegetated buffer will function substantially better than a poorly vegetated buffer. Regulations can essentially give the applicant the option of

revegetating the existing buffer in order to have the standard width, or foregoing buffer restoration and providing a wider but poorly vegetated buffer.

8.3.8.6 Best Management Practices to Enhance or Ensure Effective Buffer Function

Water Quality Protection

A buffer's effectiveness at improving water quality is largely a factor of how water that is carrying pollutants travels across and through the buffer. The scientific literature is full of references to pre-treatment practices that enhance a buffer's effectiveness at removing pollutants and reduce the width of buffer necessary.

In areas with agricultural or silvicultural land uses, the primary pollutants of concern are sediments, nutrients, and pesticides. Narrow (15- to 30-foot-wide) grass filter strips have been shown to be effective at removing coarse sediments and adsorbed pollutants as well as helping encourage sheetflow and infiltration of surface runoff, thus enhancing a buffer's effectiveness at removing remaining pollutants. Therefore, requiring or encouraging the construction of a narrow grass filter strip between agricultural or silvicultural areas and more naturally vegetated wetland buffers is strongly advised.

In urban areas, the pollutants of concern are primarily sediments and metals from roads, parking lots, and construction sites. Adequate treatment of stormwater runoff is critical to remove most of the pollutants and to reduce peak flows prior to discharge to a wetland or its buffer (see below for more discussion of stormwater). To encourage sheetflow and infiltration, stormwater should be dispersed through a shallow infiltration trench at the outer edge of the buffer (farthest from the wetland).

In residential areas, the pollutants of concern include sediments, metals, nutrients, and pesticides (from lawns). A combination of appropriate stormwater treatment and the use of a grass filter strip or grassy swale is recommended to pretreat and disperse surface runoff prior to introduction into a buffer.

In rural residential areas, the primary concern is pollutants such as nutrients and fecal coliform from animals. Many hobby farms in rural areas house livestock that should be kept out of wetlands and their buffers.

Stormwater Management

In addition to the introduction of pollutants, development adjacent to or upgradient from a wetland can alter the quantity and timing of surface water and/or groundwater inputs to the wetland. Considerable research has documented the adverse impacts from changes in wetland hydroperiod. The scientific literature also shows that upland buffers around wetlands do little to ameliorate these impacts except in wetlands with small contributing basins. (See Volume 1, Chapter 4, for further discussion.)

Thus, it is imperative that adequate stormwater management practices be applied to any project adjacent to or upgradient from a wetland. This includes such practices as the construction of settling/detention facilities as well as treatment with a grassy swale. Inadequately detained and treated stormwater will overwhelm a buffer's ability to filter and treat pollutants. Direct surface discharges to buffers usually result in channelized surface flow that significantly reduces pollutant removal and can erode buffers.

Refer to Volume 1, Chapter 3 for additional information on disturbances caused by urbanization.

Wildlife Habitat

The two primary actions that can be taken to reduce impacts to wildlife habitat are to (1) ensure that the wetland and its buffer are connected to other habitat areas, and (2) reduce the intrusion of noise, light, people, and pets.

Ensuring connectivity is usually an issue of site design. Some wetlands are already isolated from other habitat areas and it will not be possible to provide connectivity. On sites where wetlands are currently connected to other habitat areas, it is important to maintain that connectivity through corridors. While the scientific literature indicates that wildlife travel corridors should be as wide as 500 feet, it may be beneficial to provide a corridor of any size. Generally, corridors of less than 100 feet will only provide the cover needed for small mammals and less sensitive birds.

Local wildlife experts should be consulted to determine the appropriate corridor design for a given site. Buffer averaging can be a useful tool to help ensure connectivity with adjacent habitat areas without unduly burdening the landowner.

Reducing the intrusion of noise, light, people, and pets can be accomplished in many ways. Buffers vegetated with dense trees and shrubs are effective at reducing intrusion of noise and light. Additionally, projects can be designed to reduce noise and light intrusion by locating noisy areas such as parking lots, playgrounds, and loading docks away from the edge of the buffer. Lighting can be designed and located so it points away from the wetland and its buffer. Fences or berms can be constructed to block noise and light. Fences can also be used to limit human and pet intrusion. Dense shrubs, particularly those with thorns, can be planted along the edge of a development to block noise and light and limit intrusion.

With forethought and careful planning, projects can be designed to reduce impacts to wildlife habitat. When combined with adequately vegetated buffers of sufficient width, these measures can help ensure that disturbance to wildlife use of a wetland is minimized.

8.3.8.7 Issues in Managing Buffers

Many steps need to be considered to ensure that, once established, buffers continue to provide the functions for which they were protected. These steps frequently are

overlooked or given scant attention by local governments, resulting in the degradation of buffers over time.

Ownership of the Buffer Area

The issue of who owns the area included within a buffer is an important one. There are basically two options:

- The buffer area can be included in a separate tract or lot and held in common ownership by a homeowners association, agency, or non-profit organization; or
- The buffer can be included in lots owned by adjacent landowners.

The second option is often pursued by a developer who wants to divide the buffer among individual lots in order to achieve a required minimum lot size. However, a study by Cooke (in Castelle et al. 1992) of buffer areas in two counties in western Washington showed that buffers that were owned by many different lot owners were more likely to be degraded over time. Even with easement language on each lot owner's deed specifying the buffer protection provisions, owners tend to clear buffer vegetation over time to expand lawns, build storage sheds, or serve other uses. If the buffer area is not held in some kind of common ownership, it is much more difficult to enforce against those landowners who encroach upon its boundaries. Therefore, when feasible, wetlands and their buffer areas should be placed in a separate, non-buildable tract that is owned and maintained by an organization that is dedicated to protecting the buffer.

Buffer Delineation, Recording, and Signage

Clearly delineating and marking a buffer area helps ensure that it is not degraded over time. Following project approval, and prior to site construction, the buffer should be measured, recorded on applicable legal documents, and clearly marked on the ground. During the construction phase, constructing a temporary sediment fence or "clearing limits" fence helps to ensure that the boundary is seen by equipment operators and that the wetland and buffer are protected from erosion during construction. Following construction, a fence may still be desirable to demarcate the boundary and to limit human and pet access and reduce the intrusion of noise and light.

Placement of signs along the buffer boundary is important for two reasons: to help mark the boundary, and to help educate landowners about the purpose and value of protecting buffer areas. In areas with high potential for human intrusion and degradation of the buffer, more extensive signage explaining the value of the buffer may be necessary to develop support for protecting the buffer. In addition to signs, brochures can be developed and distributed to adjacent landowners to explain the reasons why buffers and wetlands are protected and what human activities are allowed. Typically, applicants are responsible for developing and constructing fences and signs and for distributing educational materials. However, local jurisdictions can develop standards for fences, signs, and educational materials to ensure consistency and effectiveness. Maintenance of fences and signs is typically the responsibility of the adjacent landowner or a homeowners association, if applicable, or lies with the local jurisdiction.

Buffer Maintenance

In cases where enhancement or restoration of a buffer is required, monitoring and maintaining the buffer area is essential. A monitoring/maintenance program should include evaluation of the success of plantings and provide for contingency measures if vegetation survival standards are not met. Responsibility for this is usually borne by the developer or landowner. It is also important to monitor buffer areas when human use is allowed or expected. Adverse effects of human access such as vegetation trampling, littering, and soil compaction or erosion should be monitored and corrected if found. Local jurisdictions can develop and implement a buffer maintenance and monitoring program but few have done so. Alternatively, applicants can be required to monitor and maintain buffers and submit regular reports to the local jurisdiction.

Monitoring and Enforcement

Simply designating and marking the boundaries of buffer areas is not sufficient to protect buffers in all cases. Regular monitoring of buffer areas is critical to determine whether vegetation and soils are being damaged and to ensure that adjacent development does not encroach on the buffer over time. Where illegal activities occur, enforcement actions to restore the buffer may be necessary. Local jurisdictions should establish a buffer enforcement program similar to enforcement programs for private stormwater or wastewater facilities.

8.3.8.8 Buffers in Urban Areas

A frequent concern about buffers is their applicability to urban and urbanizing areas. The concerns generally fall into two categories: (1) the science on buffers comes largely from agricultural and forestry settings and is perceived to be irrelevant to urban areas; and (2) the need to maximize density of development in urban areas is in direct conflict with the protection of large upland areas around wetlands (and streams).

The concern over the relevancy of the literature on buffers to urban areas is largely unfounded. While many of the studies of buffer effectiveness occur in non-urban settings, the principles are the same. Buffers do not function any differently in urban settings than rural settings. The same processes of sediment, nutrient, and toxics removal operate similarly in urban areas as they do in rural settings. The role of buffers in providing needed upland habitat for wetland species and in screening adjacent noise and light is also performed similarly. In fact, a case can be made that buffers in urban areas are even more important from a habitat standpoint because there is little other upland habitat available. The factors that may be different in urban areas are that urban wetlands may perform some functions at a lower level because of degradation, and the range of wildlife species utilizing urban wetlands may be smaller. However, remaining wetlands (and adjacent upland areas) in urban areas may, in fact, function as habitat islands and be critical to many species.

The issue of balancing wetland protection with competing mandates in the GMA is a legitimate one that can be addressed in a number of ways. A buildable lands survey with

a good wetlands inventory can provide important information on the actual conflicts that may exist (rather than a perceived conflict). Provisions to allow density trading from buffers to adjacent or nearby developable lands can help.

However, the best way to address the issue of buffers in urban areas is to conduct a landscape analysis and develop a subarea plan that identifies, prioritizes, and protects the most important wetland, riparian, and upland habitats (see Chapters 5 through 7 of this volume for additional discussion). Maintaining and restoring connectivity between wetland, riparian, and upland habitats is key to protecting wildlife. A landscape analysis can help identify existing connections that should be protected as well as areas where connectivity can be restored. Combined with low-impact development standards and state-of-the-art stormwater management, this kind of approach could result in smaller buffers around the other critical areas that are not providing vital habitat. The studies should always be ground-truthed during project review.

8.3.8.9 Buffers around Small Wetlands

Another frequent complaint about buffers is that it is unreasonable to require "large" buffers around "small" wetlands because the buffer can end up being several times the area of the wetland. While a strictly scientific perspective may nonetheless support the buffer size in these situations, it causes many people to question the validity or reasonableness of wetland regulations.

One option for addressing this issue that creates minimal risk to wetland functions is a variance or reasonable use exception. For those jurisdictions adopting the more detailed buffer approach (Alternative 3) described in Appendices 8-C and 8-D, there is unlikely to be a problem because this approach provides reasonable ways to reduce buffers.

However, for those jurisdictions wanting to adopt a more basic buffer approach, it may be appropriate to develop criteria for allowing buffer reductions around small wetlands, particularly in Urban Growth Areas. Some possibilities include:

- For Category II or III wetlands smaller than 10,000 square feet with a habitat score of less than 20 points (in the Ecology rating system), reduce the standard buffer width by 50%.
- For Category IV wetlands smaller than 10,000 square feet, make the buffer 25 feet wide.

It may be important to limit this type of reduction by allowing it only within Urban Growth Areas, not allowing it with buffer averaging, and requiring fencing or some other type of demarcation around the buffer boundary.

8.4 Monitoring the Effectiveness of Regulatory Programs

A local government should be able to track decisions made in the implementation of its critical areas ordinance and produce regular status reports for the public to review. This is an important step to demonstrate that the goals and requirements of the GMA are being met. The monitoring program should be able to answer questions such as:

- How many wetlands have been affected by permit decisions?
- How many acres have been filled?
- How many buffer reduction requests granted? Have buffers been increased?
- How well have the mitigation projects succeeded in replacing wetland acreage and function?
- How many variances issued? How many exemptions granted? How many violations?
- How much non-compensatory restoration is being done?
- How many impacts have been avoided? Where?

Without the collection of these data, a local government cannot evaluate how well it is doing in moving toward a "no net loss" goal for its regulatory program. Furthermore, these data are an integral part of a local government's "adaptive management" approach because they allow decision-makers to improve the regulations based on real (vs. perceived) data.

The monitoring program does not have to be complicated but should be linked to the goals established for the regulatory program (discussed in Section 8.2). A regulatory program that adopts rigid requirements will not require as much data collection as one that relies on case-by-case flexible implementation. Flexible programs by design represent a higher risk to wetlands because case-by-case decision-making can lead to greater cumulative effects than more rigid regulatory programs. (See "balancing predictability with flexibility" in Section 8.2.1.). Many of these data can be collected as part of follow-up work for permit compliance.

This chapter has not outlined minimum items to include in a monitoring program because they are entirely dependent on what is adopted in code. See Chapter 12 of this volume for additional information on monitoring and adaptive management.

Chapter 9
Developing Non-Regulatory Tools

9.1 Introduction

When considering the goal of protecting landscape processes and wetland functions, it is helpful to think in the context of creating a diverse "toolbox" of options. The planning approaches discussed in Chapters 6 and 7 provide a way for jurisdictions to envision what their landscapes and wetlands will look like in the future, incorporating the requirements of the Growth Management Act to accommodate development while protecting critical areas. Regulatory tools (discussed in Chapter 8) such as buffers, compensatory mitigation, wetland ratings, and others establish standards for protecting and managing resources when a specific land use action is proposed on a specific site.

Non-regulatory tools discussed in this chapter, including preservation, conservation, restoration, and incentives, can also be used on a site-specific basis or can be applied to an entire management area. Non-regulatory approaches are voluntary in nature and complement the tools used in the regulatory component of a wetland program. Non-regulatory tools are another important part of the toolbox because they:

- Reduce risk to the resource of loss and/or degradation;
- Provide options for landowners and governments to consider in the early stages of making decisions about whether and how landscape processes can be conserved;
- Can address large areas of the landscape and thus be effective in protecting landscape processes and wetland functions;
- Address the needs of those landowners who prefer a voluntary approach;
- Provide a proactive approach to improve landscape conditions that incorporates willing landowner and community participation;
- Help to achieve no-net-loss and make eventual gains in wetland function and acreage; and
- Have financial and tax benefits.

Non-regulatory tools are part of Step 2, prescribing solutions, in the four-step framework discussed in this volume (Figure 9-1).

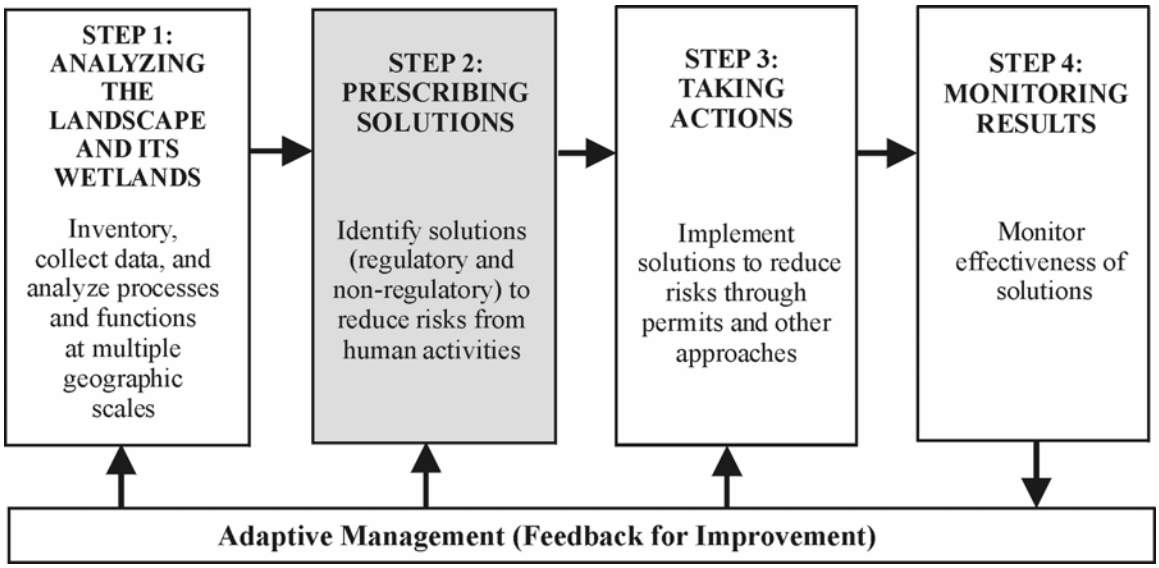


Figure 9-1. Developing non-regulatory tools is part of Step 2 in the four-part framework for protecting and managing wetlands.

Incorporating a non-regulatory program with appropriate implementation tools can occur at any stage of a jurisdiction's planning process. However, the non-regulatory efforts will be most effective if they are incorporated in the early stages of planning; for example, during the formation of a Green Infrastructure plan (Chapter 6). During these early stages, the information from a landscape analysis (Chapter 5) can be used to help the jurisdiction assess options for maintaining landscape processes into the future, and to decide which option provides the most desirable outcome. A non-regulatory program, with selected tools, can then be used as a means to help achieve the desired option.

Preservation, conservation, and restoration are actions that are used in both regulatory and non-regulatory contexts. In the regulatory context, these terms may represent actions that are limited in scope. For example, preservation may be defined narrowly. As described in the recent guidance by Ecology and the U.S. Army Corps of Engineers (April 2004), preservation can be used only under specific conditions such as preserving a wetland that is under immediate threat.

9.2 Establishing the Goals for Non-Regulatory Programs

Non-regulatory actions are those that are voluntary in nature. They fall into three general categories:

- **Preservation** provides a way to set lands aside such that they are not actively used for human activities;
- **Conservation** allows for human activities but limits their impacts by applying best management practices and other measures to protect resource functions; and
- **Restoration** serves to return processes to the landscape. For wetlands, the key restoration step is reestablishment of the appropriate water regime.

Each of these actions can be incorporated at various locations within a jurisdiction. Conducting a landscape analysis (as discussed in Chapter 5) is very helpful in determining how each of these types of non-regulatory actions can supplement regulatory programs to ensure that landscape processes are maintained. Generally, all three of these actions may be desirable for balancing the needs to maintain landscape processes. However, some jurisdictions may find that only one or two of these actions will be the primary focus, while others may incorporate all three.

Conducting the landscape analysis clarifies which non-regulatory action is most relevant to respective locations in a jurisdiction. For example, a particular subbasin may be dominated by agricultural activity and have both water quality problems and a high potential for water quality filtration, if wetlands were restored. In this case, the focus could be improving *conservation* through application of best management practices in agricultural areas, and *restoration* of wetlands with willing landowners. In another subbasin the need might be to *preserve* some wetlands with high-quality habitat fringing an urban growth area.

Understanding the landscape processes therefore helps with the design and implementation of a non-regulatory program. Appropriate tools can then be applied selectively in the areas that are most relevant, or more broadly throughout the management area. A brief overview of preservation, conservation, and restoration in the non-regulatory context is provided below. The specific tools that can be used to implement these non-regulatory actions are discussed in more detail later in this chapter and in the chapter on implementation (Chapter 11).

Preservation

In their paper on *Conservation of Biodiversity in a World of Use*, Redford and Richter (1999) state:

> *(1) different degrees of human use or alteration result in differential conservation of biodiversity components, (2) some components and*

> *attributes of biodiversity are more sensitive to human use than others, and (3) only extremely limited use or virtually no alteration will protect all components.*

Thus, a key role for preservation is to permanently protect those areas that are so highly sensitive to use, so rare or irreplaceable, or so critical to landscape processes that they cannot afford to be degraded or lost.

Preservation employs the permanent protection of land through either:

- Full fee title ownership of all property rights, or
- Partial ownership of the development and/or use rights of the land through a conservation easement.

Conservation easements serve to protect the land in perpetuity by restricting the property deed with conditions for preservation. A "holder" of the conservation easement (such as a land trust) is designated to enforce the terms of the easement through time. Short of full fee purchase, conservation easements are the strongest legal protections available for land preservation.

Conservation

Conservation allows for the active use of the land while retaining landscape processes over time. Conservation applies to areas used for resource production, as well as urbanizing areas where changes in land use might adversely impact a resource. For example, agriculture and forestry landowners are being encouraged to apply "best management practices" such as riparian and wetland buffers.

Conservation of wetlands is a concern in urbanizing settings where adjacent human use affects wetlands and buffers. Improved management practices on the part of homeowner' associations, private landowners, and project developers can help to reduce impacts. Education and outreach are vital in promoting the use of conservation tools.

Restoration

Restoration provides a method for recovering landscape processes and wetland functions that have been lost or degraded. While regulatory mitigation actions compensate for the loss of acreage or functions as a result of a current development activity, they are not designed to recover wetland acreage or functions that have been lost over time. However, voluntary (non-compensatory) restoration actions can restore acreage and functions lost as a result of past land uses.

Some types of wetlands have been more altered than others due to the relative ease of draining and converting them to other uses. The net result has been a homogenization of the remaining wetland diversity and a shift in the relative proportion of habitat types. In addition, wetlands have been affected in terms of their distance to each other, the connectivity of habitat between them, and their location, distribution, and position within

watersheds. This affects the dispersal of animals and plants between wetlands, and how wetlands affect water quality, flood attenuation, and hydrologic processes (Bedford 1999, citing Brinson 1993). These and other factors need to be considered as part of a non-regulatory wetland restoration effort. Refer to Appendix 9-A for additional considerations in planning restoration projects.

9.3 Cost Savings

One of the most important considerations in the development of non-regulatory goals is cost savings. Cost savings fall into two categories: the maintenance of green infrastructure services, and cost efficiencies through directing non-regulatory efforts toward geographic areas that will provide the greatest benefit.

As discussed in Chapter 6, landscapes and their wetlands provide an array of "green infrastructure" services—flood attenuation, water filtration, water recharge and discharge, etc. Studies have indicated that protecting these green infrastructures instead of having to build infrastructures to replace them actually provides cost savings. When considering the goals of non-regulatory efforts, the jurisdiction should understand these financial implications (see Chapter 6 under "fiscal savings"). Despite the common perception that non-regulatory programs are too expensive, money spent to purchase land for permanent preservation and thus protect its functions and services can result in a significant cost savings over the long term.

Cost efficiencies should be considered in designing a non-regulatory program to maximize performance for dollars spent. A landscape analysis can direct the identification of problem areas within subbasins or watersheds and help to identify appropriate non-regulatory actions and tools. Knowing where processes have been degraded helps to prioritize preservation and restoration actions, while targeting them to the ideal locations and thus using funds effectively. Also, prioritizing which locations need attention first helps to minimize further loss of landscape processes, thus retaining existing green infrastructure.

An active education initiative is an important initial step in promoting non-regulatory efforts. Citizens and political leaders need to understand that the costs of providing built infrastructure can outpace tax revenues generated by new development. They should also be made aware that short-term costs to preserve land, and any loss of tax revenues on that land, will be offset over the long term by fiscal savings from the functions and services the land provides.

Jurisdictions in several parts of the country have conducted fiscal analyses to document the cost savings that a non-regulatory approach can provide. Conveying this information to local leaders and citizens serves to increase understanding and promote support for non-regulatory programs. (Further information on these fiscal savings can be found by reviewing Chapter 6 and Appendix 6-A.)

9.4 Important Parts of a Non-Regulatory Program

Once non-regulatory program goals are established and the scope of the conservation, preservation, and restoration approaches is understood, program components need to be put in place. There are some common components that will need to be considered for any effective non-regulatory program, including:

- Program staffing – coordinator, support staff, site management;
- Identification, mapping, and prioritization of geographic areas where non-regulatory tools will be applied;
- Funding mechanism(s) for conducting project actions;
- Incentive tools for landowner participation;
- Education and technical outreach to the public and landowners;
- Project partners to assist local project actions; and
- Monitoring of project sites and overall program success.

Most of these program components are discussed in the implementation portion of this document (see Chapter 11). However, an overview of key funding and incentives tools is provided below. For more information on funding and incentive options, as well as complete coverage of landowner conservation tools, please refer to the *Exploring Wetlands Stewardship Guide: A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004).

9.4.1 Funding Mechanisms

Purchasing land to preserve it, whether in full fee title or through partial development rights, requires some form of local revenue. Common forms of financing for conservation include property tax, sales or use tax, real estate transfer tax, impact fees, special assessment districts, general obligation bonds, and revenue bonds. The ability to raise local revenue for conservation allows the money to be used as a match to obtain additional funds through state or federal grant sources, thus enhancing the local conservation potential.

In *Local Greenprinting for Growth*, the Trust for Public Lands and National Association of County Officials (2002) provide the following table, which summarizes these common conservation financing sources with a list of pros and cons for each.

Table 9-1. Common conservation financing sources.

Financing Source	Definition	Pros	Cons
Property tax	Tax on real property paid for by commercial and residential property owners	Steady source of revenue Relatively easily administered Tax burden distributed Small increases create substantial funding Popular with voters when focuses on compelling land conservation needs	Competition for other public purposes Overall concern among taxpayers about higher rates
Sales & use tax	Tax in sales of goods and services	Relatively easily administered Low reporting costs Can generate large sums, even at small tax levels May be paid in part by out-of-town visitors Can tap into tourism profits generated by open space amenities May include exemptions such as food & medicine	Revenues can drop when economy slows Considered regressive
Real estate tax	Tax on the sales of property paid by either the buyer or seller at time of transfer	Funds can be substantial Nexus between taxing new development and protecting open space	Initial opposition from real estate/development interests can make passage difficult Less predictable revenue stream
Impact fees	One-time fee paid by developer to offset costs of infrastructure needed for new development	Nexus between taxing new development and protecting open space	Parks and open space projects might require direct link to new development

Financing Source	Definition	Pros	Cons
Special assessment district	Special tax district for area that benefits from an open space area	Users finance acquisition and management Predictable revenue stream Accountability in government spending Sense of ownership of and responsibility for area parks and services Can establish in small increments May be able to set own election date and process	Possibly time consuming to implement Overall concern among taxpayers about high rates
General obligation bond	Loan taken out by a city or county against the value of the taxable property	Allows for immediate purchase of open space, locking in land at current prices Distributes the cost of acquisition over time	Extra interest costs of borrowing Voter approval required, sometimes by supermajority levels
Revenue bond	Loan paid from proceeds of a tax levied for the use of a specific public project, or with proceeds of fees charged to those who use the financed facility	Not constrained by debt ceilings of general obligation bonds Voter approval rarely required	More expensive than general obligation bonds
Source: Trust for Public Lands and National Association of County Officials (2002).			

9.4.1.1 Conservation Futures Levy

In Washington, one of the most common forms of conservation revenue comes from the Conservation Futures Levy. RCW 84.34.200 and RCW 84.34.230 establish the authorization for any Washington county to establish a real property tax in the amount of $0.0625 per $1,000 of assessed valuation. This provision for local conservation fund-raising is quite unique in the country and presents an opportunity for local communities to acquire and preserve wetlands and other areas that provide green infrastructure services. However, it is currently used by only a third of the counties in the state. Those counties that are using it have been quite successful in preserving important lands within their communities over the years.

General obligation bonds and impact fees, as well, have also been frequently used by local jurisdictions in Washington for conservation purposes.

9.4.1.2 Land Banking

Land banking is an acquisition program that combines taxing real estate sales as a revenue generator with the benefit of purchasing land before it is developed. It was initiated in Massachusetts in 1984. Washington State has a pre-existing authorization, since 1990, to establish a real estate excise tax under RCW 82.46.070 for the establishment of land banks. This authority allows counties to impose a property transfer tax where tax proceeds are used exclusively for fee-simple or less-than-fee acquisition and/or maintenance of conservation areas. The excise tax, initiated either by resolution of the county legislative body or by public petition, is voted on by residents for final approval.

Only one Washington jurisdiction has established this form of tax revenue. The San Juan County Land Bank, established in 1990, has successfully completed conservation easements on 17,000 acres and fee purchase on approximately 900 acres. To date they have received between $18 million and $19 million in revenue. After its original 12-year authorization period ended, the program was extended following active campaigning by local real estate agents. The land bank was reauthorized with a 74% approval vote by county residents (Shaffer personal communication, 2003).

A paper by Cummiskey (2001) details the establishment of a Cape Cod land bank during the late 1990s. The author states that despite the existence of numerous planning tools such as building restrictions, zoning bylaws, subdivision regulations, and historic district designations, accelerating development continued to threaten shorelines and other resources. This necessitated the addition of other management tools to protect the lifestyle and natural qualities of Cape Cod. The author points out that more cities and towns in Massachusetts and other states are considering land banks as growth management tools to address coastal development, as well as urban, suburban, and rural sprawl.

9.4.2 Landowner Incentives

A diversity of non-regulatory tools are available that appeal to the interests and needs of different landowners and governments. Many tools offer some form of a market-based incentive to help motivate conservation. These incentives include full and partial-interest (conservation easement) land purchases, tax-based incentives, and incentive zoning with tradable development rights and cluster or higher density alternatives. These tools can be pivotal in helping local governments to achieve the conservation, preservation, and restoration of wetlands and the maintenance of landscape processes.

9.4.2.1 Open Space Current Use Taxation

"Land taxes often act as a disincentive to landowners wishing to conserve natural areas" (Edwards 1994). In *Developing America's Natural Areas Market*, Edwards states that government can assist in conservation by removing existing disincentives to private

protection of land, and by assisting in developing a natural areas market rather than relying on private conservation programs alone.

This is what Washington's Open Space Current Use Taxation (CUT) Program offers (RCW 84.34). It allows landowners to voluntarily enroll their property in a local county program that offers property tax reductions for the conservation of natural resource features considered of value to the community at large. The optional Public Benefit Rating System (PBRS) affords the local jurisdiction the ability to identify particular natural systems considered most beneficial to the community.

Applying the Public Benefit Rating System as a Watershed Action Tool (Rubey 1999) provides guidance for local jurisdictions that wish to use the PBRS more strategically. Specific criteria are offered to identify properties containing natural resource features that will help ameliorate water quality problems, flooding, habitat loss, and other disturbances in the landscape. Using the PBRS criteria can even be tailored to address different subbasin needs within the overall jurisdiction. This offers flexibility to shape the implementation of the CUT Program to protect landscape processes.

9.4.2.2 Other Incentive-Based Conservation Approaches

There are other ways in which landowners can benefit by protecting and enhancing wetlands. *Exploring Wetlands Stewardship, A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004) discusses numerous approaches, including:

- Transferring property title with compensation,
- Transferring title without compensation,
- Retaining ownership and managing the property, and
- Conservation in the context of development.

Exploring Wetlands Stewardship also covers the grant funding programs available to assist with implementation of preservation and restoration projects. A complete listing of state and federal programs, with many local programs, is offered as a reference for matching wetland projects with potential funding.

When acquisition of property and conservation easements (which provide permanent protection) are not available or acceptable to a private landowner, another less permanent option is a resource conservation agreement (also called a "conservation lease"). The conservation lease offers tax relief or a conservation management payment as the incentive for conservation. It is often a preferred approach for agricultural or timber landowners. Main et al. (1999) point out that the system of taxation in the United States discourages private agricultural landowners from maintaining lands in non-profitable land uses, thus fueling the conversion of native habitats and resulting in loss or fragmentation. A conservation lease can offer some compensation to these landowners for conserving lands, rather than converting them to marginal farming lands.

There are numerous conservation tools for working with landowners to conserve, preserve, or restore a wetland. It is important to note that having a broad range of tools available provides something for each individual need. With this in mind, a local government can establish incentive tools (such as a Current Use Taxation Program with a Public Benefit Rating System) early in its planning process to allow for optimum use of these tools.

9.4.3 Incentive Zoning Options

Incentive zoning operates within existing regulatory programs to influence development patterns toward preservation of open space. For example, cluster development requires that development be placed on only a portion of the land parcel, thereby retaining the balance as open space. Incentives for increasing the density of development by up to 20% have been allowed in some communities where creating a larger number of lots than is normally allowed in a development is done in exchange for dedicating additional open space (Smart Growth Network 2002).

The transfer of development rights (TDR) is also frequently considered. Basically, TDR moves the development allowance from a less desirable site with higher resource functions or values to a less sensitive site more suited to development. A strong market component is necessary to fuel the transfer, and very abundant and uncontroversial receiving sites must exist. Also, the proposed preservation zone must have comparatively lower real estate market activity. McGilvray et al. (1985) found that saltmarsh lagoons in coastal communities were hard to preserve using TDR because of the much higher property values and desirability these ocean view sites command.

A recent paper on agricultural land fragmentation examined the spatial effects of three land protection tools in a study conducted in the eastern United States (Brabec and Smith 2002). It compared TDR, purchase of development rights (PDR), and cluster development approaches. The authors found that for maintaining viable agricultural practices against isolation and reduction in size, TDR and PDR tools worked best. Because the area they studied had a strong transfer market, the TDR tool performed well. The TDR resulted in the aggregation of 91% of the parcels into protected areas with an average size of 465 acres. The PDR programs aggregated 75 to 88% in the various communities studied. With the cluster program, 36% of the sites were aggregated (64% isolated) and averaged only 30 acres in size.

Avoiding fragmentation is a key aspect of any preservation strategy, so this study provides valuable insights regarding the potential of these different tools for wetland applications. The analysis and comparison of the three land protection tools reinforces the importance of utilizing and coordinating a variety of non-regulatory tools to achieve optimal results (Brabec and Smith 2002).

Chapter 10
Characterizing the Risks from Proposed Solutions to Protect and Manage Wetlands

10.1 Introduction

The scientific information available indicates that as human populations grow, we increasingly impact the environmental processes that maintain the functions of our natural resources (Dale et al. 2000). We have not yet found the ways by which we can eliminate impacts in the face of our growing population. The goal for managing our natural resources, including wetlands, should be to minimize the risk to resources from our activities (Cairns 1997).

A characterization of risks considers both the adverse impacts and improvements that result from actions that are proposed to manage wetlands and changes in land use. Such a characterization provides a way to develop, organize, and present scientific information so that it is relevant in making decisions about future land uses. It also provides a basis for comparing different options for managing wetlands, and it enables decision-makers and the public to make more informed decisions about wetland resources. This approach can be used to describe the likelihood of future adverse impacts or the likelihood that past decisions have already impacted the resource.

Local jurisdictions must consider whether the plans, policies, and regulations they are developing will minimize the risk to the functions and values of wetlands. If the risk to the wetland resource is still high with the proposed plans, policies, and regulations in place, the jurisdiction will want to find additional measures that can be taken to further lower the risk.

The descriptions of impacts used for a risk characterization may range from qualitative judgments to quantitative probabilities. The guidance for characterizing risks described in this chapter can be applied to both approaches (qualitative and quantitative). The task is to characterize each policy, zoning map, regulation, exemption, etc. based on its risk to the wetland resource.

For example, a regulation that sets a 300-foot buffer around every wetland significantly reduces the risk to wetlands from human activities in the immediate vicinity. That regulation can be characterized as having “low risk.” On the other hand, the review of the literature indicates that a 30-foot buffer alone is not large enough to protect most functions of a wetland. A jurisdiction that decides the only regulation they will provide for a wetland is a 30-foot buffer would have to characterize their action as having “high risk.”

There are no simple, unambiguous methods to characterize the risks of different actions that can be taken by local jurisdictions to protect wetlands. The methods are being developed and are still quite subjective. Ecology and Fish and Wildlife recommend, however, that local jurisdictions try to characterize the risk of their actions. A subjective characterization is better than none at all if the choices and decisions made are documented. The following section outlines one type of process by which the risks can be characterized and documented.

A characterization of risks of proposed solutions to protect and manage wetlands is not a requirement of the Growth Management Act. However, the procedural guidelines adopted by CTED in 2001 recommend the identification of risks to critical area functions and values resulting from the adoption of development regulations. Following are relevant excerpts from WAC 365-195-915:

Criteria for including the best available science in developing policies and development regulations.

(1) To demonstrate that the best available science has been included in the development of critical areas policies and regulations, counties and cities should address each of the following on the record:

(c) Any nonscientific information -- including legal, social, cultural, economic, and political information -- used as a basis for critical area policies and regulations that depart from recommendations derived from the best available science. A county or city departing from science-based recommendations should:

(i) Identify the information in the record that supports its decision to depart from science-based recommendations;

(ii) Explain its rationale for departing from science-based recommendations; and

(iii) Identify potential risks to the functions and values of the critical area or areas at issue and any additional measures chosen to limit such risks. State Environmental Policy Act (SEPA) review often provides an opportunity to establish and publish the record of this assessment.

10.2 A Process for Characterizing Risk

Ideally, local jurisdictions will be taking steps to protect and manage wetlands at the different geographic scales discussed in previous chapters. Whether planning at the scale of the management area or the site itself, the risks can be characterized by answering a series of questions about the actions being proposed:

- What disturbances will be caused by a proposed action (e.g., change in land use through zoning, regulations that affect how land is used, etc.)?

- What risk do these disturbances pose to the functions and values of wetlands?
- What measures are proposed to minimize the risk or replace the resource at risk?
- Do these measures reduce the risk to acceptable levels?

10.2.1 Identifying the Environmental Disturbances Caused by Proposed Solutions

Volume 1, Chapter 3, summarized the different types of environmental disturbances that can occur as humans modify natural ecosystems to meet our needs. The plans, regulations, and other approaches taken by local jurisdictions to direct and control the use of land can therefore also be characterized in terms of the disturbances they may allow, or rectify. The first step in characterizing the risk, therefore, is to identify how a specific type of land use activity may cause an environmental disturbance.

The characterization of risks should start with a thorough list of the different solutions being proposed to protect and manage wetlands (zoning categories, regulations, exemptions, ordinances, and so on). Each of these has the potential to cause an environmental disturbance by allowing certain land uses to occur or by changing the current land use to some other one.

The types of environmental disturbances identified in Volume 1 include:

- Changing the physical structure within a wetland (e.g., filling, removing vegetation, tilling soils, compacting soils);
- Changing the amount of water (increasing or decreasing the amount);
- Changing the fluctuation of water levels (frequency, amplitude, direction of flow);
- Changing the amount of sediment (increasing or decreasing the amount);
- Increasing the amount of nutrients;
- Increasing the amount of toxic contaminants;
- Changing the water temperature;
- Changing the acidity (acidification);
- Increasing the concentration of salt (salinization);
- Decreasing the connection between habitats (fragmentation); and
- Other disturbances (noise, etc.).

For example, at the scale of the management area, areas zoned as urban have the potential to change the patterns of water flow, increase the input of nutrients and toxic compounds,

and cause fragmentation of the landscape. Areas zoned as high-density residential have the potential to change patterns of water flow, introduce toxics from lawn care, and disturb wildlife by introducing predation by pets.

An example of disturbances caused by management actions at the site scale is that of allowing single-family residences, as an exemption, in the buffers of wetlands. Such an action would allow disturbances from nutrients and toxics (lawn care), pets, and possibly a change in water regime to occur.

Table 10-1 provides an example of how the environmental disturbances and risks associated with various management actions could be summarized.

Table 10-1. An example of a table summarizing risks associated with common land use actions.

Action	Disturbance caused by allowing action	Risk of disturbance to wetland functions and values
Urban zoning in a recharge area	Change in water regime, increased surface runoff, and less infiltration	High for wetlands fed by groundwater and for those that will receive the direct runoff from paved surfaces
Permit fill of wetlands	Change in structure of wetland and loss of wetland area	High for functions within wetland
300 ft buffers for wetlands with a high habitat score	Minimal	Low
200-300 ft buffers for high habitat score	Will allow some disturbance of wildlife and limit upland zones suitable for amphibians	Moderate
< 200 ft buffers for high habitat score	Significant disturbance of wildlife	High

10.2.2 Identifying the Risk of Disturbances to the Functions and Values of Wetlands

Not all human-caused disturbances will result in significant impacts to the functions and values of wetlands in a jurisdiction. Once all the possible disturbances have been identified (as discussed in the previous section), the next step in the characterization of risk is to identify which of the proposed land use actions have the greatest risk of impacting wetlands. This task is best done using maps, especially at the scale of the management area. The process described in Chapter 5 for performing a landscape analysis can be used to identify what parts of the landscape within the management area are sensitive to the different types of disturbance that may be generated by proposed land use actions.

For example, if wetlands are located in an area zoned as urban or residential, then the risk to these wetlands is high as a result of the disturbances these land uses generate. Creating

impervious surface in areas where water infiltrates rapidly into groundwater creates a risk to wetlands that rely on that groundwater.

Regulations that focus on the wetland sites themselves can also be analyzed in terms of the risks they pose to wetlands. For example, the exemption of single-family residences in the buffer of a wetland (mentioned previously) would pose a much higher risk to wetlands that have a high habitat value than those that function poorly as habitat. Actions to reduce the risk to wetlands should also be considered in this characterization.

Areas that are proposed for restoration or preservation as part of a jurisdiction's planning process should be considered in terms of how these actions might reduce the risks to wetlands. For example, the restoration of a diked field to a floodplain wetland would improve the flood storage function of wetlands and reduce the overall risk to the jurisdiction from losses of this wetland function.

10.2.3 Proposing Measures to Minimize the Risk or Replace the Resource at Risk

If the characterization of risk indicates that some of the regulations, policies, or plans pose a risk to the functions and values of wetlands in a jurisdiction, it is important to identify what actions can be taken to minimize this risk. For example, if a comprehensive plan calls for urban development in an area where groundwater is recharged, the risk to the aquatic resources can be reduced by requiring that all runoff be infiltrated on-site, or that paved areas use some of the more innovative approaches such as permeable surfaces.

A summary table such as that shown in Table 10-2 can be used to document the risks identified and the actions taken to minimize risks.

Table 10-2. An example of a table summarizing the risks of land use actions and measures to minimize the risks.

Action	Disturbance caused by action	Risk of disturbance to wetland functions and values	Measures to minimize risk	Does this reduce risk to acceptable level?
Urban zoning in a recharge area	Change in water regime, increased surface runoff, and less infiltration	High for wetlands fed by groundwater and for those that will receive the direct runoff from paved surfaces	Change development standards in recharge area to require all surface water to be infiltrated	yes
Permit fill of wetlands	Change in structure of wetland and loss of wetland area	High for functions within wetland	1. Require compensation at ratios that will ensure no net loss 2. Ensure compliance 3. Do not permit fill in wetlands that cannot be replaced (e.g., bogs)	maybe

The King County example of a characterization of risk

As part of revisions to its critical areas ordinance, King County has prepared an *Assessment of Proposed Ordinances* that describes the risks to resources from the county's proposed regulatory and non-regulatory actions. Section 2.9 from Chapter 2 of the King County report describes the risks to the wetland resource from actions such as specified buffers, allowed alterations, classification (rating), and mitigation requirements. One section of the King County report is reproduced in Appendix 10-A of this volume. The report is also available on the web at http://www.metrokc.gov/ddes/cao/.

Chapter 11

Implementing Regulatory and Non-Regulatory Programs

11.1 Introduction

This chapter discusses key aspects of implementing regulatory and non-regulatory programs. Implementing such programs to protect and manage wetlands is Step 3 in the four-step framework discussed in this volume (Figure 11-1).

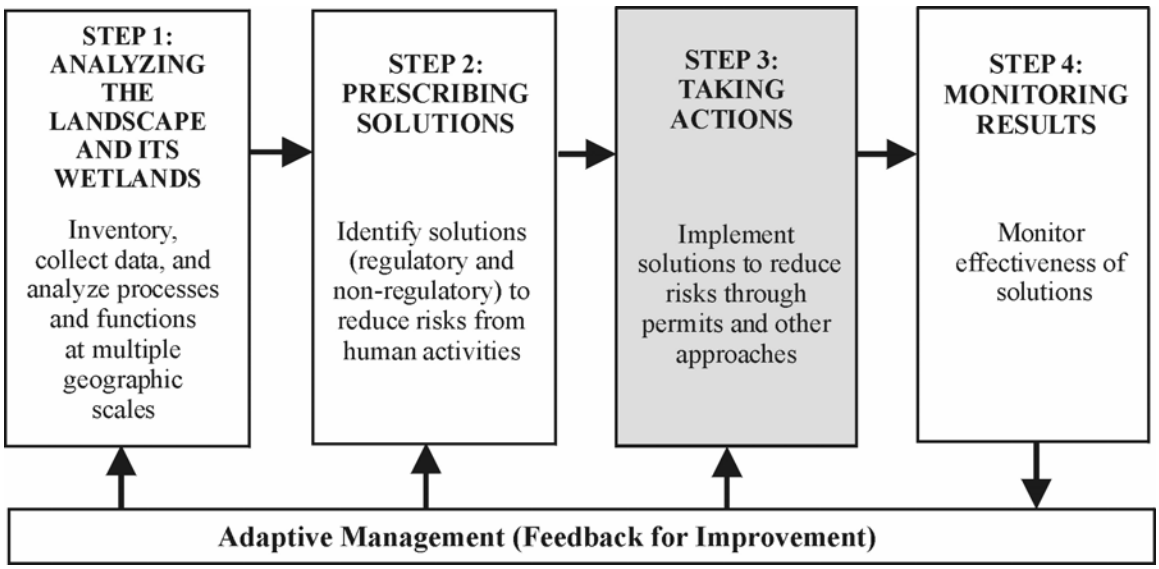


Figure 11-1. Implementing regulatory and non-regulatory approaches is Step 3 in the four-step framework presented in this volume.

11.2 Implementing a Regulatory Program

The single most important element in ensuring effective implementation of a regulatory program is having adequately trained staff. It can also be important to have educational materials for applicants and citizens.

11.2.1 Adequately Trained Staff

Most critical area regulations pertaining to wetlands allow for some discretion in applying the regulations to site-specific situations. Even when regulations are written in

a prescriptive fashion, many applicants and/or their consultants will make a case for why their projects should be treated differently. In many instances, a consultant will be an individual with extensive experience and credentials in wetland science, and it can be difficult for a local planner to respond in a reasonable and appropriate manner to requests for differential treatment. Additionally, while most applicants and their consultants provide accurate and complete information, occasionally a planner will be confronted with information that is inaccurate or incomplete. It is critical that the planning staff responsible for implementing wetland regulations have the knowledge to be able to effectively review submitted information and determine if it is accurate and complete.

To effectively implement a wetland regulatory program, staff should have at least a basic knowledge of the following topics:

- Wetland delineation;
- Wetland rating;
- Wetland function assessment;
- Potential impacts to wetlands from different types of development projects; and
- Wetland mitigation, including site selection and design, monitoring, maintenance, etc.

While some larger jurisdictions can afford to have a wetlands specialist on staff, most local jurisdictions have to rely on staff who wear many hats and who do not have the background or time to learn all that they need to know to effectively administer wetland regulations. To address this situation, many jurisdictions contract with a third-party consultant to provide the expertise needed to review submitted documents; field check delineations, ratings, and function assessments; and provide recommendations for approval, denial, or conditioning of permits.

11.2.2 Educational Materials

Many landowners and project applicants find it difficult to understand regulations and the requirements for application submittals. Additionally, many landowners do not understand why wetlands are important and why regulations are needed. Brochures and other informational materials that explain why wetlands are important, why regulations are necessary, and how applicants can get assistance can be very helpful and save planning staff a lot of time.

While general materials on some of these topics are available from federal and state agencies, locally developed materials may be the most useful.

11.3 Implementing a Non-Regulatory Program

Implementing local comprehensive plan directives for non-regulatory actions requires the establishment of a program framework, in the same way that regulatory controls require a program with dedicated staff, coordination, and funding. Actions to conserve, preserve, or restore lands that have been identified in Green Infrastructure plans or comprehensive plans (discussed in Chapters 6 and 7) require certain program elements for implementation. Components of a non-regulatory program (mentioned earlier in Chapter 9) include:

- Program staffing – coordinator, support staff, site management;
- Identification, mapping, and prioritization of geographic areas where non-regulatory tools will be applied;
- Funding mechanism(s) for conducting locally sponsored project actions;
- Incentive tools for engaging landowner participation;
- Education and technical outreach to the public and landowners;
- Project partners to help locally sponsored projects; and
- Monitoring of project sites and overall program success.

An overview of each of these program components is provided below.

For more information about setting up a non-regulatory program, see *Designing Wetland Preservation Programs for Local Governments: A Guide to Non-Regulatory Protection* (Ecology publication #92-18). This publication is slightly dated but still offers a general discussion of some of these components.

11.3.1 Staffing a Non-Regulatory Program

A non-regulatory program should have a dedicated staff coordinator. The role of the coordinator is to oversee implementation of the program by addressing such tasks as:

- Identifying appropriate sites for preservation and restoration;
- Working with landowners to apply better conservation practices;
- Establishing and updating incentive and funding programs;
- Engaging in education and outreach activities;
- Providing technical assistance for non-regulatory actions;

- Overseeing voluntary action projects sponsored by the local jurisdiction by raising grant funds, forming partnerships for assistance, shaping technical design, conducting site monitoring, etc.;
- Supervising support staff or volunteers within the program; and
- Coordinating with other departments.

How many of these tasks the coordinator will need to perform will depend on the size of the program and whether there are other staff employed by the local jurisdiction. This will reflect the capacity of the local government based on its size and its emphasis on using a non-regulatory approach.

Along with staff to implement the program components, there will usually need to be a recipient department, such as parks or public works, to receive the project sites and manage them over the long term. The alternative would be for the property to be passed to a state agency or non-profit land trust. However, state agencies may not be willing to accept any new properties to manage, and land trust organizations will require a management endowment. There are different ways to address this issue; the solutions will depend on whether the local jurisdiction buys lands in full fee and wishes to own and manage them over time. If not, some other entity such as a land trust partner might hold the land or a conservation easement in perpetuity. The land trust may even be willing to manage the lands as well.

11.3.2 Mapping and Prioritizing Sites

Site mapping and prioritization will have begun during the earlier planning stages, ideally with the background of a landscape analysis and directives from a Green Infrastructure plan that help to prioritize known project sites (see Chapters 5 and 6 for further discussion). If these plans have not been completed by the local jurisdiction, then the acquisition and restoration program could operate more opportunistically, or the jurisdiction could decide on potential project areas based on technical reports and studies that point to desirable sites. In either case, projects will usually need to be prioritized for sequential implementation.

Additional review and strategizing will probably be needed as implementation of the non-regulatory program begins. This might involve sorting through the various subbasins or sensitive landscape areas within the entire management area to focus on sites with immediate threats or opportunities, and deciding what projects can be funded over the immediate fiscal period. Prioritizing will likely be conducted on an ongoing basis as funding, staff, and opportunities fluctuate.

11.3.3 Establishing Funding Mechanisms and Landowner Incentive Tools

Funding mechanisms and landowner incentives were reviewed in Chapter 9. These tools play an essential role in non-regulatory programs. Having a funding tool is an absolute necessity to a local government that wishes to conduct voluntary preservation and restoration projects. Without a local funding source to provide a match, state and federal grant programs cannot be accessed. Lists of funding programs are provided in *Exploring Wetlands Stewardship: A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004).

One very strong funding tool is the Conservation Futures Levy. This levy can be implemented by legislative ordinance and a portion of the funds dedicated to preservation and restoration projects (see Chapter 9 for further details).

Landowner incentives are also essential for engaging citizens in voluntary conservation actions and are discussed in detail in Chapter 9. In particular, local jurisdictions may wish to consider the value of establishing a watershed-based Public Benefit Rating System (PBRS) to implement their Current Use Taxation Program for "Natural" Open Space. The results of a landscape assessment can be integrated into a PBRS program as discussed in Chapter 9.

When incorporating preservation and restoration in order to implement a Green Infrastructure plan, it is particularly appropriate to utilize local infrastructure funds such as special purpose district levies, in-lieu fees, and direct general fund appropriations.

11.3.4 Educating the Public

Education is an initial and ongoing need as part of implementing non-regulatory programs. Education is also vital for Green Infrastructure planning or the development of a comprehensive plan element to direct non-regulatory efforts (as discussed in Chapters 6 and 7). Often decision-makers and the public view the upfront expenditures required to implement a non-regulatory effort as unjustified without factoring in the long-term costs of building infrastructure or the tax savings resulting from open space (see Chapter 6 for information on these fiscal savings).

Education is essential to providing the public with an accurate understanding of why non-regulatory programs are valuable to the community, as well as the landscape, and how people can become involved in non-regulatory activities. Education and outreach efforts are key factors in increasing enrollment in incentive programs. They encourage the public to get involved through voluntary actions either on their own property or by supporting local projects (for example, through monitoring of sites). In so doing, educational efforts can also improve support for regulatory programs.

11.3.5 Creating Partnerships for Locally Sponsored Projects

While landowner incentives are important, direct preservation of key critical areas is also essential to maintaining landscape processes through time. As discussed in Chapter 9, preservation employs the permanent protection of land through either full fee title ownership of all property rights, or partial ownership of the development and/or use rights of the land through application of a conservation easement. Completing these types of transactions can be complex and take time. Local governments often benefit from partnerships with other agencies or organizations to accomplish preservation projects.

Land trusts offer the services of brokering land acquisitions, raising acquisition funds, and marketing tax benefits to landowners. Land trusts protect land permanently, they work directly with landowners to secure the land transaction, they are knowledgeable about the land resource and the tax advantages of land preservation, and they are perceived as non-adversarial by landowners (see Appendix 9-A.) Land trusts often engage the voluntary assistance of retired resource professionals who can provide technical help with site assessments and monitoring.

Additionally, a national land trust called the Trust for Public Land will assist in securing properties for governments when funding is pending and the window of opportunity to preserve a parcel is short. TPL releases the property to the jurisdiction when funding is available. Information on land trust partners and other partners, as well as funding program opportunities, can be found in the publication *Exploring Wetlands Stewardship: A Reference Guide for Assisting Washington Landowners and Communities* (Rubey 2004).

State and federal agencies are also excellent partners to assist with non-regulatory efforts. These agencies can help with securing grant funding for projects. They can also offer technical knowledge about wetland functions, restoration techniques, and long-term management. Agency assistance is provided at no charge to the local jurisdiction.

Either internal coordination or **internal partnerships** will also be needed between planning staff and site management staff (such as parks or public works departments) who may be the recipients of lands that have been purchased and/or restored. As mentioned earlier, site ownership and management may be handled by an external partner such as a land trust or state agency.

Partnerships with other **non-profit organizations** such as Audubon or Ducks Unlimited may be essential to completing site monitoring tasks (such as bird counts on restored wetlands) and for implementing actual site restoration plans.

11.3.6 Monitoring

When implementing a program for preserving and/or restoring wetlands, the local jurisdiction will be concerned with monitoring at both the site level and the program level.

At the site level, local governments will:

- Allocate incoming Conservation Futures dollars, or other funds, to secure properties;
- Engage in restoration tasks such as breaching dikes, removing exotic plants, planting vegetation, etc.; and
- Monitor site conditions and manage preserved and restored lands.

At the program level, they will:

- Target annual preservation and restoration site completion goals for progress with achieving the objectives of Green Infrastructure plans or conservation plans;
- Enroll landowners in incentive programs such as current use taxation;
- Educate citizens about local stewardship activities; and
- Offer technical assistance.

Monitoring the effectiveness of these efforts provides an essential feedback loop for making course corrections on project sites and for revising practices used to implement programs. Monitoring is discussed in more detail in Chapter 12.

Chapter 12
Monitoring and Adaptive Management

12.1 Introduction

Monitoring and adaptive management (Figure 12-1) have often been low priorities in our efforts to manage natural resources. Funding, staff availability, and technical issues may make a monitoring program prohibitive for some jurisdictions. In addition, monitoring may also expose what are perceived as failures (Washington State Joint Natural Resources Cabinet 1999).

However, the benefits of a successful monitoring program can be substantial. Many actions taken to protect and manage wetlands have to be considered as experiments because we have not tracked their success in the past. We do not know, or fully understand, all the cause and effect relationships between human actions on the land and the functions performed by wetlands. Thus, we cannot fully predict the outcome of actions taken to protect and manage wetlands.

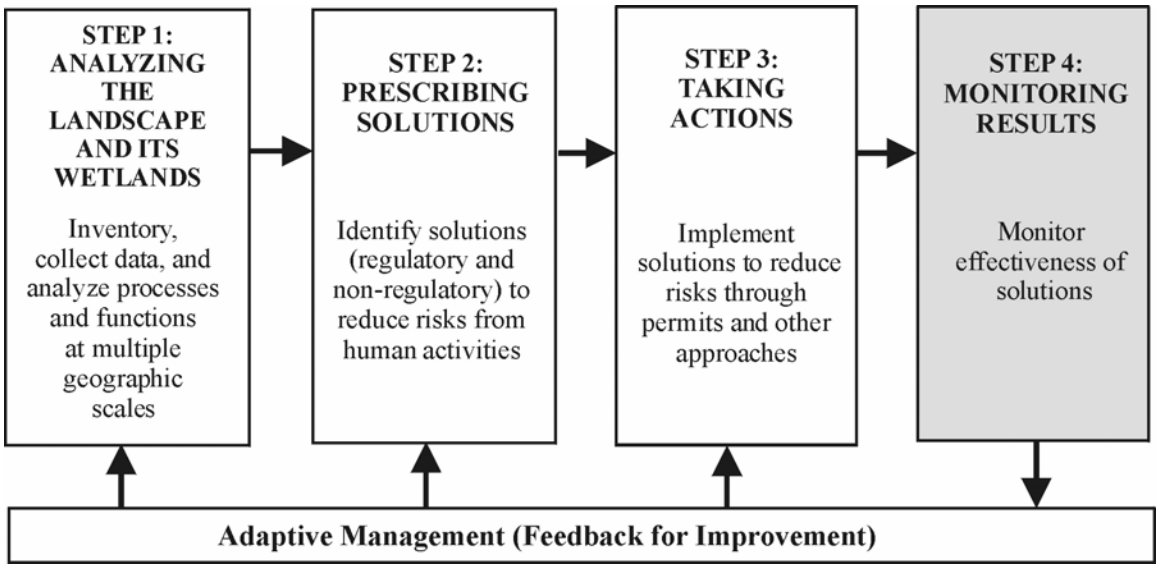


Figure 12-1. Step 4 in the process of protecting and managing wetlands is monitoring (shaded box). Adaptive management (lower box) is a systematic process for continually improving management policies and practices by learning from the outcomes of previous policies and practices.

Monitoring in the context of "adaptive management" is the most efficient way to face this uncertainty. Adaptive management represents a commitment to change approaches for protecting and managing wetlands and to redirect resources as warranted by new

information, even if such change is difficult or unpopular (Washington State Joint Natural Resources Cabinet 1999).

The focus is to monitor the effectiveness of actions taken in Steps 2 and 3 described in previous chapters, and to change the actions as needed. The process is iterative as shown in Figure 12-2. Data collected through monitoring are used to reassess the resource and provide the basis for modifying the solutions and implementation of the program. The goal is to implement a system for modifying past decisions, if needed, that is based on the best available science and that uses new information generated from monitoring the specific actions taken.

A commitment to adaptive management by a local jurisdiction means that there is a willingness to revisit and change past decisions if needed. All aspects of plans, regulations, and other actions should be reconsidered if the monitoring data show there is further loss of wetland functions and values. There is no point in undertaking a program to monitor the resource if there is no willingness to change as a result of new data.

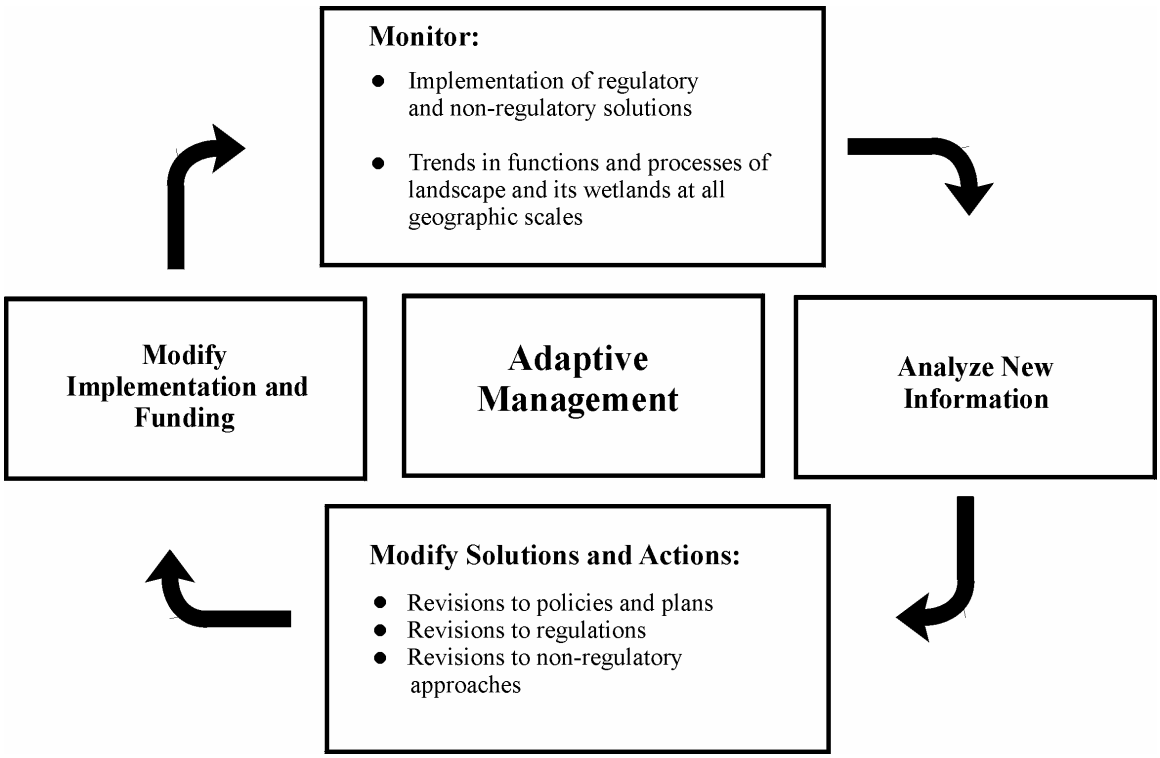


Figure 12-2. Conceptual representation of how wetlands can be protected and managed using adaptive management. Adaptive management implies that the process does not end with the completion of the four steps but keeps cycling.

12.2 What Should Be Monitored?

Monitoring associated with protecting and managing wetlands by local jurisdictions can be divided into three categories, as listed below. All aspects of monitoring are important

in providing feedback to guide decisions for adaptive management. If the functions and values of wetlands are not adequately protected, managers need to know whether this results from inadequate implementation, inadequate standards, or inadequate strategies.

- **Monitoring trends** tracks landscape processes and the wetland resource over time at all geographic scales and records changes in functions and values at individual wetlands. The monitoring should determine if the goals and objectives established for the wetland resource by a local jurisdiction are being met. Monitoring trends is critical in interpreting the effectiveness of efforts to protect and manage wetlands.

- **Monitoring implementation** addresses the extent to which the regulatory and non-regulatory actions proposed in plans and regulations have been taken. This type of monitoring provides a basis for tracking the actions taken and for quality assurance.

- **Monitoring the effectiveness of strategies** addresses how effectively the complete program meets explicit objectives or desired future conditions. This type of monitoring will usually involve working together with other jurisdictions, and it will probably require some assistance from state and federal agencies.

Different strategies are needed to monitor at different geographic scales. In addition, the objectives of a monitoring program may be met in many different ways, not all of which require extensive collection of data. It is not the intent of this chapter to describe the different monitoring strategies and methods that can be used. These will depend on the wetland resources present in a local jurisdiction, the goals and objectives set by that jurisdiction, the solutions they propose, and the actions they take

The following sections outline some of the basic questions that need to be addressed through monitoring for an adaptive program that protects and manages wetlands.

12.2.1 Monitoring Trends in the Resource

The goal of monitoring trends in the wetland resource is to understand if, and how, the landscape processes that control structure and functions within a wetland have changed as a result of changes in land use. The resource needs to be monitored at the contributing landscape scale, the management area scale, and the site scale.

The analysis can be undertaken using the methods and tools discussed in Chapter 5. Regardless of the methods used, however, there is one major question that needs to be addressed through monitoring: *Have land use changes altered landscape processes to the extent that they impact the functions of wetlands in a jurisdiction?* Changes to processes and functions can be either negative, indicating further degradation, or positive, indicating that restoration is succeeding.

This type of monitoring involves identifying:

- Have the major sources of water to the system and flow paths been changed (either degraded or restored)?
- Have the major sources of sediment to the water system changed?
- Have the major sources of nutrients to the system changed?
- Have the major sources of toxic compounds to the system changed?
- Have there been any changes to relatively undisturbed connections between natural habitats?

The objective for monitoring trends at the wetlands themselves is to answer the question: *Have the functions and values of each individual wetland within the jurisdiction changed?*

Continuously monitoring all wetlands, or even a random subset of them, in a jurisdiction is optimal but may not be feasible because of the cost. In the absence of such a program, it is suggested that a local jurisdiction track trends by analyzing the wetland assessments that applicants submit when they propose actions at individual sites. Qualitative trends can be tracked by noting the overall changes in the quality or functions of wetlands being proposed for alteration within each hydrogeomorphic class (depressional, riverine, etc.) or special wetland type (bog, forested, etc.).

Restoration of wetland functions at non-regulatory project sites should also be monitored to determine if the objectives of the projects are being met.

12.2.2 Monitoring Implementation

Monitoring implementation addresses the extent to which the measures proposed for protecting and managing wetlands have been taken as planned. The objective of this task is to determine if the solutions developed in Step 2, Prescribing Solutions, are actually carried out as planned.

12.2.2.1 Monitoring Implementation at the Contributing Landscape Scale

Monitoring the implementation of solutions developed at the scale of the contributing landscape depends on whether the contributing landscape falls entirely within the jurisdiction or if it includes several jurisdictions. In the former case, monitoring the contributing landscape is the same as monitoring the “management area” described below. If the contributing landscape spans several jurisdictions, then the monitoring needed will be based on the objectives of the plans and solutions developed among the jurisdictions.

It is not possible in this document to cover how to monitor all the possible watershed plans, regional plans, partnerships, etc. that can be developed. However, it is important that each objective identified in such plans should have associated with it measures for monitoring its implementation. For example, a watershed plan may have an objective that all jurisdictions in the watershed adopt the same method for rating wetlands to ensure that wetland functions are characterized in the same way throughout the watershed. Monitoring the implementation of this objective involves keeping track of when each jurisdiction adopts the chosen wetland rating system.

12.2.2.2 Monitoring Implementation at the Management Area Scale

Monitoring the implementation of solutions developed at the scale of the management area is a matter of keeping accurate records of the actions taken by the jurisdiction to protect and manage wetlands, and a commitment to compile and analyze the data at specified intervals. The analysis should be based on comparing the actual actions taken against the actions proposed in the original comprehensive plan, critical areas ordinances, shoreline master programs, etc.

For example, a critical areas ordinance may state that each permit for modifications to a wetland requires that the wetland be rated on its functions and values. Monitoring the implementation of this item would require keeping records of how may permits were issued that had the wetlands rated, and how many were issued without the rating.

This type of monitoring should also be applied to non-regulatory programs. For example, if a jurisdiction has a program to acquire conservation easements on lands that it considers important to maintaining landscape processes, it should monitor how many easements have been acquired compared to the total number needed.

Table 12-1 lists some of the common solutions used by jurisdictions in protecting and managing wetlands. Keeping records of these solutions will provide the basis for monitoring the implementation at the scale of the management area.

Table 12-1. Monitoring common planning, regulatory, and non-regulatory solutions to protecting and managing wetlands.

Action	What to Monitor
Zoning	Number of zoning variances permitted
Development standards for areas sensitive to disturbance	Number of variances permitted
Setbacks to protect resource	Number of variances permitted Number of violations
Preservation of important wetlands	Number of acres with conservation easements or fee title
Conservation of wetland resources	Number of acres enrolled in Current Use Taxation program or other applicable programs
Voluntary restoration of wetlands	Number of acres successfully restored

12.2.2.3 Monitoring Implementation at the Site Scale

Monitoring the implementation of solutions developed at the site scale is a matter of keeping accurate records of the permits approved and other actions taken at individual sites. This includes, for example, monitoring the success of actions taken to restore wetlands, enforcement actions, follow-up site visits, and compliance with permit conditions. The review of the scientific information presented in Volume 1, Chapter 6, highlighted the fact that many projects that compensate for impacts to wetlands are not successful because there has been no follow-up. Therefore, follow-up for compensatory mitigation projects is very important.

12.3 What is Adaptive Management?

Adaptive management has been defined in various ways since its development in the early 1970s. Different people and organizations continue to have somewhat differing views of the best definition for their purposes. In order to bring some consistency and clarity, the following working definition for this concept is used in this chapter:

> *Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of previous policies and practices.*

The goal of adaptive management, in the context of managing wetlands by local jurisdictions, is to implement a system for making decisions that is guided by the best available science and that uses new information generated from the monitoring of the resource. The process is iterative as shown in Figure 12-2. Monitoring results in new data that provide the basis for revising past decisions, and these revised decisions are then monitored.

Adaptive management is based on the assumption that managed ecosystems are complex and inherently unpredictable. The approach admits that, at present, humans do not know enough to manage ecosystems. Adaptive management, from this perspective, treats management policies and practices as experiments that assess the responses of an ecosystem as human behavior changes (Lee 1999). The goal is to learn and change objectives as needed. However, this approach has often not been considered the mark of a good manager, who is rewarded instead for steadfast pursuit of objectives (Lee 1999).

Since a program of adaptive management is linked to the monitoring of the resource and the implementation of plans, it is not possible in this report to outline specifically what such a program should entail. The details will depend on the solutions for protecting and managing wetlands that are proposed by each jurisdiction. The important point to stress is that adaptive management will only work if there is a willingness to monitor and then actually change polices and practices.

Some of the characteristics of adaptive management are:

- Acknowledgement that there is still much uncertainty about what policy or practice is best for the particular issue related to protecting and managing wetlands;
- Careful implementation of a plan of action designed to reveal the knowledge that is currently lacking;
- Monitoring of both the resource and the implementation of plans and practices;
- Analysis of the outcomes of policies and practices in terms of the original objectives; and
- Incorporation of the results into future decisions.

A brief history and additional resources for adaptive management

The text below is adapted from the University of Oregon (http://oregonstate.edu/instruction/anth481/ectop/ecadm.html).

C.S. Holling and several colleagues developed the concept of adaptive management at the University of British Columbia's Institute of Resource Ecology in the late 1960s. Adaptive management reached the scientific literature in Holling's book, *Resilience and Stability of Ecological Systems*, published in 1978. The emphasis of the Holling approach is to experiment to learn the boundaries of natural systems. Holling and his colleagues worked with resource managers in British Columbia on a number of management experiments and public participation workshops, testing the process.

Adaptive management became an important concept in resource management in the United States when K.N. Lee introduced it to the Northwest Power Planning Council in 1984. Lee learned about adaptive management from Randall Peterman, who in February 1984 gave a talk about experimental management. Subsequently, different forms of adaptive management have become part of the Northwest Forest Plan, the Oregon Plan for Salmon and Watersheds, the Oregon Department of Forestry Plan to manage state forests, and many other processes for resource planning.

For additional information on adaptive management, see:

Holling C.S. 1978. *Adaptive Environmental Assessment and Management.* John Wiley & Sons.

Walters, C. 1986. *Adaptive Resource Management*. The Free Press.

Lee, K.N. 1993. *Compass and Gyroscope*. Island Press.

Lee, K.N. 1999. Appraising adaptive management. *Conservation Ecology* 3(2): 3. Available at: http://www.consecol.org/vol3/iss2/art3

Adaptive Management Practitioners' Network: http://www.iatp.org/AEAM/index.html

The Adaptive Management Network creates and supports learning and mentoring opportunities for practitioners linking science and collaboration to address critical, practical, and complex ecological and institutional challenges.

Appendix 1-A
Members of Core Team and Local Government Wetlands Advisory Team

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Appendix 5-A
Sources of Existing Data for Use in Landscape Analysis

Type of Information	Database	Source
100-year floodplains	FEMA	Federal Emergency Management Agency
Boundaries of Water Resource Inventory Areas that can be used to define the contributing landscapes	WRIA/24	Ecology
Geologic formations under the soils	Surficial Geology	Washington State Department of Natural Resources http://www.dnr.wa.gov/geology/dig100k.htm
HGM Classification	Combine DEM with Hydric Soils and Wetland Inventory	See Appendices 5-B and 5-C for Ecology methods
Land use	STATE/LULCL	Ecology
Location, size, and type of wetlands in a landscape	NWI (National Wetland Inventory)	U.S. Fish and Wildlife Service NWI is available either in paper maps or in digital format (http://wetlands.fws.gov/downloads.htm)
Mapping of streams and rivers	HYDRO	Washington State Department of Natural Resources
Priority Habitats and Species	Priority Habitats and Species (several data layers)	Washington State Department of Fish and Wildlife
Roads and rails	TRANS	Washington State Department of Natural Resources
Salmon and fish use	WARIS	
Soil types	SOILS	USDA, Natural Resources Conservation Service http://www.ftw.nrcs.usda.gov/stat_data.html
USGS quadrangle data (7 ½')	QUADS	Washington State Department of Natural Resources
USGS topographic grid data	GRID/LAT75 ELEVATION GRID	University of Washington http://duff.geology.washington.edu/data/raster/index.html Ecology

Appendix 5-B
Methods and Information Resources for Use in Analyzing Landscapes and Wetlands

This appendix presents methods and general references regarding analysis of the landscape and its wetlands as well as assessment of the characteristics and functions of individual wetlands. It includes a brief description of the approach that the Department of Ecology is developing for analyzing the landscape. Appendix 5-C contains examples of Ecology's landscape analysis as conducted in the City of Leavenworth and in Whatcom County. Chapter 5 of this volume presents a number of questions, regardless of the method used, that should be answered when conducting landscape analysis.

Methods for analyzing the larger geographic scales (contributing landscape, management area) are, however, only starting to be implemented in Washington to assist local governments in developing plans, regulations and non-regulatory approaches to protect landscape processes and wetlands. Therefore, there is very little information about the effectiveness of these methods at providing the information necessary to manage and protect wetlands from this broader perspective.

On the other hand, methods for analyzing the functions and characteristics of individual wetlands have been extensively tested in Washington State. Numerous methods are summarized in this appendix.

References on Landscape Scale Processes in the Pacific Northwest

The following books are recommended for developing an understanding of landscape processes in the coastal region of the Pacific Northwest. Though these books focus on riverine ecosystems, the concepts, principles, and research presented are very useful in understanding the interaction of processes that occur at larger geographic scales with all wetland types.

Naiman, R. and R. Bilby (eds.). 1998. *River Ecology and Management: Lessons from the Pacific Coastal Ecoregion.* Springer-Verlag, New York. 705 pgs.

From the publisher's abstract:

> *Touching all parts of the natural environment and nearly all aspects of human culture, streams and rivers act as centers of organization within landscapes. They provide natural resources such as fish and clean water,*

> *transportation, energy, diffusion of wastes, and recreation. A basic ecological understanding of the structure and dynamics of running waters is needed to formulate sound management and policy decisions. The vast Pacific coastal ecoregion of the United States contains an extraordinary array of physical setting and examples of the range of dynamics associated with rivers and their management. The interface between the science and policy of natural resource management is illustrated by examples from this ecoregion, including the protection riparian forest, the marbled murrelet, salmon, and amphibians. This study includes sections on the physical environment, the biotic environments, ecosystem processes, management, and recommendations for the future. Specific topics include channel dynamics, hydrology, water quality, microbial process, primary production, fish and wildlife, riparian forest dynamics, organic matter and trophic dynamics, biogeochemical cycling, maintaining biodiversity, monitoring and assessment, economic perspectives, legal consideration, and the role of non-governmental organizations in river management.*

In particular, Chapters 2 through 4 in Part I (Physical Environment), Chapters 11 and 12 in Part III (Ecosystem Processes), and Chapters 19 and 20 in Part IV (Management) are very useful in understanding landscape processes and how to approach assessment at a watershed scale.

Montgomery, D., S. Bolton, D. Booth, and L. Wall (eds.). 2003. *Restoration of Puget Sound Rivers.* University of Washington Press. 512 pgs.

From the publisher's abstract:

> *In the Pacific Northwest, as in most regions of the United States, we are still learning about the processes that create habitat and river structure, how those processes influence aquatic ecosystems, and how to gauge the response of river systems to both land-use change and restoration efforts. River systems are still responding to historic changes, and degraded habitat may not be restored successfully if natural conditions are not well understood, particularly if massive change in watershed hydrology or other processes are the root cause….The eighteen chapters of Restoration of Puget Sound Rivers – presented by the region's experts at a symposium of the Society for Ecological Restoration – examine geological and geomorphological controls on river and stream characteristics and dynamics, biological aspects of river systems in the region, and the application of fluvial river systems in the region, and the application of fluvial geomorphology, civil engineering, riparian ecology, and aquatic ecology in efforts to restore Puget Sound Rivers.*

In particular the first five chapters of this book are very useful in gaining an understanding of landscape processes and the effect of alterations on these processes.

The reference also addresses potential objectives for restoration based on landscape setting, geology, and land uses.

General References for Analysis at a Landscape Scale

The following books provide some general information about tools for analyzing wetlands and aquatic resources at the larger geographic scales. These may provide useful background information to anyone trying to develop an approach that will work in their jurisdiction.

Kroenert, R., U. Steinhardt, and M. Volk 2001. *Landscape Balance and Landscape Assessment*. Springer-Verlag, New York. 304 pgs.

Abstract from the publisher:

> *During the last decades, landscape ecology has developed tremendously. It concerns both the theoretical basis and practical application. The authors follow a hierarchical approach that is inherent in landscape structures and processes as well as in planning practice. They show first approaches for the inclusion of factors of the landscape balance into planning procedures and new methods (GIS-coupled modeling, remote sensing) combined with more classical approaches from the basis of landscape assessment. Approaches for multi-criterial landscape assessments will be presented also. The overall target is to give recommendations for sustainable land-use and management. Each chapter concludes with a synthesis of the theme under discussion. Ideas concerning the state-of-the-art are integrated as well as future trends in research. All methodological approaches will be explained with examples from differing regions.*

Heathcote, I.W. 1998. *Watershed Management: Principles and Practice.* John Wiley & Sons, Inc. 414 pgs.

Abstract from the publisher:

> *This book presents a flexible, integrated framework for watershed management that addresses the biophysical, social, and economic issues affecting water resources and their use. Comprehensive in scope and multidisciplinary in approach, it equips you with the necessary tools and techniques to develop sound watershed management policy and practice - from problem definition and goal setting to electing management strategies and procedures for monitoring implementation. Topics include watershed components and processes; establishing management plan parameters and objectives; stakeholder identification and consultation; development of practical management options; both simple and detailed methods for the assessment of management alternatives; techniques for determining the legal implications and the environmental, economic, and*

social impact of a management plan; and choosing the best plan and putting it into action. Supplemented with case studies and examples, Integrated Watershed Management is an ideal resource for upper-level students and professionals in environmental science, natural resource management, and environmental engineering.

Reimold, R.J. 1998. *Watershed Management: Practice, Policies, and Coordination.* McGraw-Hill Companies. 608 pgs.

Abstract from the publisher:

Ensuring a safe and adequate supply of water requires the combined efforts and expertise of resource managers, engineers, planners, technical experts, and policy analysts worldwide. This contributed volume is unique in recognizing this need and provides today's first truly comprehensive, international coverage of effective watershed management. Experts representing the full spectrum of environmental professions and viewpoints provide detailed case studies of how watershed management is being implemented around the world, focusing on the United States, France, the former Soviet Union, the Pacific Rim, the Nile River, and other areas. Successful approaches such as whole watershed and full stakeholder involvement; watershed sanitary surveys; urban watershed management; river basin planning; integrated management and water resource protection; watershed-based coastal management wetlands restoration; water quality monitoring and assessment; stormwater and other nonpoint pollution source management; water withdrawal; wastewater discharge permitting; and other tools for cost-effective watershed management are highlighted. Mathematical models demonstrate how various systems can be successfully managed for future sustainability.

Methods for Analyzing the Contributing Landscape and Management Area

The following list identifies a few methods that have been suggested or used for providing information that can be used in managing and protecting wetlands at the larger geographic scales.

EPA Synoptic Approach

Abbruzzese, B., and S.G. Leibowitz. 1997. A synoptic approach for assessing cumulative impacts to wetlands. *Environmental Management* 21(3): 457-475.

Leibowitz, S.G., B. Abbruzzese, P.R. Adamus, L.E. Hughes, and J.T. Irish. 1992. *A synoptic approach to cumulative impact assessment: A proposed methodology.* U.S. Environmental Protection Agency. EPA/600/R-92/167.

One of the case studies used to demonstrate the concept of the synoptic approach is Washington State. Abstract (from the authors):

> *The U.S. Environmental Protection Agency's Wetlands Research Program has developed the synoptic approach as a proposed method for assessing cumulative impacts to wetlands by providing both a general and a comprehensive view of the environment. It can also be applied more broadly to regional prioritization of environmental issues. The synoptic approach is a framework for making comparisons between landscape subunits, such as watersheds, ecoregions, or counties, thereby allowing cumulative impacts to be considered in management decisions. Because there is a lack of tools that can be used to address cumulative impacts within regulatory constraints, the synoptic approach was designed as a method that could make use of available information and best professional judgment. Thus, the approach is a compromise between the need for rigorous results and the need for timely information. It is appropriate for decision-making when quantitative, accurate information is not available; the cost of improving existing information or obtaining better information is high; the cost of a wrong answer is low; there is a high demand for the information; and the situation calls for setting priorities between multiple decisions versus optimizing for a single decision. The synoptic approach should be useful for resource managers because an assessment is timely; it can be completed within one to two years at relatively low cost, tested, and improved over time. An assessment can also be customized to specific needs, and the results are presented in mapped format. However, the utility of a synoptic assessment depends on how well knowledge of the environment is incorporated into the assessment, relevant to particular management questions.*

Department of Ecology's Landscape Approach

Ecology has developed an approach that characterizes landscape processes through an understanding of patterns of water flow and the movement of sediment, nutrients, and toxic compounds. It is based on research that landscape processes drive wetland structure and function. Patterns of water flow are described using several GIS-based data layers including landscape setting, topography, geology, and soils. Once water flow patterns are mapped and described, the relationships between landscape processes and both historic and existing wetland resources can be established. The approach also includes steps to describe existing and future alterations to landscape processes, and identification/ranking of wetland restoration areas and appropriate land use activities.

The purpose of Ecology's approach is to

- Provide information that can be used to sustain and restore ecosystems;
- Establish a common environmental framework for coordinating planning efforts;
- Assist in preparation of comprehensive plan and Shoreline Master Plan updates:
  - Provide direction on appropriate designations for land use and zoning;
  - Promote integration of the Growth Management Act and Shoreline Management Act (SMA);
  - Establish a framework for characterizing environmental processes and developing a restoration plan as required under the new SMA guidelines; and
  - Promotes "no net loss" of shoreline functions.

The Ecology approach involves the following five steps. The steps and accompanying checklists are to be used in conjunction with a PowerPoint tutorial, which is available online at: www.ecy.wa.gov/programs/sea/landscape.

1. Identify priority planning areas.
2. Characterize processes of water flow:

   2.1 Map geologic formations and identify relative level of permeability for each (if possible develop understanding of how surficial geology was formed).

   2.2 Develop plan view map of groundwater flow patterns using topography and contour lines.

   2.3 Identify other factors and their effect on water flow patterns (faults, precipitation patterns, etc.). Use historic information to assist in developing maps.

   2.4 Develop regional profile of groundwater flow.

   2.5 Summarize natural water flow processes.
3. Identify impacts to natural water flow processes from current land use.
4. Identify future development conflicts.
5. Identify compatible land uses and restoration areas measures.

Maryland Stream Corridor Assessment Survey

The following description was taken from the survey web page in April 2004: http://www.dnr.state.md.us/streams/stream_corridor.html

The Stream Corridor Assessment (SCA) survey was developed by DNR's Watershed Restoration Division as a tool to help environmental managers identify environmental problems and prioritize restoration opportunities on a watershed basis. As part of the survey, trained personnel walk the watershed's entire stream network and record information on a variety of environmental problems that can be easily observed within the stream corridor. Common environmental problems documented in the survey include: eroding stream banks, inadequate stream buffers, exposed pipes, altered stream channels, fish migration barriers, pipe outfalls, in-stream construction sites and trash dumping locations. In addition to identifying the location of common stream problems the survey also collects information on both in- and near-stream habitat conditions so that comparative assessments can be made of the condition of different stream segments.

It is important to note that Stream Corridor Assessment Survey is not intended to be a detailed scientific evaluation of a stream system nor will it replace the more standard chemical and biological surveys. Instead the survey is intended to provide a rapid method of examining an entire drainage network so future monitoring and management efforts can be better targeted. Part of the need for this type of survey is that many existing scientific surveys are very time consuming, expensive and can only collect information for a relatively small section of stream at any one time. The Stream Corridor Assessment Survey, on the other hand, is designed so that teams of 2 or 3 volunteers are able to survey 2 or more stream miles per day. Individuals performing the survey receive training in both stream ecology and how to conduct the survey.

North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS)

Sutter, L.A. and J.R. Wuenscher. 1996. *NC-CREWS: A Wetland Functional Assessment Procedure for the North Carolina Coastal Area (Draft)*. Division of Coastal Management, North Carolina Department of Environment and Natural Resources, Raleigh, NC. 61 pgs./appen.

The following description was taken from the NC-CREWS web page in April 2004: http://www.wes.army.mil/EL/emrrp/emris/emrishelp6/north_carolina_coastal_region_evaluation_of_wetland_significance_tools.htm. Note that this method was developed to rate wetlands in North Carolina. The indicators of function used would have to be modified to reflect conditions in the region of Washington where the method is being used.

Primary purpose: To predict the relative ecological significance of wetlands within their watershed and region using a GIS-based landscape-scale procedure. Developed for use in planning and overall management of wetlands rather than for regulatory decisions.

Eleven functions are addressed: surface runoff storage; floodwater storage; shoreline stabilization; terrestrial wildlife; aquatic life; nonpoint source; floodwater cleansing; landscape character; water characteristics; replacement difficulty; and restoration potential.

Procedure: Using GIS analysis, a High, Medium, or Low rating is assigned to each of 39 parameters that describe the landscape and internal wetland characteristics. The parameter ratings are successively combined to produce ratings (H, M, or L) for subfunctions and primary functions. The primary function ratings are combined to form an overall rating of the wetlands ecological significance (i.e., beneficial significance, substantial significance, or exceptional significance).

Output: Measure of overall ecological significance of a wetland within its watershed and the larger landscape.

Contact person: Jim Stanfill, Division of Coastal Management, North Carolina Department of Environment and Natural Resources, P.O. Box 27687, Raleigh, NC 27611 phone: (919) 733-2293; fax: (919) 733-1495; e-mail: jim_stanfill@mail.enr.state.nc.us

Limitations listed by authors: "The NC-CREWS models should not be used as a guide to design, however, individual variables (parameters) may provide useful information. It is not the intended purpose for the procedure, therefore, it contains properties that limit its application for this purpose. For example, NC-CREWS uses opportunity variables, but does not set upper limits on those opportunities that could potentially reduce functional capacity (e.g., a wetland located near a pollutant generating area is assigned a high rating). In some circumstances, a wetland may not have the capacity to remove all nutrient input. An upper limit on the opportunity must be defined to insure that the existing or planned wetland can predictably have the capacity to provide a function."

Spatial Wetland Assessment for Management and Planning (SWAMP)

Sutter, L.A., J.B. Stanfill, D.M. Haupt, C.J. Bruce, and J.E. Wuenscher. 1999. *NC-CREWS: North Carolina Coastal Region Evaluation of Wetland Significance.* North Carolina Division of Coastal Management, Department of Environment and Natural Resources. Raleigh, NC.

The following description was taken from the SWAMP web page in April 2004: http://www.csc.noaa.gov/lcr/swamp/text/p661.htm#intro. Note that this method was developed to rate wetlands in North Carolina. The indicators of function used would have to be modified to reflect conditions in the region of Washington where the method is being used. Ecology is presently working to adapt this method the coastal region of the Pacific Northwest.

The Spatial Wetland Assessment for Management and Planning (SWAMP) uses basic ecological principles to evaluate the significance of wetlands within a watershed while allowing the decision maker to establish the rules for overall rating. The model is based on the NC-CREWS model (Sutter et al. 1999) but has significantly faster processing time and offers greater flexibility in adjustment of parameters and rating rules. Three groups of functions are evaluated including water quality, hydrology and habitat.

Procedure: Requires digital information in GIS format. including:(1) wetland boundaries and types; (2) land cover; (3) soils data; (4) hydrography; and (5) watershed boundaries.

The functional significance of wetlands are rated (non quantitative) on the basis of three broad categories: exceptional functional significance, substantial functional significance, and beneficial functional significance.

Output: To produce information about the relative ecological importance of wetlands that would be useful for wetland planning and management..

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Limitations listed by the authors: The result of the procedure is not a substitute for a site visit in making regulatory decisions, but a predictor of what a site visit would determine. The parameters and thresholds developed for the ACE Basin would be more defensible if data had been collected to specifically support the assumptions behind each parameter.

Methods for Analyzing Wetland Sites

All projects involving impacts to wetlands will, at some level, be required to describe the functions provided by that wetland. The level of analysis will depend upon the type and

scale of the proposed impacts, such that the detail necessary will be commensurate with the impacts.

If Ecology is involved in a project, the applicant will generally be requested to apply the *Washington State Wetlands Rating System* to determine the category of the wetland and how well it performs certain functions. Regulatory agencies may request that an applicant complete an assessment of functions if wetland impacts will be significant and the wetland is in one of the classes for which a *Washington State Wetland Function Assessment Method* exists (see below).

The following is a list of methods that were specifically developed to analyze wetlands in Washington or are commonly used in the state.

Washington State Wetland Function Assessment Methods (WAFAMs)

WAFAMs are a collection of assessment methods developed by interdisciplinary teams of experts and published by Ecology. The methods are based on the hydrogeomorphic (HGM) classification for wetlands.

Advantages

- Relatively rapid for the scientific rigor of the assessments that result.
- Provide a numeric expression of the level of performance of wetlands in regard to their potential to perform and their opportunity to perform some functions.
- Developed for specific areas in Washington and for specific wetland types.
- Peer reviewed and field tested in the area for which they were developed.
- Results are reproducible to ± 10%, especially with training.

Limitations

- Large, structurally complex sites may require a couple of days.
- Site visits at different times of the year may be necessary to accurately determine the water regime (e.g., the length and extent of inundation).
- Specific training in the application of WAFAM is required before one uses it for regulatory purposes.
- WAFAM methods are lacking for specific wetland types of Washington. Methods do not exist for riverine wetlands in eastern Washington, for any montane areas, or for any slope, tidal, or dunal wetlands.
- Numeric results may be misused to assume scores are continuous functions rather than discrete integers.

Recommended Uses

- Projects involving significant wetland impacts in terms of size (e.g., >2 acres) or estimated level of performance of the wetland.
- Determine if functions lost to impacts have been adequately replaced in compensatory mitigation

Washington State Wetlands Rating System

The rating system is technically a characterization that groups wetlands based on sensitivity, rarity, functions, and other criteria.

Advantages

- Designed to classify wetlands into one of four categories which allow agencies/local governments to determine how the wetlands should be protected and managed.
- Rapid and relatively easy to perform; the vast majority of sites can be rated within 1 to 2 hours in the field.

Limitations

- Not an assessment of functions, but a characterization.
- May oversimplify the performance of functions needed to understand the wetland ecosystem in order to protect it, especially in large wetlands having several HGM types within one boundary.

Recommended Uses

- To determine into which category a wetland is classified: often for regulatory purposes to determine buffer widths and ratios for compensatory mitigation.
- May provide sufficient characterization of potential functions for impacts to small (e.g., <1 acre) degraded wetlands when determining needs for compensation.

Wetland Functions Characterization Tool for Linear Projects

This method is also a characterization. It uses a list of criteria for each function to guide decision-making. It relies on professional judgment regarding the likelihood that the function is being performed. The tools is available online at: http://www.wsdot.wa.gov/environment/biology/docs/bpjtool.pdf

Advantages

- Provides documentation of the criteria and rationale used when applying best professional judgment to analyze functions.

- Can be very rapid when used by trained wetland ecologists.
- Can also be used to characterize a portion of a larger wetland when a wetland exists on multiple properties and access to all parts of the wetland is restricted.
- Based on WAFAM which corresponds to "best available science."

Limitations

- Can't determine the level at which a function may be performed to plan compensatory mitigation.
- This method should not be used to measure change over time or as the result of alterations (e.g., impacts or mitigation).
- Method is subjective and results may vary significantly based on the experience and expertise of the user.

Recommended Uses

- Rapid screening of many wetlands to determine best areas for development or roads.

Semi-Quantitative Assessment Methodology (SAM) (Cooke 2000)

This method has not been published but is available on the web at http://www.cookescientific.com/SAM%20Stuff/SAM2000.pdf

SAM is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently. It is reviewed here because it is still used by some jurisdictions and wetland consultants.

SAM provides a rapid method for rating various wetland attributes, including functions, with high, medium, and low rating.

Advantages

- Easy to use and requires no specific training (some knowledge of wetland ecology would obviously be beneficial).
- Reproducible between users.
- Developed for western Washington.

Limitations

- Provides very general information.
- "Low" ratings miss many site-specific details that are important for protection and management.

- Allocates high ratings to large, rural, undisturbed wetlands, while smaller wetlands in urban areas rate lower.
- Should not be used for wetlands east of the crest of the Cascade Mountains

Wetland Evaluation Technique (WET) (Adamus et al. 1987)

WET is a rating method that was developed in the late 1980s by the U.S. Army Corps of Engineers in cooperation with Paul Adamus.

WET is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently.

Wetland Values: Concepts and Methods for Wetlands Evaluation (Reppert)

This was one of the first methods developed to help determine how wetlands function in 1979. It is a rating that groups wetlands into high, medium, low based on "functional values."

This method is no longer recommended for use in Washington's wetlands. Better tools have been developed more recently.

Proper Functioning Condition for Lentic Areas (PFC)

PFC is a qualitative method to characterize streams, riparian areas, and riparian wetlands. It was developed by the Bureau of Land Management to assess how well the physical processes in a wetland are functioning. See *Riparian Area Management: Process for assessing proper functioning condition for lentic riparian-wetland areas.* U.S. Dept. of Interior, Bureau of Land Management, TR1737-11. 1994.

Advantages

- Provides good information for designing restoration of riparian wetlands.

Limitations

- Correct application of this method requires an interdisciplinary team of experts.
- Does not separate wetlands from the rest of the riparian ecosystem.
- Primarily for riparian wetlands.
- Not an assessment that can be used independently to rate, characterize, or assess wetlands and their functions.

Recommended Uses

Could be useful in combination with other assessment methods. For wetlands that are "functional - at risk" or "nonfunctional" the methods can help to identify what is lacking (vegetation, soil, water) and may provide guidance on the likelihood of improving the condition and what actions could be taken to improve the condition.

Best Professional Judgment (BPJ)

Application of BPJ is the most common method used to determine the functions that a wetland provides. Application of this method requires that a wetland biologist/consultant decide how well a wetland performs functions based on his or her own experience or knowledge.

Most methods are based to some degree on the best professional judgment of the individuals or the teams of individuals who developed them.

Advantages

- Can be very rapid.
- If the expert has local knowledge, the information on functions may be very specific to the region and wetland type.

Limitations

- Not reproducible.
- Can't track the criteria used to base the judgment unless they are carefully recorded.
- Reliability of results varies greatly with expertise.
- Easier to be biased in regard to functions for which the expert has more knowledge.

Recommended Uses

BPJ may be used in analyzing functions for small impacts where more intensive analysis is not warranted.

Hydrogeomorphic Approach (HGM) (Brinson et al. 1995)

This approach has been developed by the U.S. Army Corps of Engineers. The documents associated with this approach are available at:
http://www.wes.army.mil/el/wetlands/hgmhp.html

The HGM approach provides guidance on developing regional methods for analyzing functions. It was put forth by the Corps for use in Section 404 permitting. WAFAM is based on many concepts in this approach.

The HGM approach is not a method to assess, characterize, or rate wetlands.

Appendix 5-C
Examples of Applying Ecology's Landscape Analysis

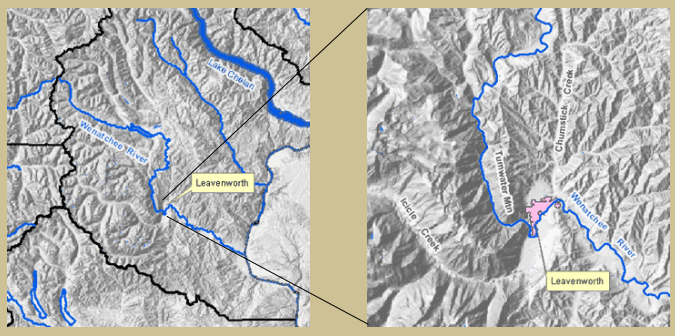
The following pages present examples of how Ecology's landscape analysis can be applied in local jurisdictions in Washington. Examples are provided for two local jurisdictions: the City of Leavenworth and Whatcom County.

City of Leavenworth

Landscape Analysis at the Sub-basin Scale

Based on
Leavenworth Water Problem Study of 1999

Additional input from Matt Karrer, Hydrologist, US Forest Service



WASHINGTON STATE DEPARTMENT OF ECOLOGY

Approach

Step 1 - Identify regional problems

Step 2 - Determine water flow processes

- Topography to draw sub-basins
- Determine initial water flow patterns
- Use geologic info & soils to refine flow patterns
- Draw profile & finalize flow patterns

Step 3 - Summarize natural water flow processes

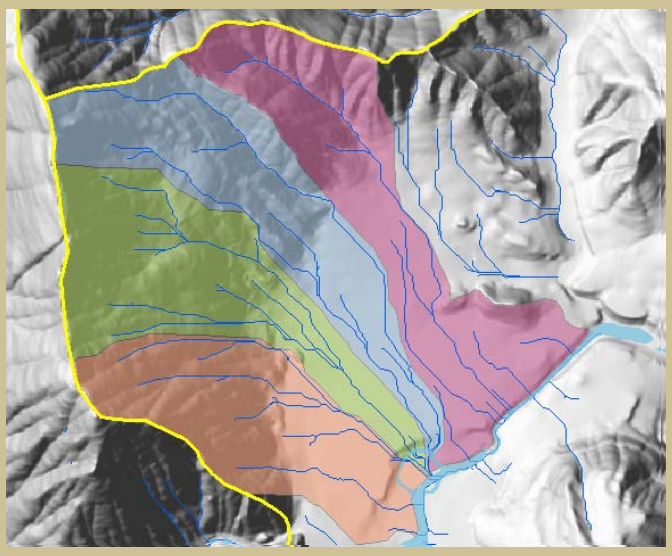
Step 4 - Identify areas where land use alters natural conditions

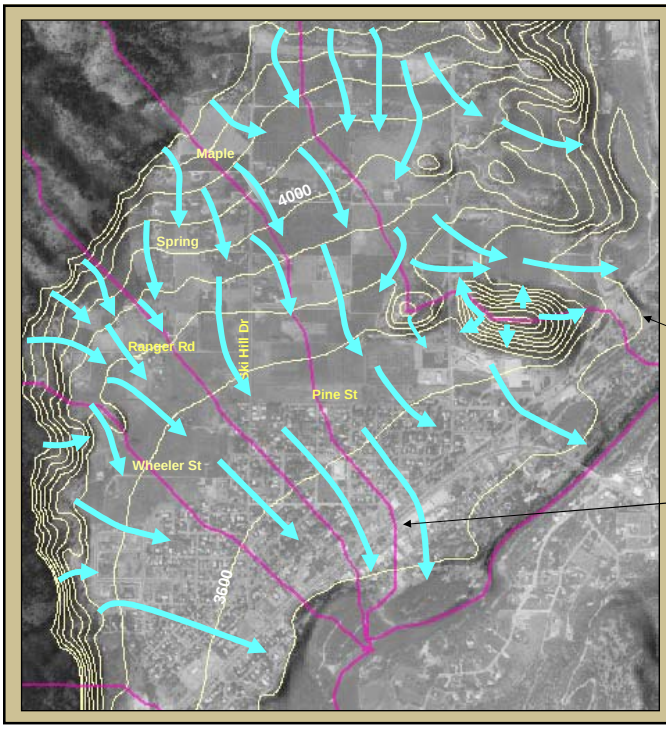
Step 5 - Identify restoration opportunities

Step 1 - Identify regional problem

- ✓ Flooding
- ✓ Water quality
- Downstream Erosion
- ✓ Loss of historic habitat
- ✓ Loss of habitat connectivity

Identify Sub-basins Contributing to Study Area

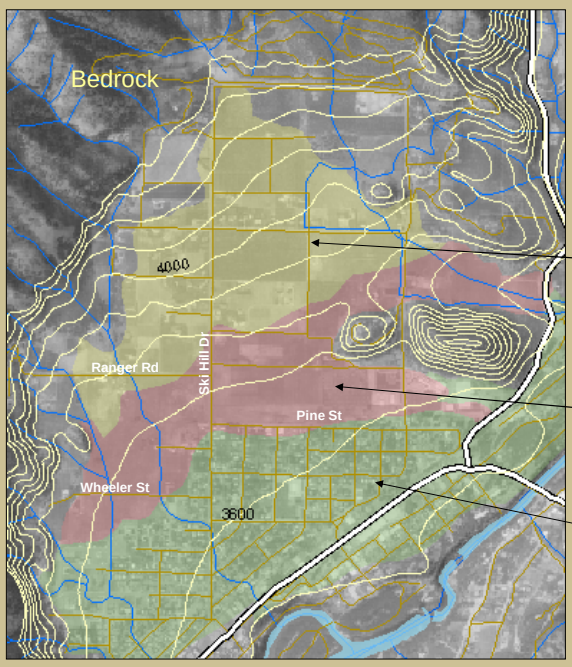




General Direction of Shallow Ground-water Flow

Contour lines – 100 ft

Subbasins



Collect Geologic Information:

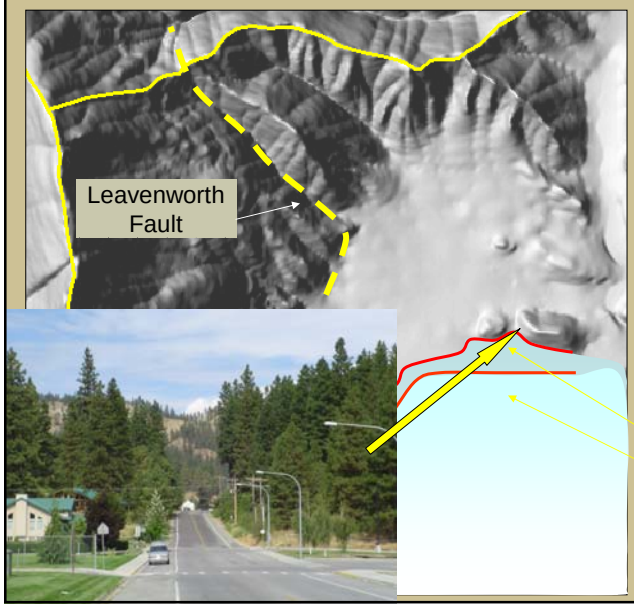
Surficial Geology

Older Alluvium – courser material

Older Alluvium – finer material

Till

Collect Geologic Information: Identify Faults and Glaciation Pattern



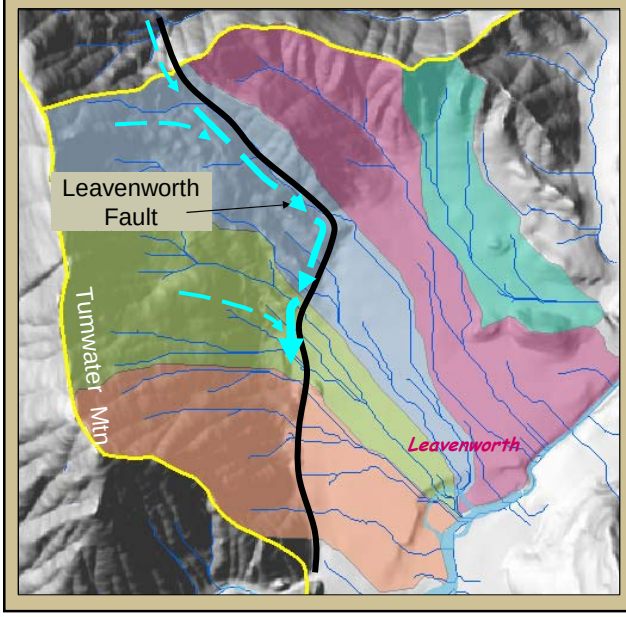
Leavenworth Fault – represents a major shear zone

Glaciers advanced several times from the south into the Ski Hill area and then receded.

Each time they receded they left terminal moraines.

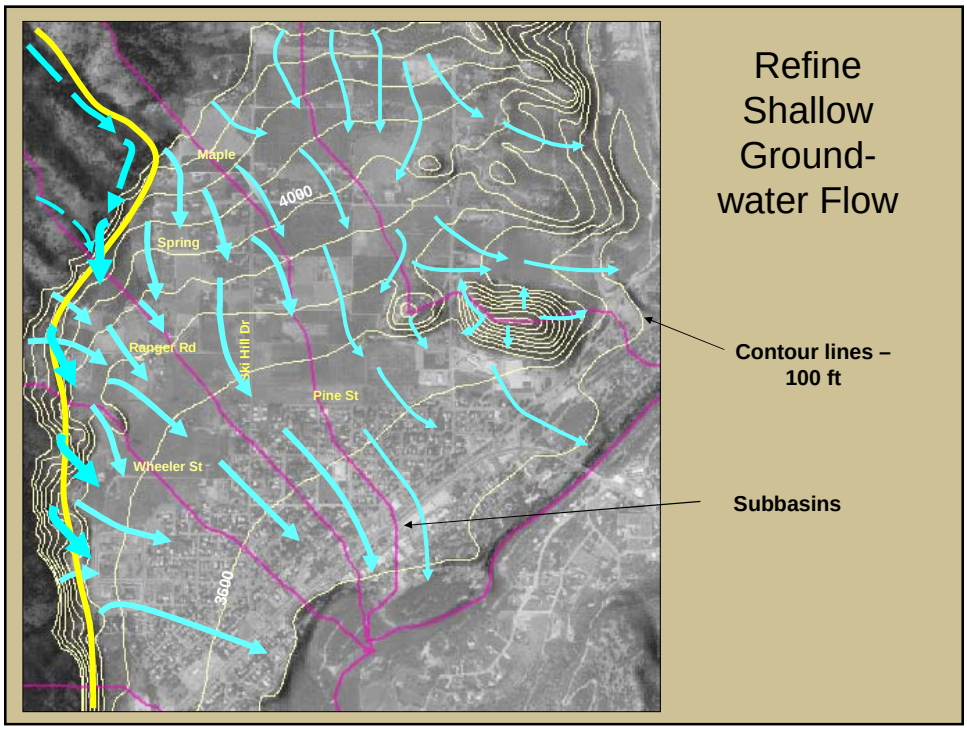
General Location of Moraines

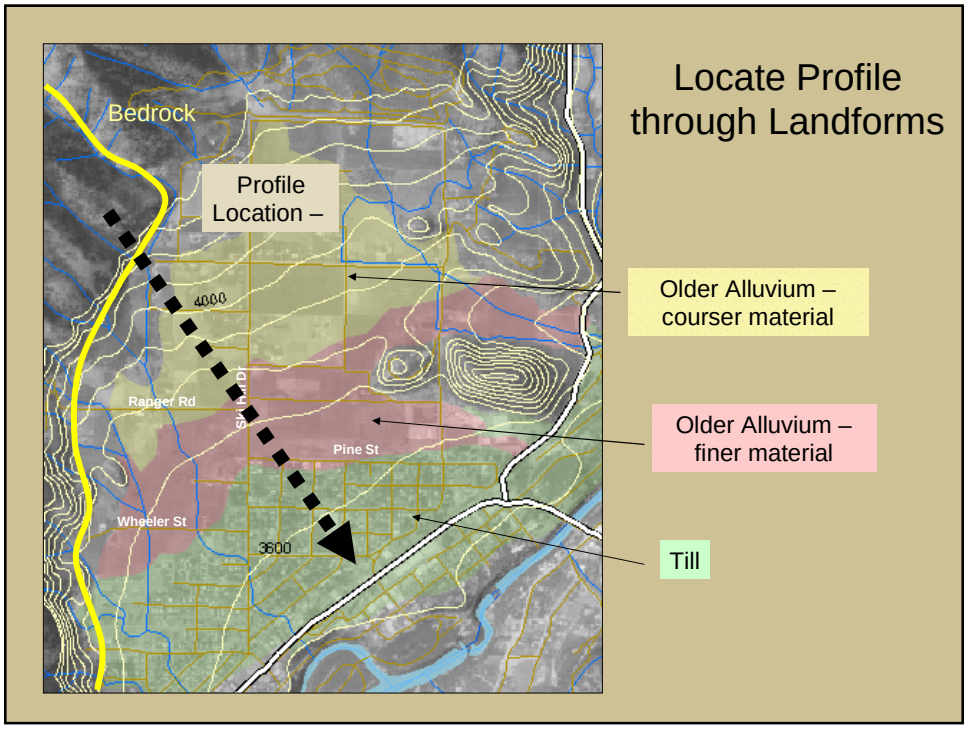
Groundwater Movement Affected by the Fault



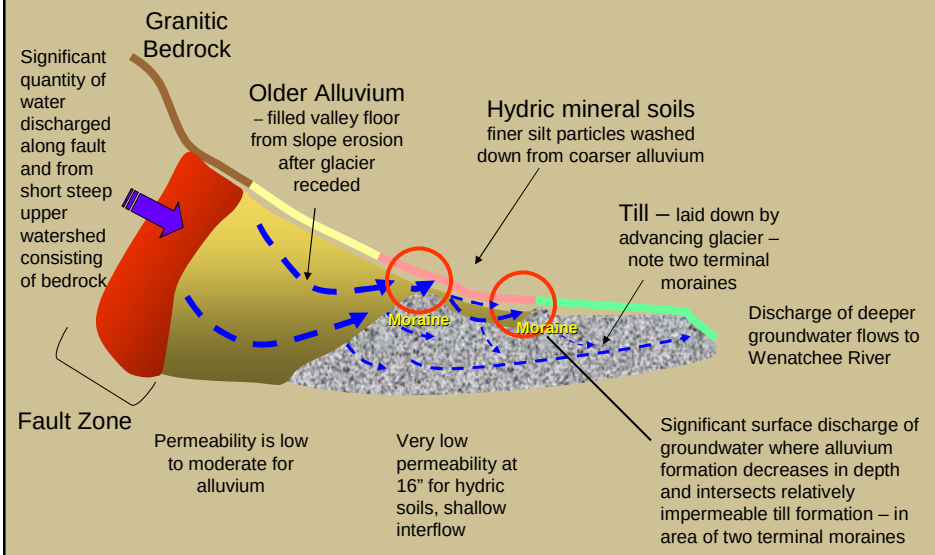
The fault shear zone creates a path of lower resistance for groundwater flow, so groundwater moving down-gradient will tend to follow the fault line.

This results in the lower basins receiving water contributed from upper basins, greatly increasing the quantity of water being delivered.

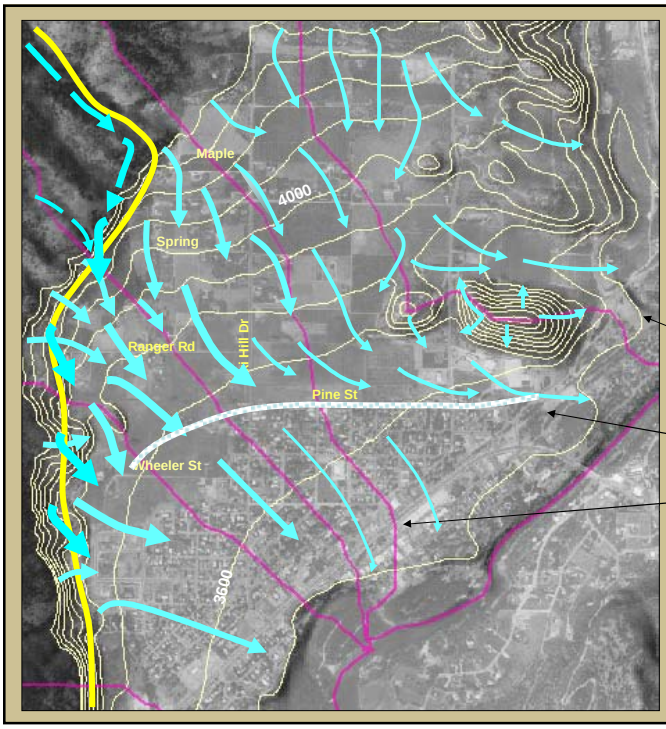

Refine Shallow Ground-water Flow
Maple
Spring
Ranger Rd
Ski Hill Dr
Pine St
Wheeler St
4000
3600
Contour lines – 100 ft
Subbasins


Locate Profile through Landforms
Bedrock
Profile Location –
4000
Ranger Rd
Ski Hill Dr
Pine St
Wheeler St
3600
Older Alluvium – courser material
Older Alluvium – finer material
Till

Profile Diagram



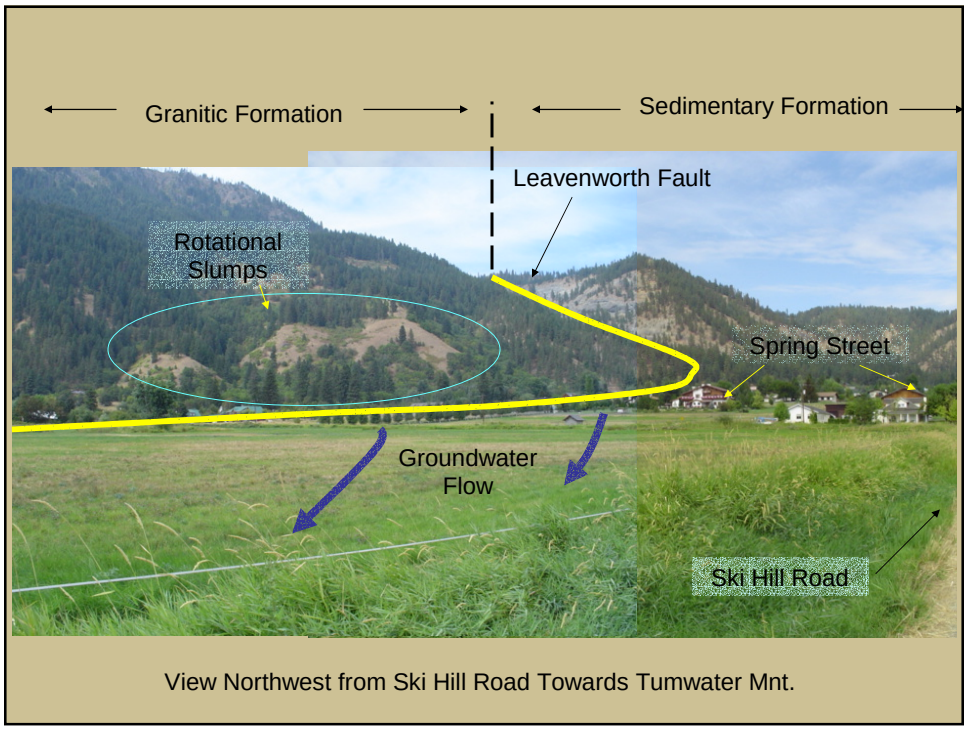
Final Ground-water Flow



Contour lines – 100 ft

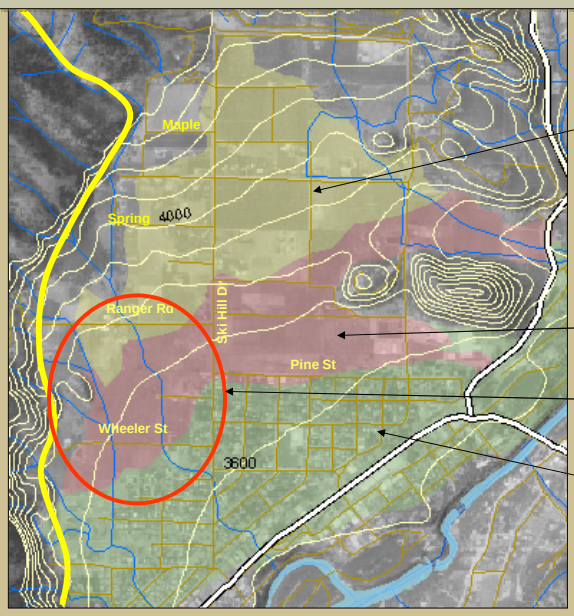
Moraine

Subbasins



View Northwest from Ski Hill Road Towards Tumwater Mnt.

Step 3 - Summarize Natural Water Flow Processes



Older Alluvium :

Area of recharge – provides storage of water and removal of nutrients and pathogens

Hydric:

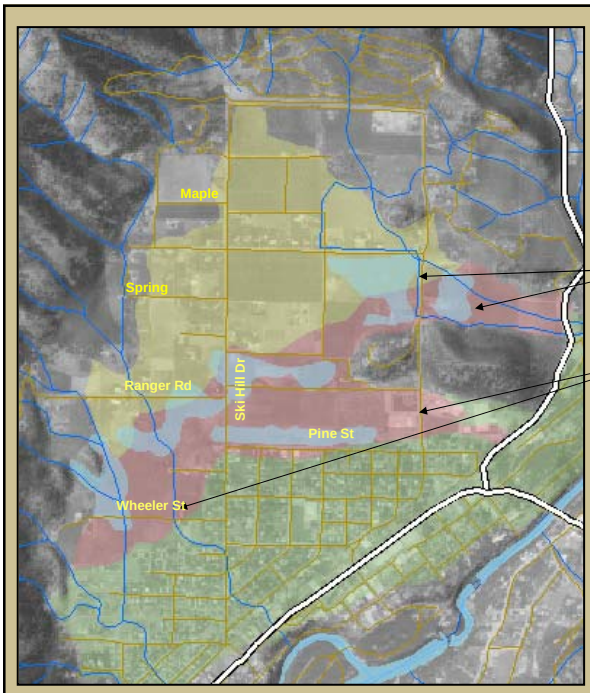
Area of discharge – wetland habitat; also provides water quality functions and some limited water storage

Quantity of groundwater discharged in western portion appears to be greater due to fault

Till:

Area of limited recharge and deeper groundwater movement

Step 4 – Identify areas where land use (existing/proposed) alters natural conditions



Indicators of Alteration to Water Flow Processes: Extent of Wetlands

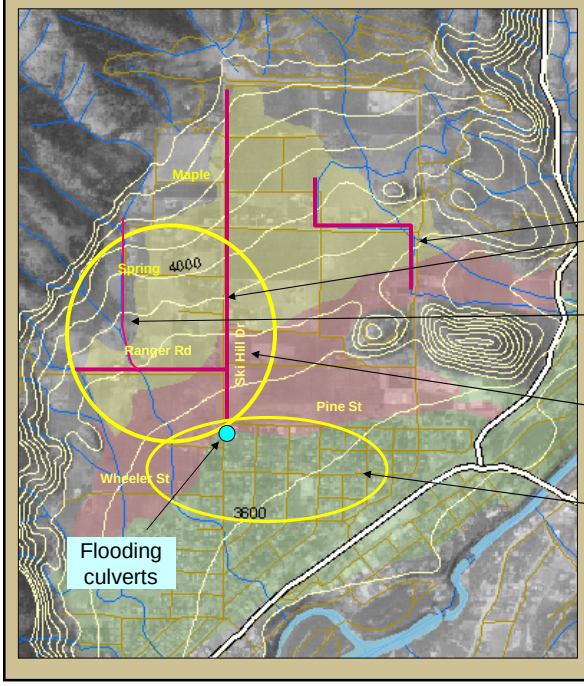
Existing Wetlands

VS

Historic or Potential Wetlands

Wetlands historically extended to the edge of the pink polygon which are **hydric soils** - soils that only form under saturated conditions.

This indicates that subsurface and surface flow to this area has been altered.



Indicators of Alteration to Water Flow Processes:

Ditch/culvert network and areas of flooding/wetness

Major Ditching

Ski Hill Rd. blocks some groundwater and surface flows

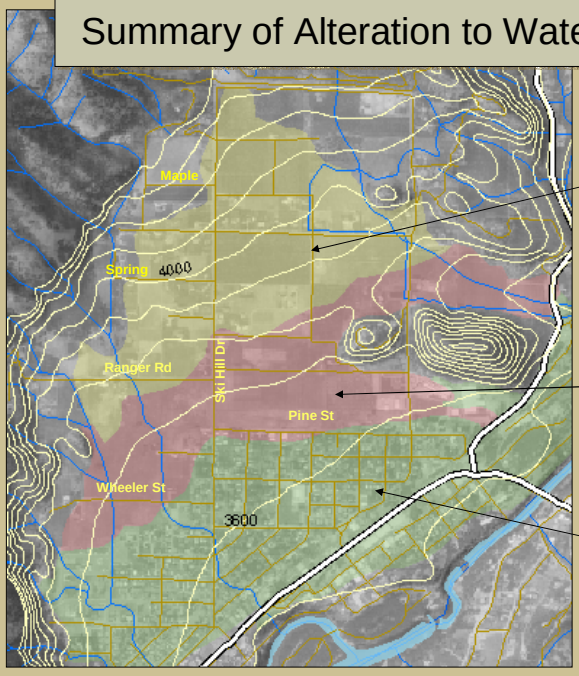
Channelization of Streams

Area of reported increased subsurface wetness

Area of flooding and sheet flow

Northeast Corner of Intersection of Pine and Ski Hill Road

Summary of Alteration to Water Flow Processes

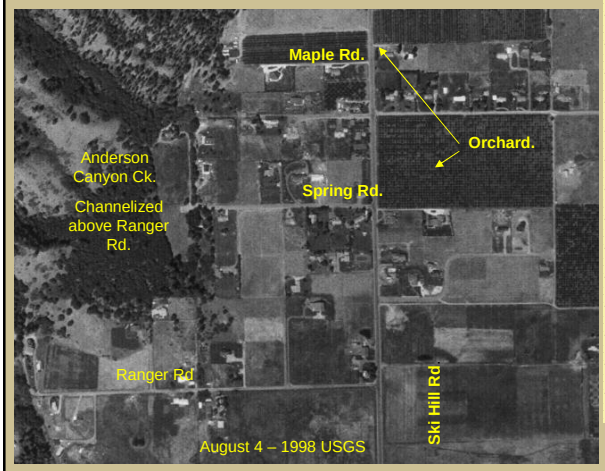


Older Alluvium : Ditching, especially along Ski Hill Rd., has significantly reduced subsurface flow of water thereby increasing flooding downstream

Hydric: Surface and subsurface flows have been reduced significantly in eastern portion. Western portion is reportedly wetter.

Till: Sheet flow and flooding has increased due to rapid delivery of upslope flows through ditches.

Summary of Alteration to Water Flow Processes - continued



Western Portion of Study Area

"Increased" subsurface wetness south of Maple Rd. and West of Ski Hill Rd appears to be due to a wetter climatic cycle since drought period of the early 90's and not land use change.

Land use alteration typically causes surface flooding not year round shallow groundwater flows as has been reported.

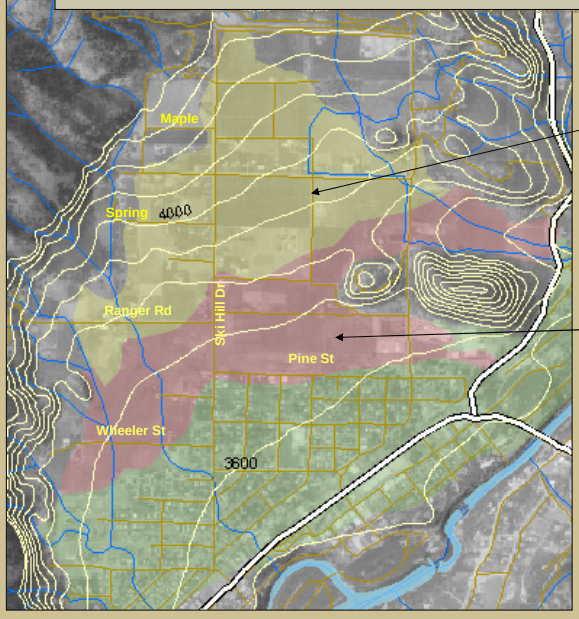
Preliminary Conclusions Based on Review & Analysis of Water Flow Alterations

- The Ski Hill area has historically been a very wet area due to a combination of geology, slope, and faulting.
- Initial analysis indicates that the bedrock area draining to the Leavenworth Fault is the primary source of groundwater in Ski Hill
- Water processes in the bedrock area have not been significantly altered (i.e., natural conditions exist).
- The lower, smaller area of the basin (Ski Hill area) has little influence on the quantity of groundwater flow present.
  - The increasing wetness is probably due to climatic changes in the past decade. (Since drought of '92 rainfall has increased)

Preliminary Conclusions Based on Review & Analysis of Water Flow Alterations….

- Groundwater is forced to the surface by two terminal moraines at the southern extent of the alluvial formation
- The surface water problems in Ski Hill :
  - Appear to be exacerbated by ditching, curtain drains, and below grade structures which intercept groundwater flow and convert to surface flow, accelerating delivery of that water to lower portion of the Ski Hill area.
  - Additional development in this area, without a comprehensive restoration plan and low impact development standards, would significantly increase the flooding and water quality problems

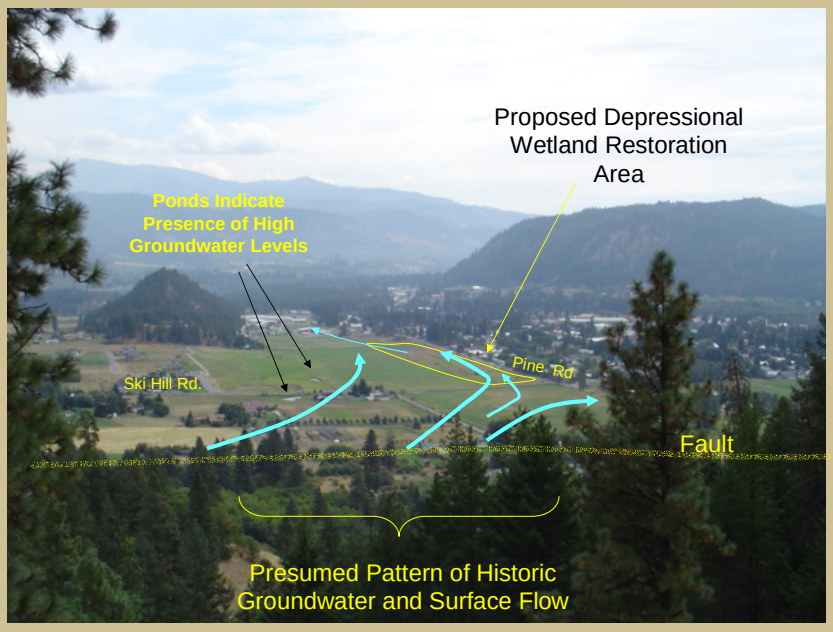
Future Development Conflicts



Future residential development can reduce recharge and **increase flooding down gradient by converting groundwater flow to surface flow** (ditching, curtain drains, basements, impermeable surface)

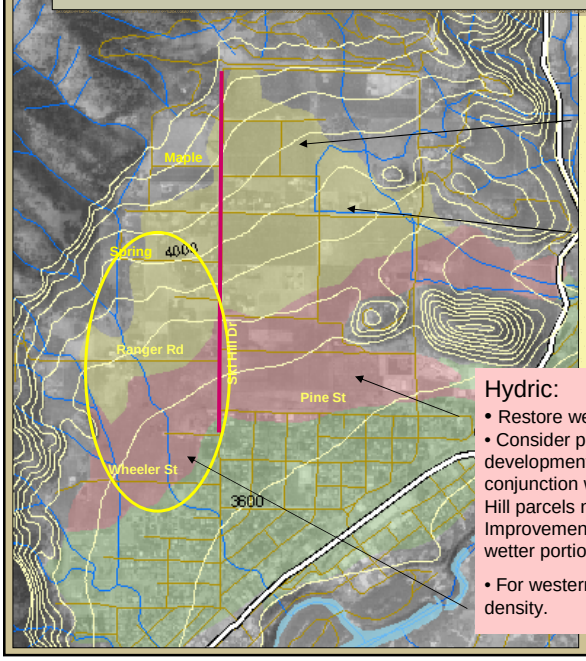
Future residential development will impact existing and potential wetland habitat, and water quality and water quantity functions will be degraded. **Development will further exacerbate flooding problems**.

Step 5 – Identify restoration opportunities



View of Proposed Restoration Area (Looking Southeast From Tumwater Mtn.)

Recommended Measures to Restore Water Flow Processes



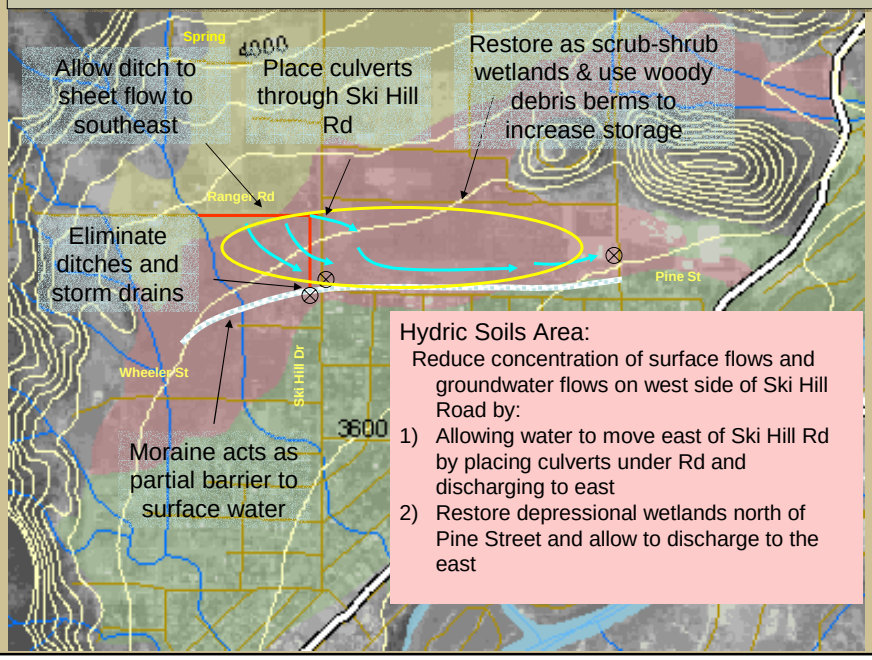
Older Alluvium :

- Eliminate ditching & develop measures to facilitate recharge of surface flows into alluvium (See C St. Design in Seattle):
- Eliminate or redesign features (i.e. basements, french and curtain drains, ditching) in new construction that interrupt groundwater flow and create surface flow (See above).
- Deep till or rip soils and plant areas with native shrubs and trees. Soil has developed shallow compacted layer due to farming.

Hydric:

- Restore wetlands in wetter areas
- Consider protective measures such as transfer of development rights or conservation easements in conjunction with a system of in lieu fees on other Ski Hill parcels not affected (e.g. form a Local Improvement District) to compensate land owners in wetter portions.
- For western portion consider lower development density.

Recommended Measures to Restore Water Flow Processes



Hydric Soils Area:

Reduce concentration of surface flows and groundwater flows on west side of Ski Hill Road by:

1) Allowing water to move east of Ski Hill Rd by placing culverts under Rd and discharging to east
2) Restore depressional wetlands north of Pine Street and allow to discharge to the east

Results Since Presentation of This Study to City of Leavenworth

- City **submitted a grant proposal** to Department of Community, Trade, & Economic Development to prepare a “green infrastructure” plan for the Ski Hill area.
- City **was awarded the grant**
- City is **reviewing three proposals** for a “green infrastructure” plan
- Plan completion expected by winter 2004

Analysis and Characterization of Functions and Ecosystem-wide Processes for SMP Update

Whatcom County

July 28, 2004

1

Why Analyze & Characterize Ecosystem Wide Processes?

- Required by the new shoreline guidelines
- Provides a framework for developing the shoreline plan
- Identifies important ecosystem relationships within the County
  - Identifies areas sensitive to changes from land use
  - Identifies areas for protection or restoration of resources
  - Identifies areas where restoration can correct current problems

2

Characterization of Functions & Processes Requires Application of the Following Steps (WAC Section 173-26-201(3)d)i)

1. Identify & assess ecosystem-wide processes and ecological functions and determine their relationship.
2. Identify ecological functions and ecosystem-wide processes that are healthy, altered, impacted, and missing.
3. Identify measures to protect and restore ecosystem-wide processes and ecological functions.

3

Executive Summary
Identify Objectives – Dakota Sub-basin

Relevant Process & or Function – Unaltered Conditions	Existing or Potential Environmental Issue	Altered Functions and Processes	Protection & Restoration Objectives	Protection – Mechanism & Measures	Restoration Mechanism
Low summer baseflow Recharge function is low to moderate over large area of watershed	Potential: Reduced diversity of aquatic organism. Increased mortality of smolts.	Recharge function is reduced in areas of drained depressional wetlands and tilled soils	Maximize recharge	Increase infiltration: Retain forest cover Protect depressional wetlands in upper watershed Minimize impervious cover	Restore native cover and wetlands in areas of highest recharge function
Reduced tidal flushing Water quality function is high for most of the watershed except for confining units on steep slopes	Existing: Water quality impacts. Closure of Drayton harbor shellfish beds. Reports of harmful algal blooms. Cause – fecal coliform and nutrients	Water quality function is reduced in areas of drained wetlands, tilled soils, and cleared forest /shrub cover	Maximize residence time	Protect existing depressional wetlands & forest cover	Restore wetlands below areas with highest degree of alteration Restore forest/shrub cover

4

Organizing Your Approach to the Characterization and Analysis

- What existing information is helpful?
  - Quantitative studies
  - Qualitative descriptions
  - Different scales
  - Different geographic extents
  - (Too much info)
- Identify information that helps develop the analysis

5

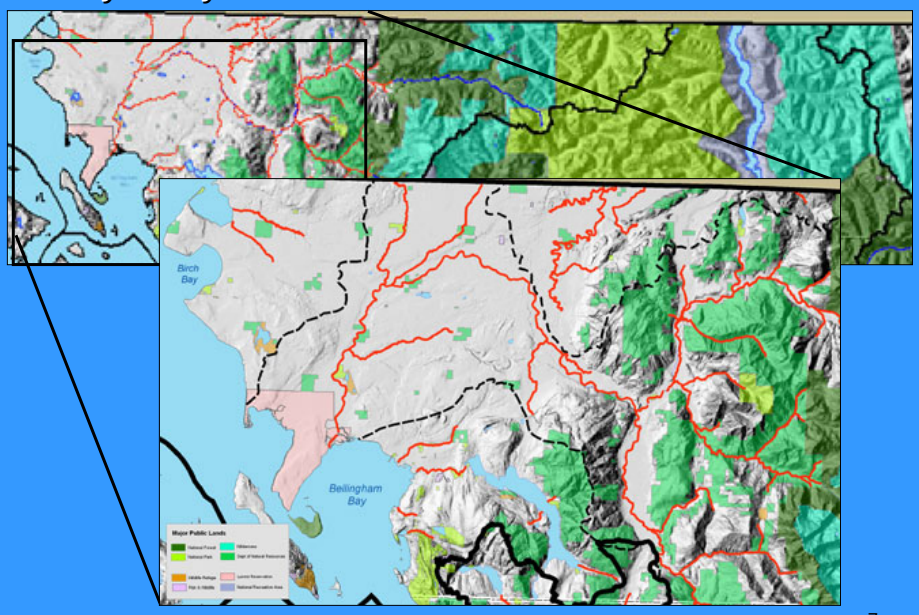
Step 1. Identify and assess ecosystem-wide processes & ecological functions and determine their relationship

- Collect base information for analysis area
- Describe ecosystem-wide processes at the landscape scale
- Describe the functions for the landscape scale-
- Describe ecosystem-wide processes at the sub-basin scale
- Describe the functions at the sub-basin scale-
- Analyze and describe relationship of processes to functions in the shoreline

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

6

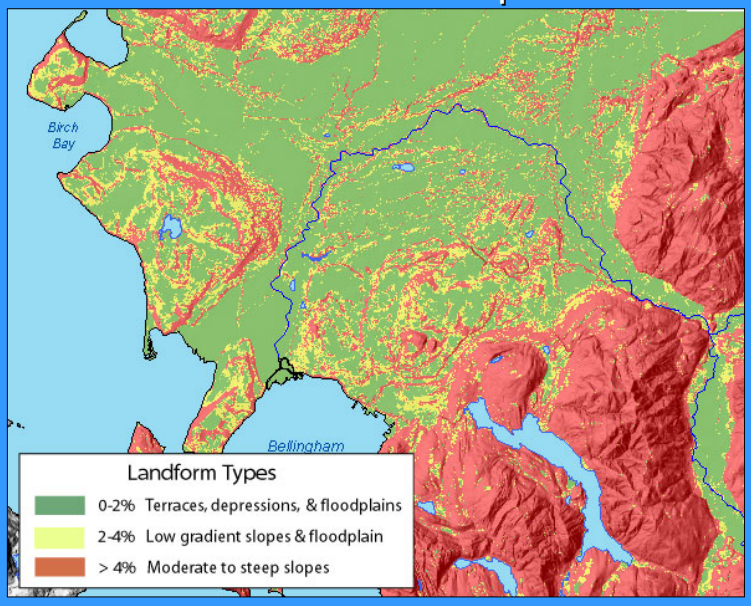
Identify analysis area…..then collect base information…



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

7

Landform Map

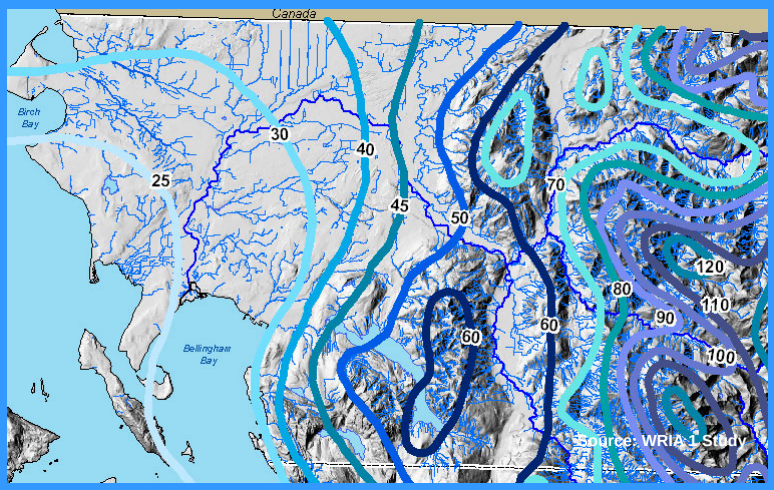


Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

8

Precipitation Patterns

Precipitation gradient indicates areas of relative difference in quantity of runoff



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

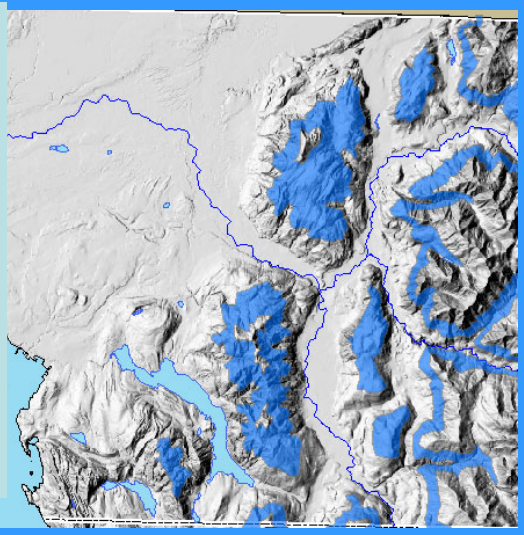
9

Rain-on-Snow Zones

Rain-on snow areas significantly affect the timing and magnitude of runoff events.

Runoff during rain-on-snow events has been associated with mass-wasting of hillslopes, damage to riparian zones, and downstream flooding.

The location and extent of these zones can help identify downstream areas that may have runoff hydrographs that are affected by these events.

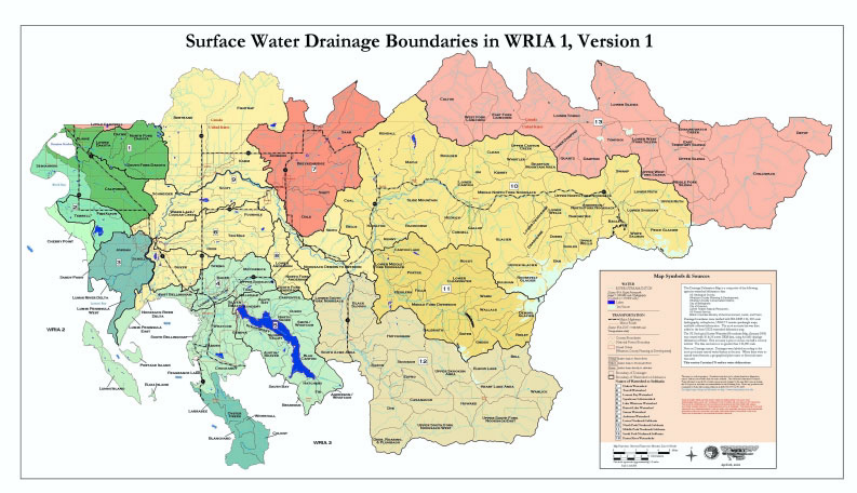


Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

10

Surface Water Drainage Patterns & Sub-basins

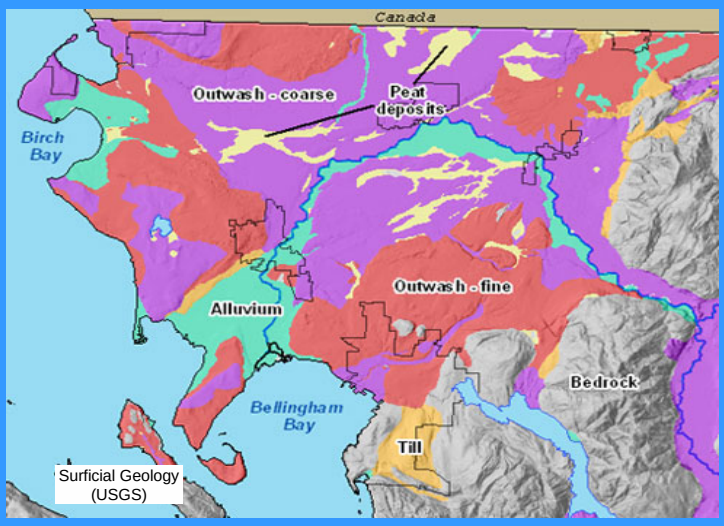
- delineate surface water network
- depending on scale, don't always coincide exactly with groundwater flow
- important to understand the links between surface water and groundwater



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

11

Surficial Geology



Surficial Geology (USGS)

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

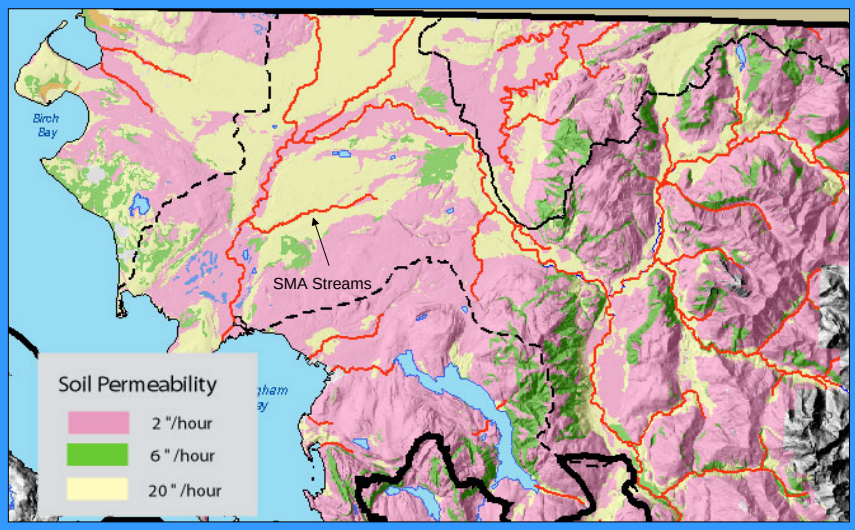
12

Geologic Hazards

- Map of landslides, alluvial fans, etc???

13

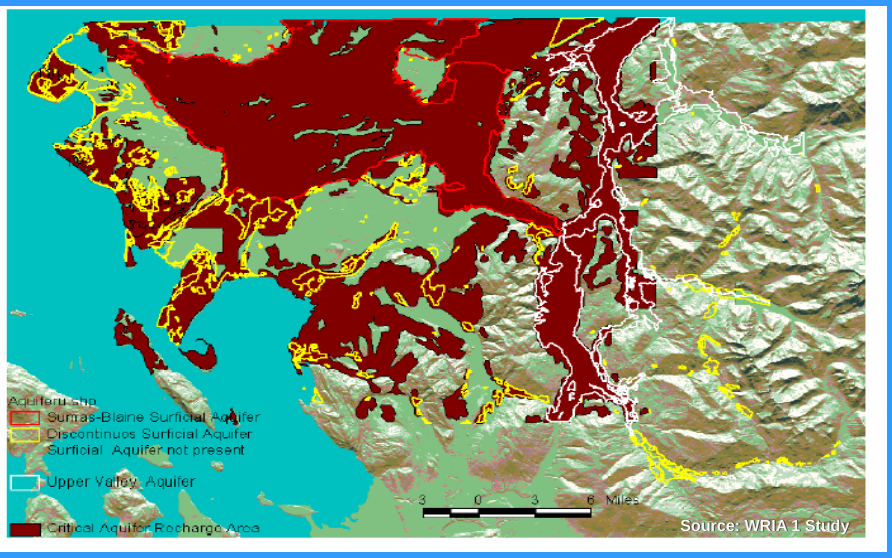
Soil Permeability



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

14

Critical Recharge Areas



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

15

Aquifer Storage Capacity

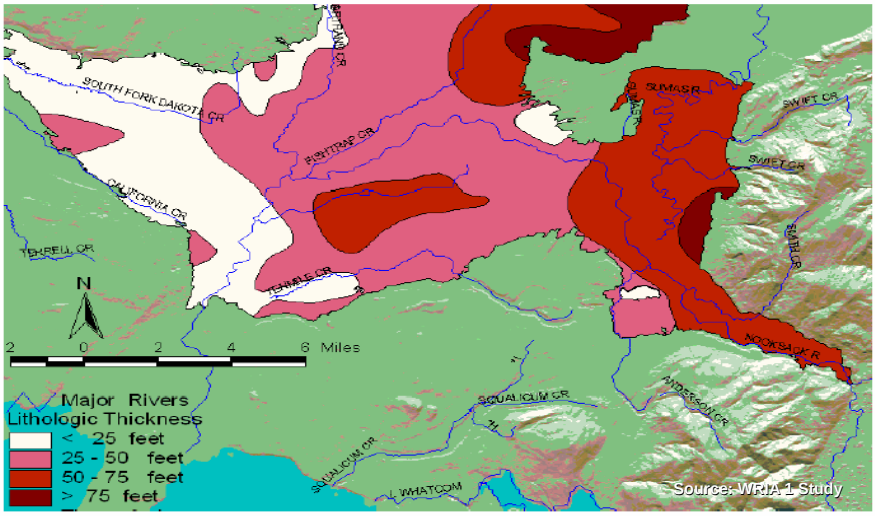
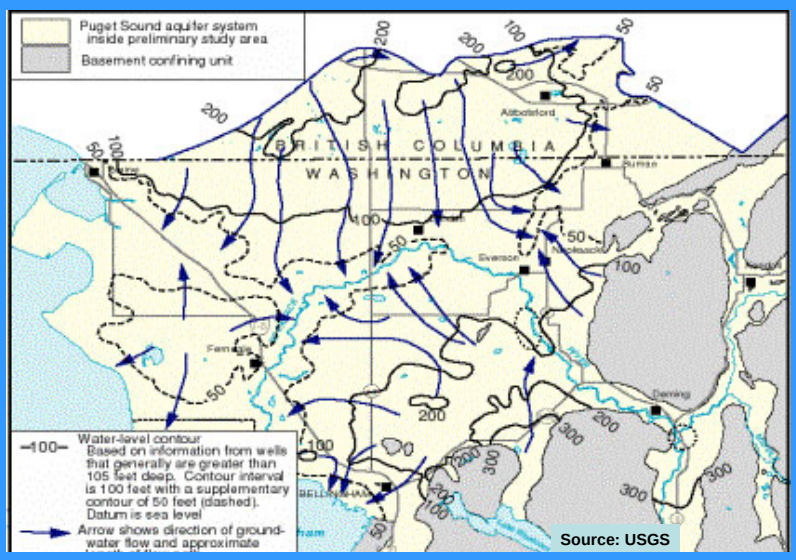


Figure 1.2.3 Aquifer thickness of central/ lowlands of the Nooksack

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

16

Groundwater Flow Lines



Source: USGS

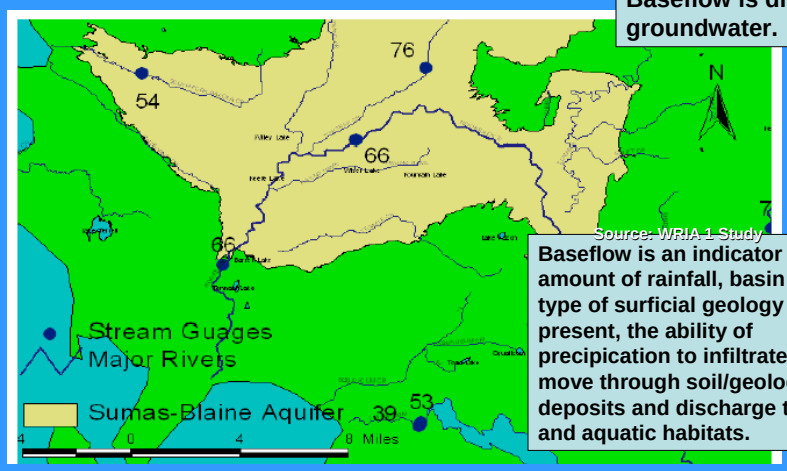
Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

17

Baseflow Contribution to Mean Annual Stream Flow

Measured As Percent of Annual Flow

Baseflow is driven by groundwater.



Source: WRIA 1 Study

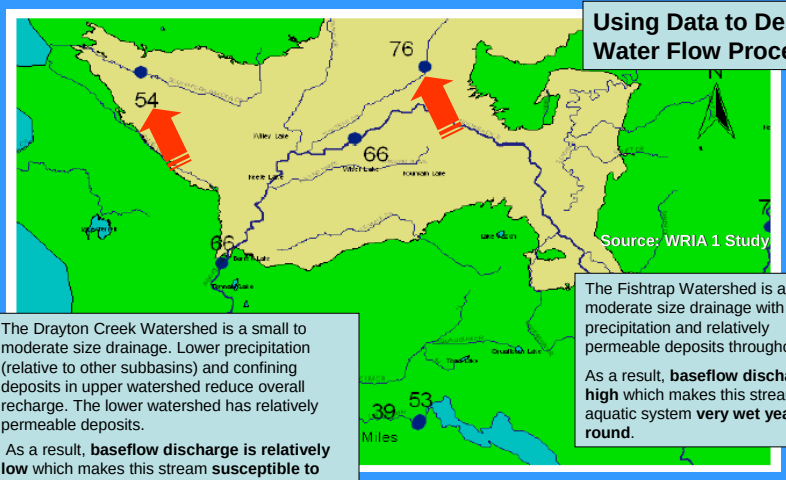
Baseflow is an indicator of the amount of rainfall, basin size, the type of surficial geology and soil present, the ability of precipication to infiltrate and move through soil/geologic deposits and discharge to creeks and aquatic habitats.

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

18

Baseflow Contribution to Mean Annual Stream Flow

Measured As Percent of Annual Flow



Using Data to Describe Water Flow Processes

The Drayton Creek Watershed is a small to moderate size drainage. Lower precipitation (relative to other subbasins) and confining deposits in upper watershed reduce overall recharge. The lower watershed has relatively permeable deposits.

As a result, **baseflow discharge is relatively low** which makes this stream **susceptible to low flows** in the summer months

The Fishtrap Watershed is a moderate size drainage with high precipitation and relatively permeable deposits throughout.

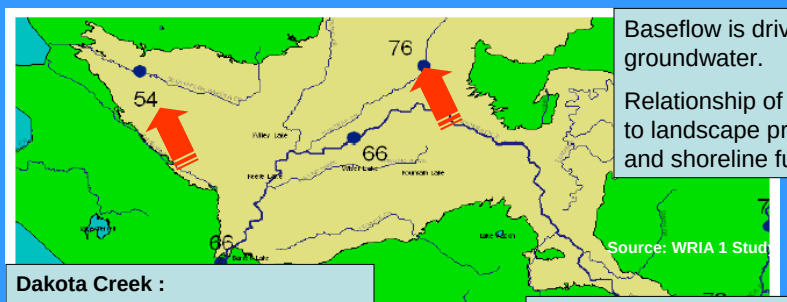
As a result, **baseflow discharge is high** which makes this stream and aquatic system **very wet year round**.

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

19

Baseflow Contribution to Mean Annual Stream Flow

Measured As Percent of Annual Flow



Baseflow is driven by groundwater.

Relationship of baseflow to landscape processes and shoreline functions.

Dakota Creek :

Lower baseflow = less groundwater

So…. lower seasonal flows can impact shoreline habitat functions such as anadromous fish habitat

Land use can easily impact recharge and reduce low flows to levels that significantly impact aquatic habitat

Fishtrap Creek :

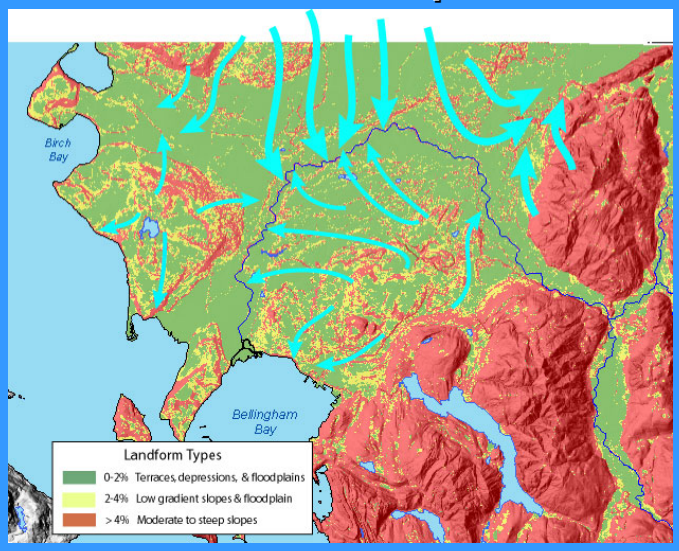
High baseflow = large quantities of groundwater

So…transport of nutrients, pollutants, and sediment can be a significant

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

20

Relationship of Landform, Ground Water Flow and Precipitation



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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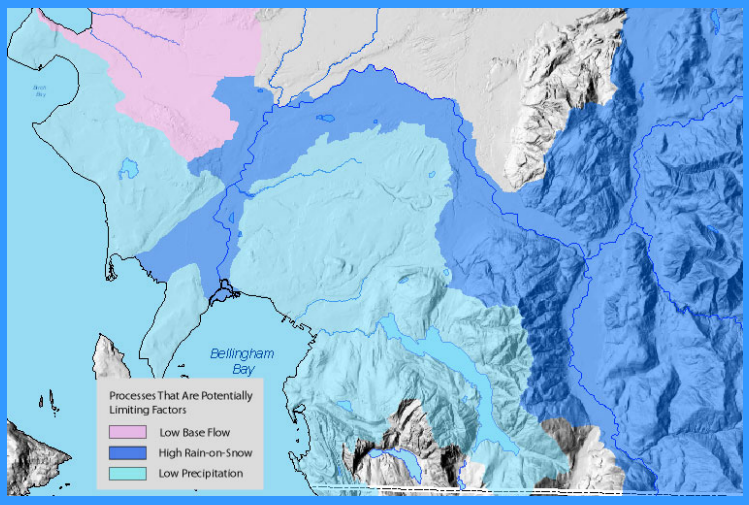
Relative Performance of Water Flow Indicators for Analysis Area			
WRIA Sub basin	Precipitation Assumptions: < 25" Very Low; 25-30" = Low; 30-45" = Mod; 45+" = High	Rain-on-Snow Assumptions:	Baseflow Assumptions: <60% of annual stream flow = Low 60 to 70% = Mod; >70% = High
Drayton	Low	None	Low
Birch Bay	Very Low	None	Low (BPJ – based on small basin and confining formation)
Kamm/Bertrand/ Fishtrap	Low to High	None	High
Sumas River	Moderate to High	Very Low?	?
Scott/Wiser/ Schneider	Low	None	?
Upper Nooksak Tributaries	High	Very High	Moderate
Upper Mainstem Nooksack	Mod to High	High	Mod to High
Lower Mainstem Nooksack	Low to Mod	Mod	Mod

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

22

Processes that are potentially limiting for shoreline functions



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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Relative Performance Level of Landscape Functions

Landform Type	Aquifer Recharge (includes rate & volume)	Flood Storage Soils, Floodplains, & Wetlands	Water Quality Improvement
Confining or low permeability deposit on steep slope	*Very Low*	*Very Low*	*Very Low*
Confining or low perm. deposit on terrace or low gradient slope	*Low*	*Low*	*Moderate*
Aquifer or high permeability deposit on steep slope	*Low (depends on thickness)*	*Low to Moderate (depends on thickness)*	*Low*
Aquifer or high perm deposit on terrace or low gradient slope: use aquifer thickness overlay and do relative comparison	*High for thick aquifer deposit* *Moderate for intermediate thickness* *Low to Mod for areas of thin deposits*	*High* *Moderate* *Low to Mod*	*High*
Depressions with Mineral Deposit	*Mod to High (Sandy outwash Deposit beneath mineral soils)*	*High*	*High*
Depressions with Organic Deposits	*Mod to High (Sandy outwash Deposit beneath mineral soils)*	*High*	*Very High*
Floodplains – glacially formed	*Low to Moderate*	*Very High*	*Mod to High*

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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Summary of water flow processes and functions at the sub-basin scale

Drayton Harbor Example

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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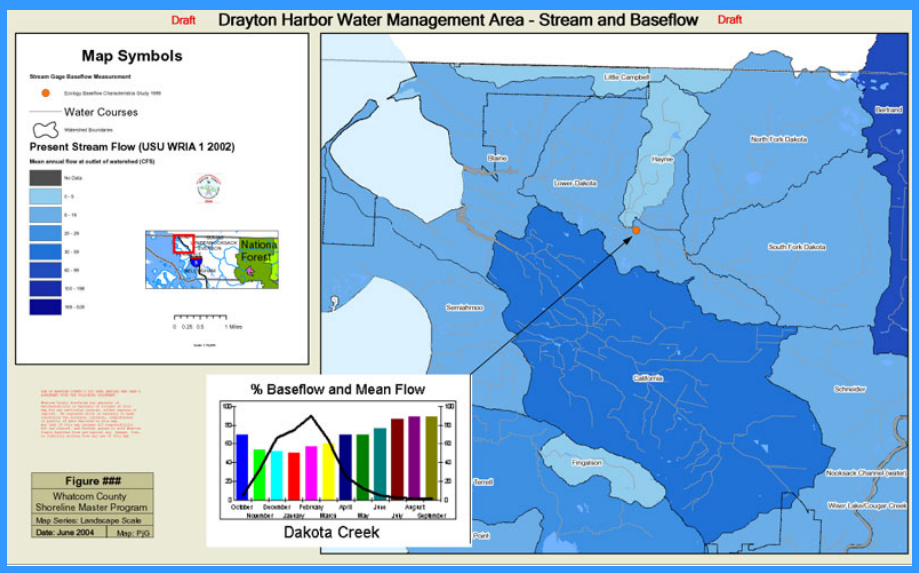
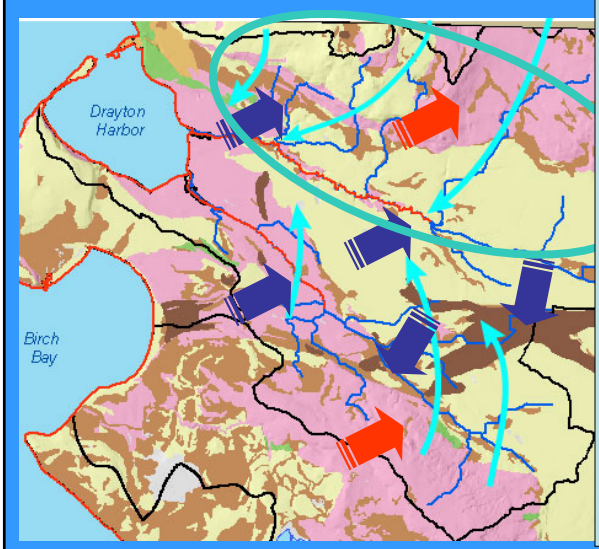
Baseflow Data



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

26

Describe water flow processes at sub basin scale



Drayton Harbor Watershed

Groundwater flow is shallow and relatively rapid on impermeable slopes.

Discharges occur at base of slopes and in depressions. Note areas of hydric soils which indicate areas of consistent discharge

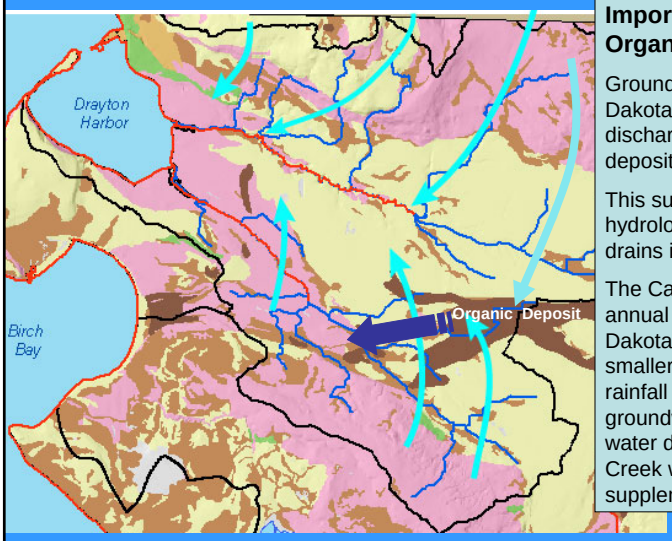
Dakota Creek - valley deposits are **permeable**, groundwater flow is deeper, pathway longer, with moderate discharge to creek but low seasonal baseflow.

California Creek - valley deposits are **impermeable**, groundwater flow is shallow with high discharge to creek. These conditions also result in low seasonal base flows.

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

27

Describe water flow processes at sub basin scale



Importance of Large Organic Deposit

Groundwater flow from the Dakota Creek watershed discharges in the large organic deposit

This surface and subsurface hydrology in the peat deposit then drains into California Creek.

The California Creek mean annual flow is higher than that for Dakota Creek despite being a smaller basin and in a lower rainfall area. It appears that groundwater and then surface water discharge from the Dakota Creek watershed may be supplementing flows.

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

28

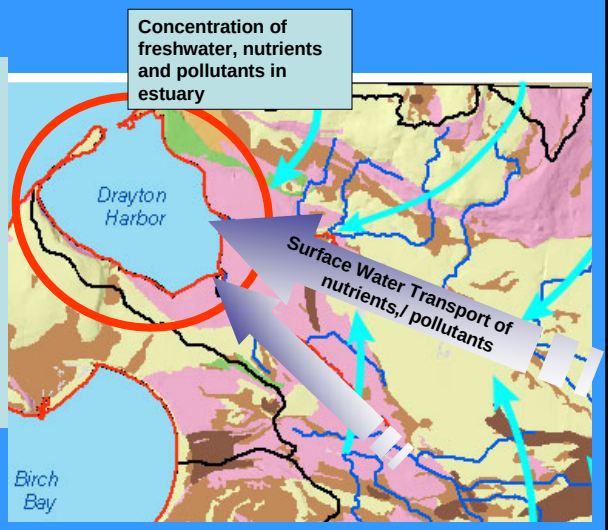
Describe water flow processes

Drayton Harbor Estuary

Estuary structure and function is driven by tidal and freshwater processes.

The estuary is within a semi-enclosed bay that **reduces tidal exchange** relative to other marine shorelines.

This can potentially **concentrate nutrients and pollutants** within the estuary.



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

29

Summarize Functions for Aquifer Recharge

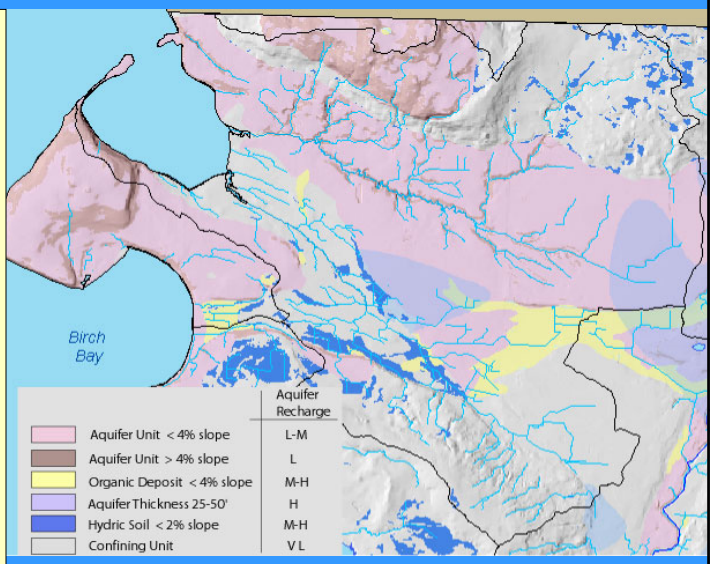
Drayton Harbor – Aquifer Recharge

Dakota Creek: Aquifer recharge function is **low** for slope areas & mod to high for depressional areas

Low to Moderate for most of valley area but **High** for two small areas in the central and eastern portion of basin.

Mod to high for depressions

California Creek. Aquifer recharge is **very low** for both slope and valley areas



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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Water Quality Function

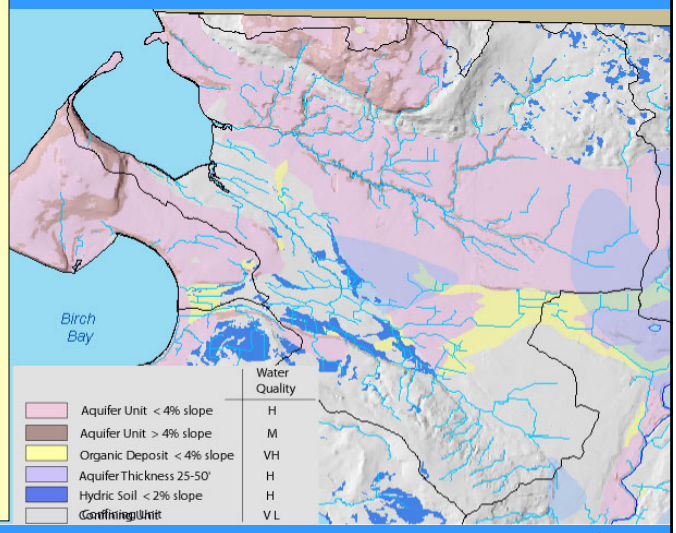
Drayton Harbor – Water Quality

Dakota Creek: Water quality function is **very low** for slope areas on a confining unit, moderate for aquifer unit on a steep slope & high for depressional areas on a confining unit.

High for aquifer unit in a valley or terrace setting.

High to Very High for depressions (includes organic deposits) in valley or terrace setting.

California Creek. **Very low** for most slope and valley areas. High for depressions and aquifer unit (in valley or terrace)



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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Flood Function

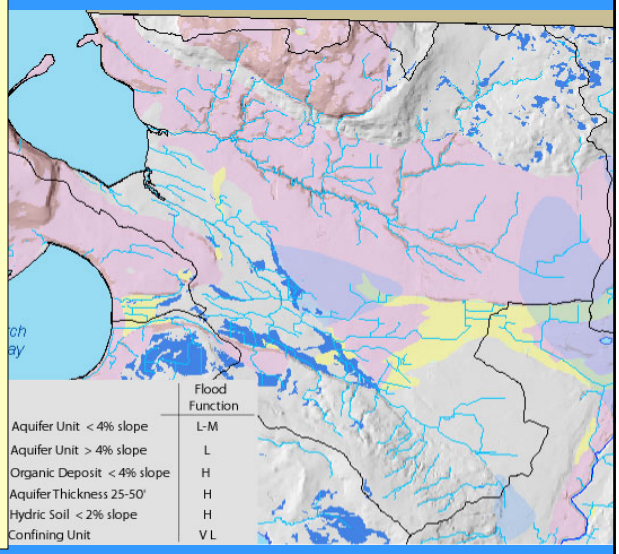
Drayton Harbor – Flood Function

Dakota Creek: For slope areas on a confining unit the Flood function is **very low**. For depressional areas on confining unit it is high.

Low to Moderate for most of valley area except for thicker deposits where it is high (eastern portion). The upper basin setting for these thicker deposits makes them especially effective in moderating downstream flooding

High for depressions especially in upper basin.

California Creek. Very low for most of the slope and valley areas (confining deposits). High for depressions and thicker aquifer units.



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

32

Describe the relationship to shoreline functions

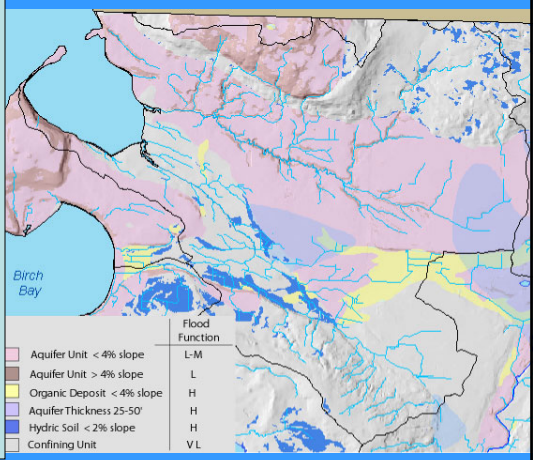
Dakota Creek - Watershed Analysis

Movement of water, nutrients & pollutants has **longer flow path** in permeable valley deposits. Most functions perform at a moderate to high level.

However, small basin, reduced aquifer capacity, and lower rainfall area results in **lower seasonal flows in shoreline areas**. Low base flows are a **limiting factor** since aquatic organisms are dependent on adequate flows in warmer months.

Estuarine habitat, especially one with reduced tidal exchange, is affected by **changes to salinity and nutrient regimes.** Stream and subsurface flows play an important role in the nature of these regimes.

Shoreline functions are dependent on maintaining adequate low flows. Alteration in processes and functions outside of shoreline could significantly impact these shoreline functions.



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

33

Describe the relationship to shoreline functions

California Creek Watershed Analysis

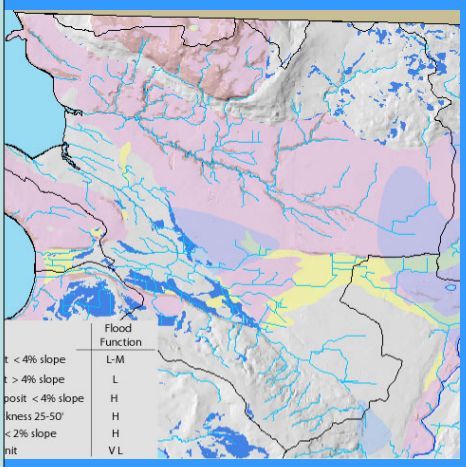
Movement of water, nutrients & pollutants has shorter **flow path** in confined slope and valley deposits. Most functions perform at a low level except for areas of depressions and more permeable deposits.

The small basin, shallow limited aquifer capacity, and lower rainfall area indicates **lower seasonal flows in shoreline areas**. Low base flows are a **limiting factor** since aquatic organisms are dependent on adequate flows in warmer months.

However, mapped groundwater flow indicates that the large organic deposit in the upper basin may be contributing additional flows to California Creek which supports higher than expected seasonal flows. These processes are important to maintaining shoreline functions.

Estuarine habitat, especially areas with reduced tidal exchange, is affected by **changes to salinity and nutrient regimes.** Stream and subsurface flows play an important role in the nature of these regimes.

Shoreline functions are dependent on maintaining adequate low flows, moderating high flows (which can change structure and functions) and nutrient/pollutant inputs. Supporting processes and functions can be easily altered in this area due to extensive confined aquifer source area. Considering these conditions, depressional areas and permeable deposits are very important to maintaining processes and functions at all scales.



asin → Sub-Basin Functions → Relationship to Shoreline

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Step 2 - Identify ecological functions and ecosystem-wide processes that are healthy, altered, impacted, and missing

- Indicators of Current Condition:
  - Land cover
  - Surface water alterations (channelization)
  - Loss of wetland habitat
  - Sub-surface alterations (pumping, population density)
  - Pollutant inputs (, dairy farms, industrial uses)
  - Effect of pollutants (303 (d) listed water bodies ins.)
  - Road density
  - Stream/road crossings
- Review Existing Studies/Reports
- Consider Additional Impacts from Future Condition

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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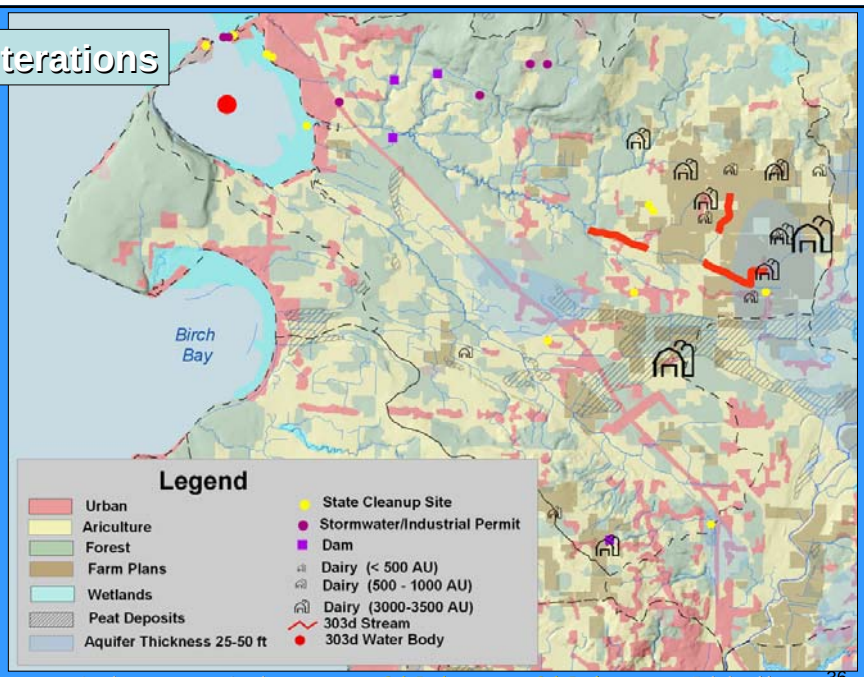
Alterations



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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Landscape Process & Function Analysis – Overview of Analysis Area

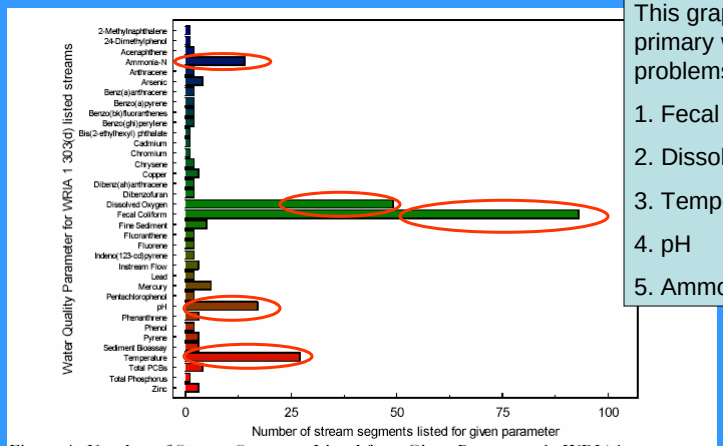


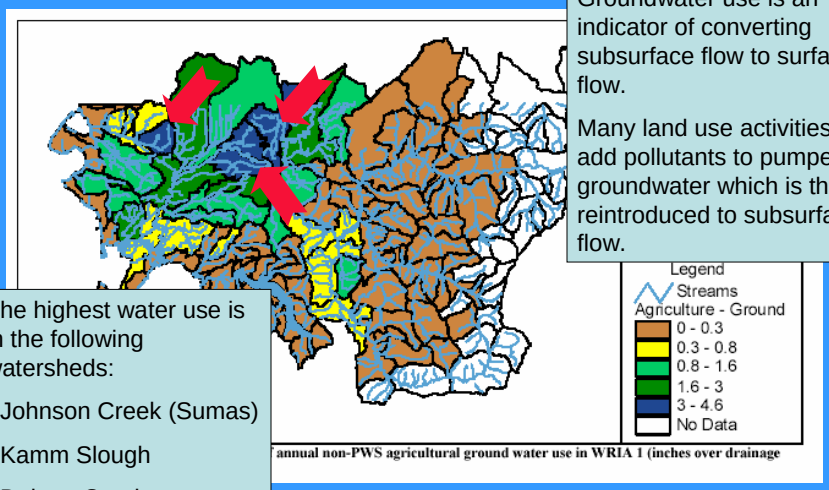
Figure 4. Number of Stream Segments Listed for a Given Parameter in WRIA1.

This graph summarizes the primary water quality problems in the study area:

1. Fecal coliform
2. Dissolved oxygen
3. Temperature
4. pH
5. Ammonia Nitrogen

This large scale overview provides clues to the type of land uses that may be altering processes and this helps focus and identify mitigation measures. problems.

Converting Subsurface Flows – Using Water Use Layers



annual non-PWS agricultural ground water use in WRIA 1 (inches over drainage

Groundwater use is an indicator of converting subsurface flow to surface flow.

Many land use activities will add pollutants to pumped groundwater which is then reintroduced to subsurface flow.

The highest water use is in the following watersheds:

- Johnson Creek (Sumas)
- Kamm Slough
- Dakota Creek

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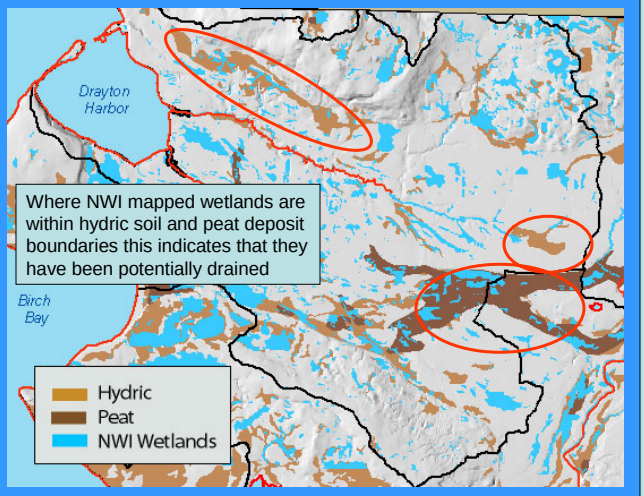
Indicator of Surface/Subsurface Alterations – Loss of Aquatic Habitat



Where NWI mapped wetlands are within hydric soil and peat deposit boundaries this indicates that they have been potentially drained

Wetlands and Riparian areas are important components in removing nutrients and toxic compounds. Wetlands that have been drained or filled no longer perform this function. Riparian areas that have been deforested and grazed/farmed perform this function at a reduced level.

Indicators of these changes include comparing hydric soil layers and NWI layers along with land use and channel layers

Water Quality Improvement Function Analysis WRIA Summary of Issues Table for Drayton Harbor

Water Quality Parameter of Concern:

Fecal Coliform

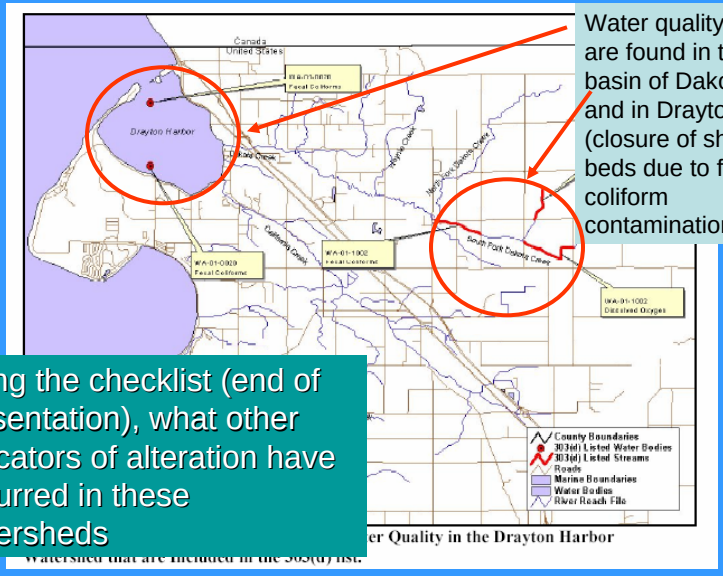
Cause:

Agricultural runoff most likely source of biochemical oxygen nding material, coliform, and nts to Dakota alifornia Creek.

This gives you a rough idea of the probable cause but not location of the cause and the potential impacts. This requires looking at other inventory data, including water quality at the sub-basin scale.

Main Stem Tributaries	Temperature, D.O., nutrients, pH, specific c coliform, solid chloride/sulfat 1990)	Temperature, D.O., turbidity, BS	• Loading data for key parameters (fecal, nutrients, oxygen demanding materials, etc.)			
Lake Whatcom Watershed 1. Lake 2. Lake Tributaries 3. Whatcom Creek and tributaries	1. Tempera nutrients conducta coliform chloride hardness 2. Tempera nutrients conducta coliform chloride hardness 3. Tempera nutrients conducta					
Drayton Harbor Watershed 1. Harbor 2. Creeks	1. Fecal col specific tmperat nutrients 2. Fecal col specific temperature, D.O., nutrients		Creeks • Monitor California Creek more frequently year round		• Agricultural runoff m likely source of biochemical oxygen demanding material, fecal coliforms, and nutrients to Dakota Creek & California Creek.	—
Sumas River	Fecal coliform, pH, specific conductance, temperature, D.O., nutrients, solids (TSS, turbidity)	D.O. fecal coliform, pH	• Loading for fecal coliform and oxygen demanding materials	Fisheries	• Agricultural runoff most likely source of biochemical oxygen demanding material, fecal coliforms, and nutrients.	—

Water Quality Improvement Function Analysis – WRIA 303d listings for Drayton Harbor



Water quality issues are found in the upper basin of Dakota Creek and in Drayton Harbor (closure of shellfish beds due to fecal coliform contamination)

Using the checklist (end of presentation), what other indicators of alteration have occurred in these watersheds

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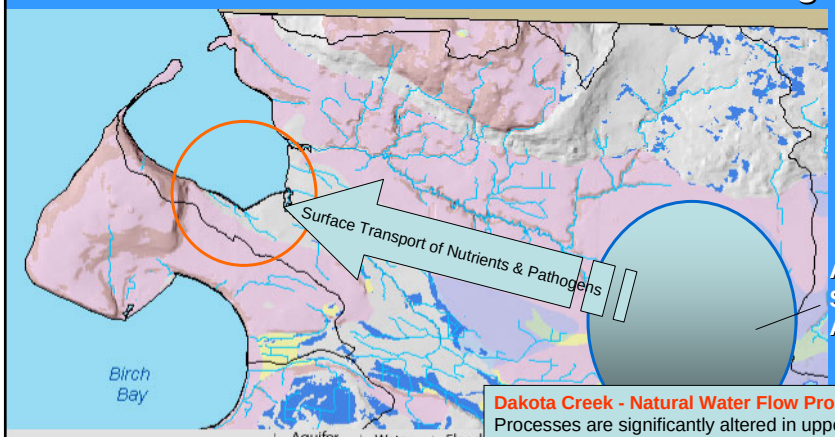
Summarize Process and Function Changes



Area of Significant Alteration

	Aquifer Recharge	Water Quality	Flood Funct
Aquifer Unit < 4% slope	L-M	H	L-M
Aquifer Unit > 4% slope	L	M	L
Organic Deposit < 4% slope	M-H	VH	H
Aquifer Thickness 25-50'	H	H	H
Hydric Soil < 2% slope	M-H	H	H
Confining Unit	VL	VL	VL

Dakota Creek - Natural Water Flow Processes: Processes are significantly altered in upper watershed of Dakota Creek in area of farm plans through a combination of field drains, ditching and tilling of fields. Results in overland flow (rainfall exceeds infiltration) and conversion of subsurface flows to surface. Extensive clearing of forest in upper basin has also increased surface flows. Most wetland functions have been altered through ditching and clearing.

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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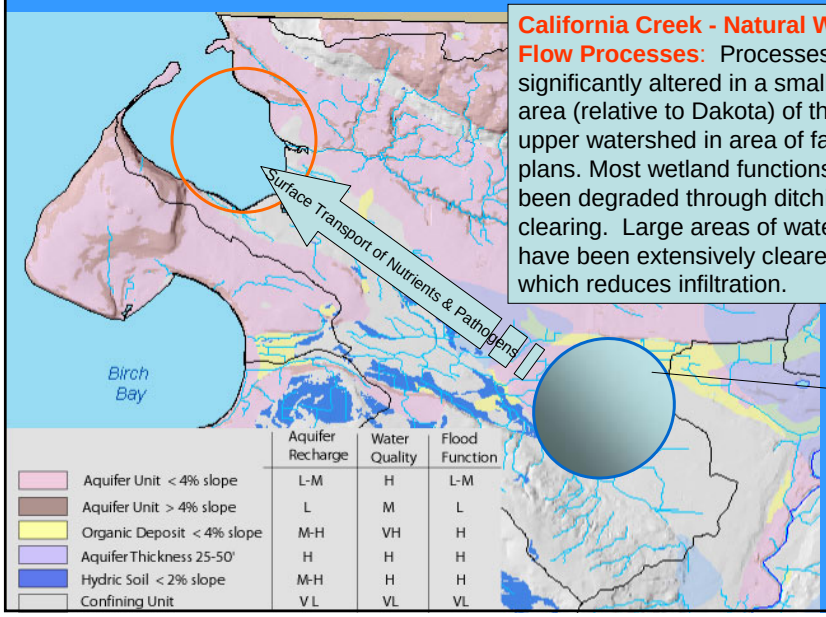
Summarize Process and Function Changes



California Creek - Natural Water Flow Processes: Processes are significantly altered in a smaller area (relative to Dakota) of the upper watershed in area of farm plans. Most wetland functions have been degraded through ditching and clearing. Large areas of watershed have been extensively cleared which reduces infiltration.

	Aquifer Recharge	Water Quality	Flood Function
Aquifer Unit < 4% slope	L-M	H	L-M
Aquifer Unit > 4% slope	L	M	L
Organic Deposit < 4% slope	M-H	VH	H
Aquifer Thickness 25-50'	H	H	H
Hydric Soil < 2% slope	M-H	H	H
Confining Unit	V L	VL	VL

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Consider Additional Impacts from Future Alterations

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Step 3 - Identify measures to protect and restore ecosystem-wide processes and ecological functions

- Identify objectives and measures for protection and restoration in the sub-basin
- Overlay current project information
- Evaluate what is not being addressed
  - Identify additional measures to restore processes

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Identify Objectives – Dakota Sub-basin

Relevant Process & or Function – Unaltered Conditions	Existing or Potential Environmental Issue	Altered Functions and Processes	Protection & Restoration Objectives	Protection – Mechanism & Measures	Restoration Mechanism
Low summer baseflow Recharge function is low to moderate over large area of watershed	Potential: Reduced diversity of aquatic organism. Increased mortality of smolts.	Recharge function is reduced in areas of drained depressional wetlands and tilled soils	Maximize recharge	Increase infiltration: Retain forest cover Protect depressional wetlands in upper watershed Minimize impervious cover	Restore native cover and wetlands in areas of highest recharge function
Reduced tidal flushing Water quality function is high for most of the watershed except for confining units on steep slopes	Existing: Water quality impacts. Closure of Drayton harbor shellfish beds. Reports of harmful algal blooms. Cause – fecal coliform and nutrients	Water quality function is reduced in areas of drained wetlands, tilled soils, and cleared forest /shrub cover	Maximize residence time	Protect existing depressional wetlands & forest cover	Restore wetlands below areas with highest degree of alteration Restore forest/shrub cover

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Identify Objectives – Dakota Sub-basin

Relevant Process & or Function – Unaltered Conditions	Existing or Potential Environmental Issue	Altered Functions and Processes	Protection & Restoration Objectives	Protection – Mechanism & Measures	Restoration Mechanism
Low summer baseflow Recharge function is low to moderate over large area of watershed	Potential: Reduced diversity of aquatic organism. Increased mortality of smolts.	Recharge function is reduced in areas of drained depressional wetlands and tilled soils	Maximize recharge by increasing infiltration Maintain groundwater quantities	Protect depressional wetlands in upper watershed Minimize effects of impervious cover in in areas of mod to high recharge Ensure gw pumping doesn't interrupt flow to streams.	Remove effects of drainage from wetlands in areas of highest recharge function
Reduced tidal flushing Water quality function is high for most of the watershed except for confining units	Existing: Water quality impacts. Closure of Drayton harbor shellfish beds. Reports of harmful algal blooms. Cause – fecal coliform and nutrients	Water quality function is reduced in areas of drained wetlands, tilled soils, and cleared forest /shrub cover	Maximize residence time	Protect existing depressional wetlands & forest cover	Restore wetlands below areas with highest degree of alteration Restore forest/shrub cover

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Objectives – Dakota and California Creek Sub-basin

Critical Process or Function – Unaltered Conditions	Existing or Potential Environmental Issue	Altered Functions and Processes	Protection & Restoration Objectives	Protection – Mechanism & Measures	Restoration Mechanism
Subsurface flows to and discharge in California Creek watershed	Potential: If this water flow process is altered, it could significantly affect baseflows in California Creek.	Recharge function is reduced in areas of drained depressional wetlands and tilled soils	Protect subsurface flows, including recharge of, that discharge to large organic deposit in upper California Creek	Protect large organic deposit in upper watershed of California Creek Protect lands in Dakota Creek that support this water flow Minimize impervious cover Retain native cover	Restore native cover and wetlands that support this critical water flow process.

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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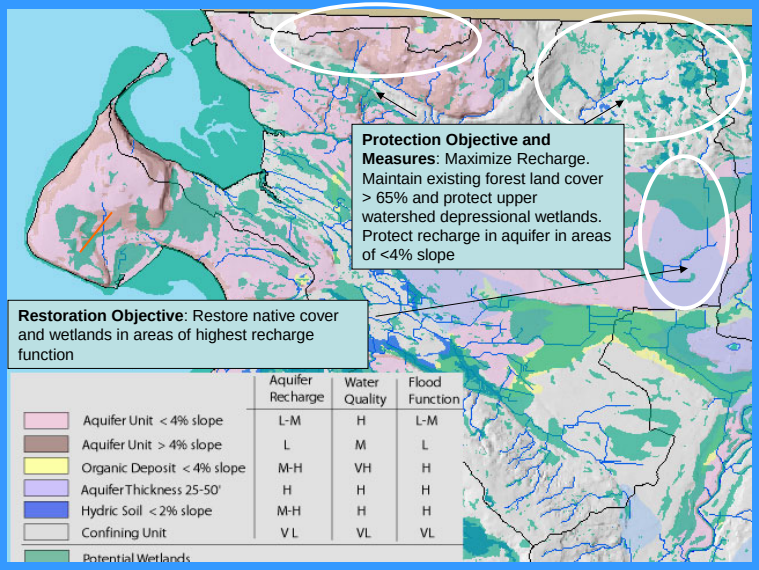
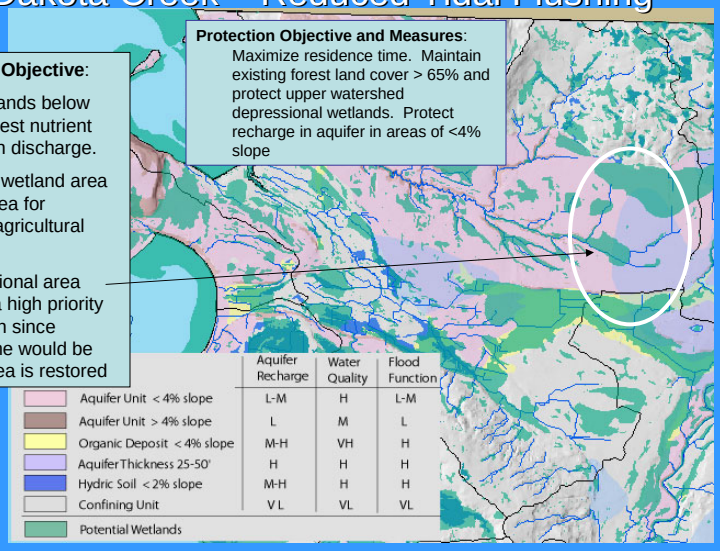
Identify Measures to Protect & Restore
Dakota Creek - Low Base Flows



Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

49

Identify Measures to Protect & Restore
Dakota Creek – Reduced Tidal Flushing



Restoration Objective:

Restore wetlands below areas of highest nutrient and pathogen discharge.

Note historic wetland area is in same area for intercepting agricultural pollutants.

This depressional area would have a high priority for restoration since residence time would be high once area is restored

Base Info → Landscape Processes → Landscape Functions → Sub-Basin Processes → Sub-Basin Functions → Relationship to Shoreline

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Identify Objectives – California Creek Watershed (cont.)

Relevant Process & or Function	Existing or Potential Environmental Issue	Alteration to Process	Threat or Cause of Alteration	Protection & Restoration Objectives	Protection – Mechanism & Measures	Restoration Mechanism
Peak Flows	Potential: Reduced diversity of aquatic organisms in fresh water areas, (structural complexity reduced) and increased transport of nutrients & pollutants to estuary.	Increased runoff	Tilling of soils in confining layer Impervious surfaces - development	Maximize infiltration in areas of confining formation	Retain existing forest cover Minimize effects of impervious cover in confining areas.	Increase native forest cover in areas of low performance recharge function
Flood Storage (potential)		Loss of storage volume	Drainage of depressional wetlands	Maximize residence time? (really maximize or restore storage capacity/ volum)	Protect depressional wetlands in areas of confining formation (low performance of flood function)	Restore wetlands in areas of confining formation.

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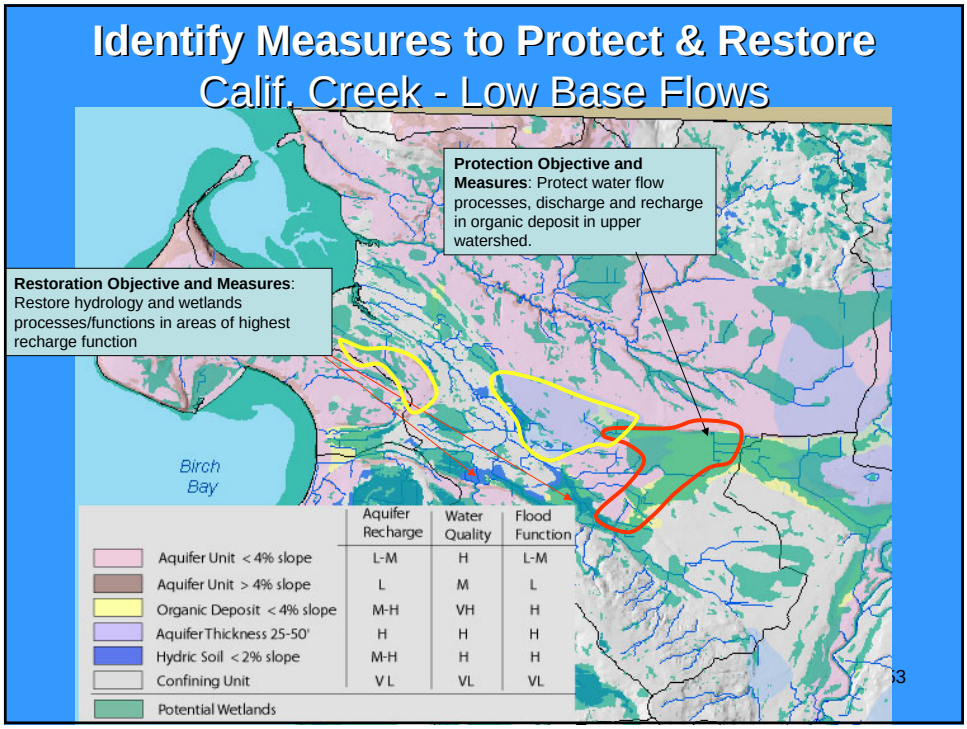
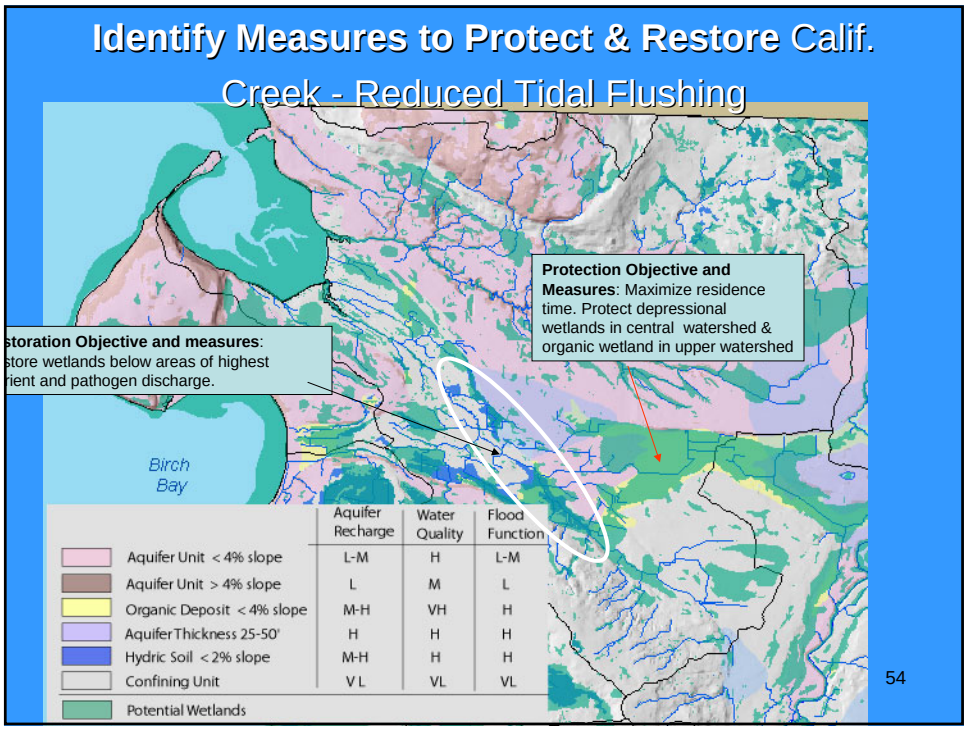
Identify Objectives – California Creek Watershed (cont.)

Critical Process or Function – Unaltered Conditions	Existing or Potential Environmental Issue	Altered Functions and Processes	Protection & Restoration Objectives	Protection – Mechanism & Measures	Restoration Mechanism
Discharge in large organic deposit and surface and subsurface flows from deposit into California Creek	**Potential: If this water flow process is altered, it could significantly affect baseflows in California Creek.**	**Organic deposit has been channelized converting subsurface flows to surface and reducing hydrology in large portions of deposit and performance of wetland functions**	**Protect subsurface flows, including movement of flows through deposit and discharge to California Creek.** **Restore hydrology to drained portions of organic deposit**	**Protect large organic deposit in upper watershed of California Creek Protect lands in Dakota Creek that support this water flow** **Minimize impervious cove.r Retain native cover**	**Restore hydrology to drained portions of organic deposit by reducing area drained by ditches and field tiles.**

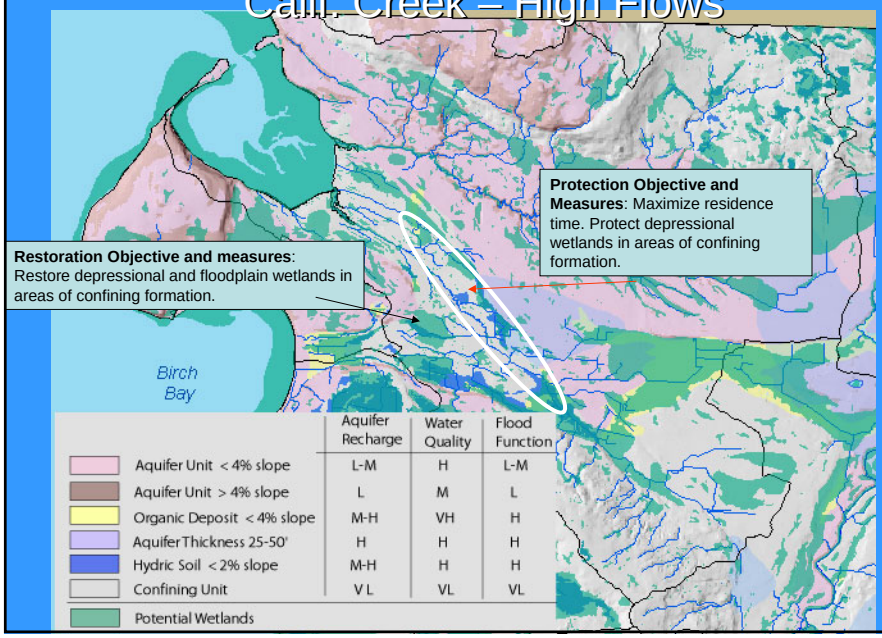
52


Identify Measures to Protect & Restore Calif. Creek - Low Base Flows
Protection Objective and Measures: Protect water flow processes, discharge and recharge in organic deposit in upper watershed.
Restoration Objective and Measures: Restore hydrology and wetlands processes/functions in areas of highest recharge function
Birch Bay
Aquifer Recharge
Water Quality
Flood Function
Aquifer Unit < 4% slope L-M H L-M
Aquifer Unit > 4% slope L M L
Organic Deposit < 4% slope M-H VH H
Aquifer Thickness 25-50' H H H
Hydric Soil < 2% slope M-H H H
Confining Unit V L VL VL
Potential Wetlands
53


Identify Measures to Protect & Restore Calif. Creek - Reduced Tidal Flushing
Protection Objective and Measures: Maximize residence time. Protect depressional wetlands in central watershed & organic wetland in upper watershed
storation Objective and measures: store wetlands below areas of highest rient and pathogen discharge.
Birch Bay
Aquifer Recharge
Water Quality
Flood Function
Aquifer Unit < 4% slope L-M H L-M
Aquifer Unit > 4% slope L M L
Organic Deposit < 4% slope M-H VH H
Aquifer Thickness 25-50' H H H
Hydric Soil < 2% slope M-H H H
Confining Unit V L VL VL
Potential Wetlands
54

Identify Measures to Protect & Restore

Calif. Creek – High Flows



55

Identify Existing Restoration Projects

56

Review Existing Restoration Plans and Projects

- Determine if they meet listed objectives & which ones
- Determine which objectives still need to be addressed
- Identify measures to address those objectives

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High Priority Restoration Area for Dakota Creek - Outside of Shoreline Jurisdiction – Intersection of Sunrise Road and Dakota Creek – Site identified by Multi-Purpose Storage Grant project

Figure 16 . Potential wetland restoration area for Dakota Creek. Downstream of this restoration area is primarily forested and therefore with less restoration potential.

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Appendix 6-A
References on Smart Growth and Related Topics

This appendix provides references for where to find additional information on Smart Growth and related topics, as discussed in Chapter 6 of this volume. Web pages and phone numbers are provided where available.

Documents

Building Green Infrastructure: Land Conservation as a Watershed Protection Strategy, Trust for Public Land, 1999. Addresses the significant advantage of land preservation in addressing water quality and water supply needs and as a holistic approach to overall watershed management. Web site: www.tpl.org

Getting to Smart Growth – 100 Policies. Web site: www.smartgrowth.org

Green Infrastructure: Smart Conservation for the 21st Century, Mark Benedict and Edward McMahan, 2001. Web site: www.sprawlwatch.org

"Green-Based" Urban Growth: Next Wave of Environmentalism. D.L. Parsell, National Geographic News, April 22, 2002. References numerous recent books on Smart Growth applications. Web site: http://news.nationalgeographic.com/news/2002/04/0422_020422_landplan.html

Growing with Green Infrastructure provides an example of greenprint development for Hope Township. Web site: www.heritageconservancy.org

Local Greenprinting for Growth, Volumes 1 – 4, 2002. A comprehensive workbook for developing a green infrastructure plan. Web site: www.tpl.org

Trails and Greenways: Advancing the Smart Growth Agenda, Huge Morris, Rails to Trails Conservancy. September 2002. Web site: www.railtrails.org

Fiscal Models

Fiscal analysis model for assessing the financial impact of Greenprint Plans – Behan Planning Associates, (518) 583-4335. Web site: www.behanplanning.com

Costs and Revenue of Residential Development: A Workbook for Local Officials and Citizens. Penn State Cooperative Extension, 2000. Call (814) 865-6713. Web site: http://cax.aers.psu.edu/residentialimpact/

Opportunity Knocks – Open Space is a Community Investment, Michael Frank, 2003. Helps calculate the fiscal savings from purchasing open space. Web site: www.heritageconservancy.org

Funding Assistance

Green Communities Program, Center for Green Space Design. Fifty percent matching grants to design Greenprint Plans. Call (801) 483-2100. Web site: www.greenspacedesign.org

Other Web Sites

www.greeninfrastructure.net

www.conservationfund.org

www.smartgrowth.org

www.smartgrowth.wa.gov

www.sprawlwatch.org/green/

www.tpl.org

www.dnr.state.md.us

www.epa.gov/greenkit/index.html

www.lincolninst.edu

www.plannersweb.com

www.pennscapes.psu.ecu/

Appendix 7-A
Examples of Cross-Jurisdictional Planning for Aquatic Resources

Managing natural resources at the larger geographic scales of contributing landscapes or watersheds has become recognized internationally as an important approach to protecting aquatic resources, including wetlands (United Nations 1997). While planning at this scale may be beyond the purview of comprehensive planning for some local jurisdictions, it is possible for local jurisdictions to join existing programs to develop plans and actions at larger geographic scales. Examples of regional planning efforts being conducted by state and federal agencies related to aquatic resources are provided below.

Watershed Planning

In 1998, the Washington State Legislature passed the Watershed Planning Act (RCW 90.82), providing a framework for developing local solutions to water supply issues on a watershed-wide basis. The planning is based on Water Resource Inventory Areas (WRIAs) which are framed around watersheds, or subwatersheds. This voluntary planning process is designed to allow local citizens, governments, and tribes to form watershed management planning units to develop watershed management plans. State agencies manage grants, provide technical assistance and, if requested, serve on the planning units. Planning units also may choose to develop strategies for improving water quality, protecting or enhancing fish habitat and, in collaboration with Ecology, setting minimum instream flows. At present, 45 of Washington's 62 WRIAs are represented by 36 planning units engaged in watershed planning.

See the Ecology watershed homepage for the status and listings of watershed planning efforts by WRIA throughout the state: www.ecy.wa.gov/watershed/. Many WRIA plans are due by December 2004, with all being due by December 2006 and 2007.

Total Maximum Daily Load or Water Cleanup Plan

The Total Maximum Daily Load (TMDL) is a process for planning for water cleanup established by Section 303(d) of the Clean Water Act. Federal law requires states to identify sources of pollution in waters that fail to meet state water quality standards, and to develop Water Cleanup Plans to address those pollutants. The Water Cleanup Plan (TMDL) establishes limits on pollutants that can be discharged to a waterbody and still allow state standards to be met. Setting such standards requires planning and monitoring at large geographic scales, and this is currently being done by Ecology's Water Quality Program.

Wetlands play an important role in reducing the amount of pollutants in a watershed because they function to remove nutrients, sediments, and toxic compounds (see Chapter 2 in Volume 1). The management, protection, and restoration of wetlands is therefore an important part of planning for water cleanup.

TMDL Water Cleanup Plans, however, do not presently consider wetland protection, restoration, and enhancement as elements in meeting the cleanup standards. Ecology has not yet adopted water quality standards for wetlands.

Interior Columbia Basin Ecosystem Management Project

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) was charged with developing a management strategy that is scientifically and ecologically based. It may potentially alter the management direction on over 60 million acres of lands administered by the Forest Service and Bureau of Land Management (BLM).

This effort combines science and management. Scientists developed a framework for ecosystem management and an assessment of the ecological, biophysical, social, and economic conditions of the Columbia Basin including lands outside of federal control. Land managers are using the scientific information to develop management strategies and provide context for Forest Service and BLM land management plans.

A large focus of this effort is on protecting and managing the aquatic resources that are related to salmon, including wetlands. Local governments in the region can use the information and analyses done by the ICBEMP to manage resources at the large geographic scale.

Columbia River Initiative

The Columbia River Initiative developed as a way to manage the increasing conflict related to the river's water resources. The public has been divided on the issue of whether additional water can be diverted from the river to off-stream uses without negatively affecting endangered salmon runs. The purpose of the Columbia River Initiative, therefore, is to develop an integrated state program for managing the water resources of the Columbia River, to allow new water withdrawals while providing support for salmon recovery.

To address this issue, scientific studies are being performed to serve as the cornerstone of a new management program that defines the conditions under which Ecology may issue water rights from the river. Since wetlands play an important role in the hydrologic cycle on which salmon depend, there is both an opportunity and a need to integrate the protection and management of wetlands into this process.

Appendix 8-A
Protecting Wetland Functions: An Overview of Considerations for Management

An important component of wetland protection and management is identifying what wetland functions need to be protected. Wetland functions can be grouped into three broad categories: water quality improvement, hydrologic functions, and habitat functions. Each of these can be further divided into more specific functions. For example, habitat functions can be divided into habitat for amphibians, habitat for mammals, etc. At the finest scale, we can consider the function of habitat for an individual species. (Chapter 2 in Volume 1 discusses the functions of wetlands in Washington State in detail.)

In addition to identifying what functions need to be protected, managing wetlands requires an understanding of how the functions are performed. Each wetland performs a function to a different degree based on a variety of factors. Some functions of wetlands are greatly affected by processes or influences that operate at large scales, while other functions are affected more by site-specific characteristics. Understanding how each function operates and how human activities can affect that function is critical to determining the appropriate type and level of protection that will be achieved through comprehensive plans, critical areas ordinances, and other regulations. (See Chapter 4 in Volume 1 for more information on how functions can be changed by human activities.)

In spite of the many differences in how wetlands function, one can generalize several approaches that will be effective in protecting each of the three groups of wetland functions (water quality improvement, hydrologic functions, and habitat functions). This appendix synthesizes the information available on what is needed to protect functions within a wetland or in its immediate vicinity, or to replace the functions if impacts are unavoidable. The discussion is organized by the three major groups of functions and by the different types of wetlands with special characteristics used in the *Washington State Wetlands Rating System*.

Wetland protection should encompass more than buffers and mitigation ratios

The most common method for protecting wetland functions has been the use of buffers. In addition, when impacts to wetlands have occurred, replacement of lost functions has typically been through setting ratios for compensatory mitigation that attempt to address the risk of mitigation failure and temporal loss of functions (see Chapters 5 and 6 in Volume 1).

Ecology has recommended standard buffers and ratios as part of the *Washington State Wetlands Rating System*. The first edition of the rating system relied on buffers and mitigation ratios to protect wetlands and maintain their functions and beneficial uses. Standards for buffers and ratios were recommended based on a wetland's category. Buffers were used as the tool for protecting the functions of a wetland, and mitigation ratios were used to ensure that the functions were adequately replaced if impacts could not be avoided.

The rating system was designed to characterize individual wetlands and their functions. Its focus is on the site itself. The guidance provided in this appendix reflects that bias and is focused on protection that can be provided in and around the wetland itself.

However, the review of recent scientific information has shown that this approach is overly simple and no longer reflects what we have learned about the complexity of wetlands and their functions. We have learned that protecting wetland functions cannot be achieved by using buffers and mitigation ratios as the only tools for protection. These measures by themselves will not completely protect many wetland functions from disturbances or replace the functions lost if impacts are unavoidable. Providing protection in the immediate vicinity of a wetland (e.g., buffers, use restrictions, etc.) will not always adequately protect wetland functions from disturbances that may occur elsewhere in the landscape. Other measures that take a larger, landscape approach and that utilize tools outside of the traditional regulatory realm may also need to be taken to fully protect wetland functions; these other measures are discussed elsewhere in Volume 2.

Protecting and Managing Habitat Functions

Wetlands provide habitat for a large number of species and play an integral part in maintaining the richness of species in the environment. Many different environmental factors affect the suitability of wetlands as habitat, the most important being the physical structure of the vegetation in the wetland, the water regime, and the condition of the vegetated and hydrologic connections between the wetland, uplands, and other aquatic resources. More detailed descriptions of how wetlands provide habitat are given in Volume 1.

The main question that arises when managing wetlands to maintain their capacity to provide habitat is: What species use the wetland and need protection? The recommendations made here are based on the assumption that wetlands with good structure and good connections to other habitats will provide habitat for a large range of species. In the absence of information on use, or lack of use, of an individual wetland by certain species, adequate protection needs to be provided that is based on the probability that the species are there. Wetlands that score highly for the habitat functions in the rating system have a higher probability of providing habitat than those with a low score. High scoring wetlands have the connections and structure to provide the habitat.

Buffers - The review of the literature indicates that there are several aspects of buffers that are important for wildlife. First, the width of buffers needed to protect habitat functions depends on the species needing protection. Some species using wetlands may need buffers in excess of 600 feet. Others, however, may need only 100 feet. In general, the information available indicates that buffers between 100 and 300 feet are adequate to protect most species found in wetlands in Washington.

Second, most studies on buffers have been done using buffers that were relatively undisturbed. It is difficult to extrapolate this information to judge the effectiveness of buffers that consist of lawns or tilled fields, or have otherwise been disturbed.

Third, the width of the buffer needed depends the type of disturbance the buffer is intended to reduce. Noise, light, or the movement of humans and pets may be reduced by providing a buffer of 100 feet. However, protecting the nesting and breeding of waterfowl generally requires a buffer of at least 200 to 300 feet depending on the type of disturbance.

Maintaining connectivity to other natural areas - The scientific information summarized in Volume 1 points out that fragmentation and the disruption of the vegetated corridors between undeveloped areas are a major cause of the loss of species richness (biodiversity). Existing connections and corridors to a wetland, as well as the structure within the wetland and its buffer, need to be preserved to protect the wetland's habitat functions.

Replacing habitat functions through compensatory mitigation - The loss of habitat functions is usually replaced by creating, restoring, or enhancing wetlands with the physical structure (vegetation, large woody debris, etc.) that provides ecological niches for different species. Studies of mitigation projects have shown that less attention is given to several other environmental factors that control the suitability of wetlands as habitat. These include the water regime needed to maintain the proposed habitat structure and the connectivity with other habitats that provides access for wildlife.

The studies of compensatory mitigation also indicate that high mitigation ratios alone will not guarantee that habitat functions will be adequately replaced. Chapter 6 of Volume 1 summarizes the many factors involved in determining whether a mitigation site is successful or not, and adequate ratios are only one factor.

At a minimum, a mitigation ratio should compensate for the loss of habitat during the time it takes the habitat structure to develop and the species to colonize the mitigation site (temporal loss of function). In the case of forested wetlands, this temporal loss is as high as 100 years or more, and as reported in Volume 1, no studies have found that all functions in a forested wetland have yet been reproduced through compensatory mitigation. Thus some functions cannot be replaced within a regulatory timeframe.

Protecting and Managing Water Quality Improvement Functions

Wetlands generally improve water quality by trapping pollutants (such as sediment) or by chemically transforming some pollutants into compounds that are no longer polluting (such as changing nitrates into nitrogen gas). The performance of the water quality functions by wetlands (removing sediment, removing nutrients, and removing toxic compounds) depends mostly on the structure of the vegetation that reduces water velocities and causes sediments and pollutants to settle, and on the chemical and biological properties of the soil in the wetland. More detailed descriptions of how these functions are performed are available in Volume 1. It is the geomorphic characteristics of the wetland and the physical structures found therein that control how a wetland improves water quality. Thus, a dense stand of invasive reed canarygrass can be just as effective at trapping pollutants as a dense stand of native sedges.

The issue in managing wetlands to maintain their capacity to improve water quality is: How much pollution is too much? Wetlands in watersheds where human activities pollute aquatic resources provide important functions by removing some of these pollutants. Large quantities of pollutants, however, can overwhelm the capacity of a wetland to improve water quality. For example, too much sediment entering a wetland can cover the organic soils that are important in trapping phosphorus and removing nitrogen.

The approach recommended for protecting wetlands at the scale of an individual site is to minimize the local input of any additional pollutants. The water quality functions that a wetland currently provides can be partially protected by limiting pollutants that would be added through a change to a more polluting land use (e.g., changing a forest to a residential development).

Buffers - Buffers trap pollutants and sediments before they reach the wetland. This helps to maintain the existing capability of a wetland for improving water quality. Protecting the water quality functions currently performed by a wetland would therefore require that any existing naturally vegetated buffers be protected from further degradation in the portion of the buffer that is most effective at trapping pollutants.

The review of existing literature in Volume 1 indicates that the effectiveness of buffers at trapping sediments and nutrients depends on many different factors, including the type of soils present, the type of vegetation present, and the slope. Furthermore the effectiveness is not linear. For example, a buffer of approximately 33 feet (10 m) will remove

approximately 60% of the sediment and pollutants, while it takes a buffer of approximately 150 feet (50 m) to remove 75% or more of the sediment and pollutants, and a buffer of 660 feet (200 m) to remove 90% of the sediment and pollutants.

Reducing additional surface discharges of untreated runoff - Buffers will not adequately protect functions in a wetland if polluted waters bypass the buffer and enter the wetland directly via pipes, ditches, or other channels. To maintain the current levels at which a wetland improves water quality, it may be necessary to limit the introduction of any additional pollutants that might come in through untreated runoff that bypasses the buffer. It is assumed that no additional pollutants will be discharged if developers meet the requirements for treatment described in Ecology's stormwater manual.

Replacing functions that improve water quality through compensatory mitigation - The review of the information on mitigation found very few projects in which the replacement of the water quality functions was an objective. These functions have not been the focus of compensatory mitigation in the past. A study by Johnson et al. (2002), however, found that creation or restoration of wetlands generally resulted in the creation and restoration of the water quality functions to some degree. Enhancement, on the other hand, did not often improve the water quality functions of the wetlands enhanced and may even have reduced them. Over half of the enhanced sites that were evaluated in Washington State had minimal or no increase in the levels of the water quality functions.

If a wetland is created or restored, some of the water quality functions will tend to be established fairly quickly while others may take much longer. The temporal loss of functions incurred during compensatory mitigation is very dependent on site-specific conditions. The structural characteristics and water regime needed to perform the water quality functions can be established early, while the organic soils needed to more effectively trap phosphorus and remove nitrogen can take over 50 years to develop.

At a minimum, a mitigation ratio should compensate for the loss of the water quality functions during the time it takes build the mitigation site. The study by Johnson et al. (2002) found that the risks of replacing the water quality functions through restoration and creation are less than those for wildlife habitat. Therefore, replacing lost water quality functions may be possible through mitigation ratios that are lower than those for wildlife habitat functions.

Ratios for enhancement, however, may have to be high because most enhancement projects that call for revegetation of disturbed wetlands result in little, if any, increase in water quality functions. Many of the wetlands used for enhancement are degraded in terms of their habitat but actually perform water quality functions at a high level. It is not possible to increase their effectiveness at improving water quality to mitigate for the loss of these functions in the impacted wetland. For example, if enhancement increases the water quality functions by only 5%, a ratio of 20:1 (by area) is needed to compensate for the impacts.

Protecting and Maintaining Hydrologic Functions

Hydrologic functions provided by wetlands include reducing flooding, reducing erosive flows, and recharging groundwater. The performance of these functions depends mostly on the water storage available in the wetland, the density of vegetation that can reduce the velocity of flood waters, the permeability of the soils, and the distance from the wetland surface to groundwater. More detailed descriptions of how these functions are performed are available in Volume 1.

Buffers - The factors that control the hydrologic functions in a wetland are not significantly altered by changes in the buffer. The amount of water coming into a wetland, its velocity, and its timing are controlled by processes that occur at the larger scale of the watershed or basin. There is one case, however, in which buffers may help protect hydrologic functions. Buffers may protect the storage capacity of depressional wetlands by trapping sediments that might otherwise fill the wetland. In the absence of buffers that trap sediment, a wetland can slowly fill with sediment, reducing the amount of water it can store. In this case the requirements for a buffer would be similar to those for the water quality functions described above.

Replacing hydrologic functions through compensatory mitigation - The review of the information on compensatory mitigation found very few projects in which the replacement of hydrologic functions was an objective. The study by Johnson et al. (2002), however, found that creation or restoration of wetlands generally resulted in the creation and restoration of hydrologic functions to some degree. Enhancement, on the other hand, did not often improve the hydrologic functions of the wetlands enhanced. Approximately two-thirds of the enhanced sites that were evaluated had no increase in the levels of hydrologic functions.

If a wetland is created or restored, the hydrologic functions will tend to be established fairly quickly because they depend mostly on the physical structure of the wetland (e.g., storage capacity, permeability of soils). Compensation for impacts to these functions is more dependent on the structure and water regime of the mitigation site rather than the mitigation ratio.

Protecting and Managing Wetlands with Special Characteristics

Natural Heritage Wetlands (Freshwater)

Natural Heritage wetlands, as defined by the Natural Heritage Program of the Washington State Department of Natural Resources, contain rare plants or those that are particularly sensitive to disturbance. These types of species are very sensitive to nutrient enrichment (eutrophication) that results from the input of nutrient-rich waters. The greatest richness of plant species, especially rare species, is found in nutrient-poor

wetlands. Rare plant species are outcompeted by large, regionally common species when excess nutrients are introduced to a wetland. Protection of Natural Heritage wetlands should focus on keeping nutrients out of these wetlands, maintaining the natural water regime, and reducing physical disturbance by humans (trampling, cutting vegetation, draining, etc.) within the wetlands.

Buffers - The buffer around a Natural Heritage wetland needs to be used to remove excess nutrients before they reach the wetland. The most efficient vegetated buffer, based on width-to-removal ratios, is about 60 m (197 feet) for removal of nitrogen and 75 m (253 feet) for phosphorus.

NOTE: A 250-foot buffer alone may not protect the rare or sensitive plants in the wetland if the watershed has high nutrient loadings or a water regime that is unstable.

Preventing new surface discharges to wetland or its tributaries - Buffers will not adequately protect rare plants in a wetland if polluted waters bypass the buffer and enter the wetland directly via pipes, ditches, or other channels. Furthermore, discharges of stormwater and changes in the water regime resulting from development will change the plant communities in a wetland (see review in Chapter 4 of Volume 1). Such changes might also impact the populations of the rare species in the wetland. Designs for treating stormwater do not reduce the nutrient loads significantly because they do not effectively remove nitrogen. To protect rare plants, it is necessary to limit the introduction of any additional nutrients that might come into the wetland through untreated runoff that bypasses the buffer.

Replacing Natural Heritage wetlands through compensatory mitigation - To our knowledge, there have been no successful mitigation projects that replaced the rare, threatened or endangered plant species found in a Natural Heritage wetland. Ecology and Fish and Wildlife assume that it is impossible to replace a Natural Heritage wetland through compensatory mitigation because the habitat required by rare and sensitive plant species cannot be reconstructed. The reconstruction of the habitat would require an extremely detailed understanding of the geological, biological, chemical, and physical requirements of each rare species found in the wetland. Such an understanding is not currently available in the existing scientific literature and would have to be developed through basic research.

Bogs

Bogs are also particularly sensitive to nutrient enrichment (eutrophication) because they have naturally low levels of nutrients. Bogs also often contain a high richness of plant species, especially rare ones, that are found only in such nutrient-poor wetlands. The rare plants in bogs, as in Natural Heritage wetlands, can be outcompeted by large, regionally common species when excess nutrients are introduced to a wetland.

Buffers - The buffer needs to be used to remove excess nutrients before they reach the bog. The most efficient vegetated buffer, based on width-to-removal ratios, is about 60 m (197 feet) for removal of nitrogen and 75 m (253 feet) for phosphorus.

Preventing new surface discharges to bog - Buffers will not adequately protect the functions of a bog if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. To protect the bog it is necessary to limit the introduction of any additional nutrients and excess water that might come in through untreated runoff that bypasses the buffer.

Replacing bogs through compensatory mitigation - Bogs (and fens) are characterized by their highly organic soil conditions, unique water regimes, and water chemistries. Studies of bog and fen restoration in Northern Europe and Canada (reviewed in Volume 1) concluded that restoration may not be possible due to irreversible changes of the characteristics of a bog. No information was available on the success of bogs or fens that were restored or created as wetland compensation. However, the literature suggests that, even if it is possible to recreate the appropriate environmental conditions, bogs and fens cannot be reproduced within a regulatory timeframe. In Washington, Rigg (1958) reports that peat accumulates naturally in eastern Washington at a rate of 1 inch in 50 years. Ecology and Fish and Wildlife therefore assumes that it is not feasible to replace bogs through compensatory mitigation.

Forested Wetlands

Forested wetlands are given special consideration because they are difficult to replace through compensatory mitigation. The protection they need is based on the functions they provide. Buffers and other measures to protect the functions, therefore, should be determined based on how well the wetland performs these functions rather than on the presence of a forested community.

Replacing mature forested wetland through compensatory mitigation - Though the studies reviewed in Volume 1 have found that trees can be planted in Washington State wetlands and they will grow, mature forested wetlands have not been successfully reproduced simply because of the time necessary for the trees and the structural characteristics of the forest to mature. Enhanced and created sites that have been planted often have a high density of stems to rapidly provide woody cover and shade out invasive species in the understory. Unless these sites are thinned, they will not reproduce the attributes of mature forested wetlands.

Alkali Wetlands

Alkali wetlands are characterized by the occurrence of shallow saline water. These wetlands provide the primary habitat for several species of migrant shorebirds and are also heavily used by migrant waterfowl. They also have unique plants and animals that are not found anywhere else in eastern Washington. The salt concentrations in these wetlands have resulted from a relatively long-term process of groundwater surfacing and evaporating.

Buffers - The ecological process that maintains an alkali wetland is the dynamic between water inflow and evaporation. Buffers have little impact on maintaining this process.

The buffer needed for an alkali wetland should be based on the wetland's habitat functions. Alkali wetlands in eastern Washington are a major resource for migratory shorebirds and other water-dependent birds, and the buffers are needed to protect the shorebirds and waterfowl from disturbance.

Preventing new surface discharges - The routing of additional surface water to alkali wetlands will change the balance between inflow and evaporation. No information was found, however, on the impacts this may have on the ecosystem in the alkali wetland. There is a significant risk, therefore, that the ecosystem may be impacted if discharges into alkali wetlands are allowed.

Replacing alkali wetlands through compensatory mitigation - The salt concentrations in alkali wetlands have resulted from a relatively long-term process of groundwater surfacing and evaporating. These conditions cannot be easily reproduced through compensatory mitigation because the balance of salts, evaporation, and water inflows is hard to reproduce. No references were found suggesting that alkali wetlands have ever been created or restored. Until alkali wetlands have been successfully created, Ecology and Fish and Wildlife will view any proposed creation project as highly experimental.

Vernal Pools

Vernal pools in the scablands of eastern Washington are the first open water areas to melt in the early spring. This open water provides areas where migrating waterfowl can find food while other, larger bodies of water are still frozen. Furthermore, the open water provides areas for pair bonding of waterfowl. Thus, vernal pools are very important for migratory waterfowl during a short period in the early spring. The rest of the time the vernal pools provide little habitat for larger animals that need larger buffers.

Buffers - The review of the literature indicates that waterfowl need at least 200-foot buffers to protect them from disturbance. In a vernal pool that is currently undisturbed, such a buffer would protect the birds from disturbance while they feed and use the pool for courtship activities.

Replacing vernal pools through compensatory mitigation - Vernal pools are characterized by the short duration of their inundation. Thus, in order to reproduce a vernal pool, a site with a suitable substrate must be found and the correct depth and water regime must be created or restored. The literature suggests that, in California, vernal pools may be reproduced under the right conditions. No information was found on the reproducibility of vernal pools in Washington.

Wetlands in Estuaries and Coastal Lagoons

Wetlands in which the water has a salinity higher than 0.5 parts per thousand, are classified as "estuarine" or "coastal lagoons" for the purposes of rating them. Both types of wetlands are found along the coast and in river mouths.

Buffers - The ecological process that maintains estuarine wetlands and those in coastal lagoons is the dynamic between marine waters coming from the ocean and fresh waters coming from land. Buffers have little impact on maintaining this process. The buffer needed for both types of wetlands should be based on the wetlands' habitat functions. Estuarine wetlands and coastal lagoons are a major resource for migratory shorebirds and other water-dependent birds, and the buffers are needed to protect the shorebirds and waterfowl from disturbance.

Other protective measures - Estuaries and coastal lagoons have a high fish and wildlife density and species diversity, provide important breeding habitat, and serve as movement corridors (see Washington Department of Fish and Wildlife web page, http://wdfw.wa.gov/hab/phshabs.htm). Both types of wetlands are also a limiting habitat and are highly vulnerable to alteration. It is not possible to specify in advance what other approaches are needed to protect these types of wetlands because of the many different habitat functions they provide. Protecting the functions of these wetlands will require considering each wetland on a case-by-case basis.

Replacing wetlands in estuaries and coastal lagoons through compensatory mitigation - The main focus of this document has been freshwater wetlands. Information on mitigating impacts to estuaries and coastal lagoons was not compiled, so no recommendations can be made. Decisions about compensating for impacts to these types of wetlands will have to be made on a case-by-case basis.

Interdunal Wetlands

Interdunal wetlands form in the "deflation plains" and "swales" that are geomorphic features in areas of coastal dunes. These dune forms are the result of the interaction between sand, wind, water and plants. Interdunal wetlands provide critical habitat in this ecosystem (Wiedemann 1984), but no methods have been developed to characterize how well these wetlands function.

Buffers - Although we have little detailed information on how interdunal wetlands function as habitat, the information does show that these wetlands provide an important resource for many species. In the absence of more detailed information about the needs of species using interdunal wetlands, the buffers recommended are those for wetlands with a moderately high level of function as habitat. It is assumed that species using interdunal wetlands will need some protection from disturbance, but not the 300 feet needed by the more sensitive species. Interdunal wetlands are physically highly dynamic and exposed, and it is assumed that species using these wetlands do have some adaptations to disturbance.

Replacing interdunal wetlands through compensatory mitigation - One of the mitigation sites assessed by Johnson et al. (2002) was an interdunal wetland that was found to be moderately successful. Other, undocumented observations would also suggest that creating wetlands in the interdunal ecosystem is usually fairly successful (P. Lund, Department of Ecology, personal communications). As a result, the recommended ratios for creating these types of wetlands are lower than for other types.

The one stipulation, however, is that losses of interdunal wetlands should be compensated only by creating other interdunal wetlands. The interdunal ecosystem in Washington and elsewhere along the Pacific Coast covers a very limited area. Any further losses of this resource should be minimized.

References

Johnson, P., D.L. Mock, A. McMillan, L. Driscoll, and T. Hruby. 2002. *Washington State Wetland Mitigation Evaluation Study Phase 2: Evaluating Success.* Publication No. 02-06-009. Olympia, WA: Washington State Department of Ecology.

Rigg, G. B. 1958. *Peat Resources of Washington*. Bulletin No. 44 Division of Mines and Geology, State of Washington.

Wiedemann, A.M. 1984. *The Ecology of Pacific Northwest Coastal Sand Dunes: A Community Profile.* U.S. Fish and Wildlife Service FWS/OBS-84/04.

Appendix 8-B
Recommendations for Elements of a Wetland Regulatory Ordinance

Please note: Appendix 8-B is a complement to Chapter 8 and its other appendices. Local governments should not adapt suggested language contained in Appendix 8-B to their critical areas ordinances without also carefully reviewing all of Chapter 8 and its supporting appendices.

This appendix contains specific recommendations for language that can be used in local critical area regulations to protect wetlands. The recommendations incorporate the relevant best available science from Volume 1 to protect wetland functions and values. While other language may also adequately include the best available science, the language recommended in this appendix represents the State of Washington's best attempt to provide a reasonable, science-based approach to wetlands regulation.

The language below is provided in a format similar to that found in many local critical area ordinances. This appendix does not include the more general provisions typically found in critical area regulations that relate to all critical areas. These can be found in Appendix A of the *Critical Areas Assistance Handbook* published by the Washington State Department of Community, Trade and Economic Development in November 2003 (http://www.cted.wa.gov/uploads/CA_Handbook.pdf). This appendix (Appendix 8-B) revises the wetland specific provisions in Appendix A of the *Critical Areas Assistance Handbook*.

Appendix 8-B should be used in conjunction with Appendices 8-C through 8-F, which contain guidance on wetland mitigation ratios and buffer widths (and supporting rationale), as well as with Chapter 8, which includes additional discussion on developing the necessary elements of a wetland regulatory ordinance.

This appendix includes:

WETLAND PROVISIONS
- Designating, Defining, Identifying, and Mapping Wetlands
- Regulated Activities
- Activities Allowed in Wetlands
- Wetland Ratings
- Standards
  - General Requirements
  - Wetland Critical Area Report Criteria
  - Compensatory Mitigation Requirements
  - Subdivisions
  - Signs and Fencing of Wetlands
  - Wetland Buffers
  - Stormwater Management Impacts to Wetlands
  - Unauthorized Critical Area Alterations and Enforcement

Wetland Provisions

Designating, Defining, Identifying, and Mapping Wetlands

A. **Designating, Defining and Identifying Wetlands.** Wetlands are those areas, identified in accordance with the *Washington State Wetlands Identification and Delineation Manual* (1997), that meet the following definition: "Wetland" or "wetlands" means areas that are inundated or saturated by surface water 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. Wetlands do not include those artificial wetlands intentionally created from non-wetland 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 non-wetland areas created to mitigate conversion of wetlands.

All areas within the [city/county] meeting the wetland definition criteria in the *Wetlands Identification and Delineation Manual*, regardless of whether these areas have previously been identified or mapped, are hereby designated critical areas and are subject to the provisions of this Title.

B. **Mapping.** The approximate location and extent of wetlands are shown on the adopted critical area maps. The following critical area maps, including [locally adopted maps or the National Wetlands Inventory] are hereby adopted. Additionally, soil maps produced by U.S. Department of Agriculture Natural Resources Conservation Service may be useful in helping to identify potential wetland areas. These maps are to be used as a guide for the [city/county], project applicants, and/or property owners to identify potential wetland areas that may be subject to the provisions of this Title.

It is the actual presence of wetland on a parcel, as delineated by the requirements of the *Washington State Wetlands Identification and Delineation Manual* (Ecology Publication #96-94, 1997), that triggers the requirements of this Title, whether or not the wetland is identified on the adopted maps. The exact location of a wetland's boundary shall be determined through the performance of a field delineation by a qualified wetlands professional, applying the *Washington State Wetlands Identification and Delineation Manual* (Ecology Publication #96-94, 1997) as required by RCW 36.70A.175.

Regulated Activities

The following activities are regulated if they occur in a regulated wetland or its buffer:

A. The removal, excavation, grading, or dredging of soil, sand, gravel, minerals, organic matter, or material of any kind;

B. The dumping, discharging, or filling with any material;

C. The draining, flooding, or disturbing of the water level or water table;

D. The driving of pilings;

E. The placing of obstructions;

F. The construction, reconstruction, demolition, or expansion of any structure;

G. The destruction or alteration of wetland vegetation through clearing, harvesting, shading, intentional burning, or planting of vegetation that would alter the character of a regulated wetland, provided that these activities are not part of a forest practice governed under Chapter 76.09 RCW and its rules; or

H. Activities that result in:

1. a significant change of water temperature;

2. a significant change of physical or chemical characteristics of the sources of water to the wetland;

3. a significant change in the quantity, timing or duration of the water entering the wetland; or,

4. the introduction of pollutants.

Activities Allowed in Wetlands

The activities listed below are allowed in wetlands in addition to those activities listed in the provisions established in Section [#] *Allowed Activities* in this Title. These activities do not require submission of a critical area report, except where such activities result in a loss to the functions and values of a wetland or wetland buffer. These activities include:

A. Conservation or preservation of soil, water, vegetation, fish, shellfish, and other wildlife that does not entail changing the structure or functions of the existing wetland;

B. The harvesting of wild crops in a manner that is not injurious to natural reproduction of such crops and provided the harvesting does not require tilling of soil,

planting of crops, chemical applications, or alteration of the wetland by changing existing topography, water conditions, or water sources;

C. Drilling for utilities under a wetland. Placing utility corridors under a wetland by drilling beneath the wetland, with entrance/exit portals located completely outside of the wetland boundary. Drilling beneath the wetland is allowed provided that the drilling does not interrupt the ground water connection to the wetland or percolation of surface water down through the soil column. Specific studies by a hydrologist are necessary to determine whether the ground water connection to the wetland or percolation of surface water down through the soil column is disturbed; or

D. Enhancement of a wetland through the removal of non-native invasive plant species. Removal of invasive plant species shall be restricted to hand removal. All removed plant material shall be taken away from the site and appropriately disposed of. Revegetation with appropriate native species at natural densities is allowed in conjunction with removal of invasive plant species.

Wetland Ratings

A. Wetlands shall be rated according to the Washington State Department of Ecology wetland rating system found in the *Washington State Wetlands Rating System* documents (Western Washington, Ecology Publication #04-06-014; Eastern Washington, Ecology Publication #02-06-019) or as revised by Ecology. Wetland rating categories shall be applied as the wetland exists at the time of the adoption of this Title or as it exists at the time of an associated permit application. Wetland rating categories shall not change due to illegal modifications.

Note: Choose the appropriate rating system from the eastern/western Washington methods from Ecology.

Wetland Rating Categories – Eastern Washington

1. **Category I.** Category I wetlands are those that (1) represent a unique or rare wetland type; or (2) are sensitive to disturbance; or (3) are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime; or (4) provide a very high level of functions.

2. **Category II.** Category II wetlands are (1) forested wetlands in the channel migration zone of rivers, or (2) mature forested wetlands containing fast growing trees, or (3) vernal pools present within a mosaic of other wetlands, or (4) wetlands with a moderately high level of functions. These wetlands are difficult, though not impossible, to replace, and provide high levels of some functions. These wetlands occur more commonly than Category I wetlands, but still need a high level of protection.

3. **Category III.** Category III wetlands are (1) vernal pools that are isolated, and (2) wetlands with a moderate level of functions (scores between 30 and 50 points). Wetlands scoring between 30 and 50 points generally have been disturbed in some ways, and are often smaller, less diverse and/or more isolated in the landscape than Category II wetlands. They may not need as much protection as Category I and II wetlands.

4. **Category IV.** Category IV wetlands have the lowest levels of functions (scores less than 30 points) and are often heavily disturbed. These are wetlands that we should be able to replace, and in some cases be able to improve. However, experience has shown that replacement cannot be guaranteed in any specific case. These wetlands do provide some important functions and should be protected to some degree.

Wetland Rating Categories – Western Washington

1. **Category I.** Category I wetlands are: (1) relatively undisturbed estuarine wetlands larger than 1 acre; (2) wetlands that are identified by scientists of the Washington Natural Heritage Program/DNR as high quality wetlands; (3) bogs larger than ½ acre; (4) mature and old growth forested wetlands larger than 1 acre; (5) wetlands in coastal lagoons; and (6) wetlands that perform many functions well.

   These wetlands are those that: (1) represent a unique or rare wetland type; or (2) are more sensitive to disturbance than most wetlands; or (3) are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime; or (4) provide a high level of functions.

2. **Category II.** Category II wetlands are: (1) estuarine wetlands smaller than 1 acre, or disturbed estuarine wetlands larger than 1 acre; (2) a wetland identified by the Washington State Department of Natural Resources as containing "sensitive" plant species; (3) a bog between ¼ and ½ acre in size; (4) an interdunal wetland larger than 1 acre; or (5) wetlands with a moderately high level of functions.

3. **Category III.** Category III wetlands are (1) wetlands with a moderate level of functions (scores between 30 and 50 points) and (2) interdunal wetlands between 0.1 and 1 acre in size. Wetlands scoring between 30 and 50 points generally have been disturbed in some ways, and are often less diverse or more isolated from other natural resources in the landscape than Category II wetlands.

4. **Category IV.** Category IV wetlands have the lowest levels of functions (scores less than 30 points) and are often heavily disturbed. These are wetlands that we should be able to replace, and in some cases be able to improve. However, experience has shown that replacement cannot be

guaranteed in any specific case. These wetlands may provide some important functions, and should be protected to some degree.

Standards

General Requirements

A. Activities and uses shall be prohibited in wetlands and wetland buffers, except as provided for in this Title.

B. **Category I Wetlands.** Activities and uses shall be prohibited from Category I wetlands, except as provided for in the *Public Agency and Utility Exception* (Section [#]), *Reasonable Use Exception* (Section [#]), and *Variance* (Section [#]) elements of this Title.

C. **Category II and III Wetlands.** For Category II and III wetlands, the following standards shall apply:

1. Water dependent activities may be allowed where there are no practicable alternatives that would have a less adverse impact on the wetland, its buffers and other critical areas, and where the use meets the intent of this Title.

2. Where non-water-dependent activities are proposed, it is presumed that an alternative development location exists; activities and uses shall be prohibited unless the applicant can demonstrate that:

    a. The basic project purpose cannot reasonably be accomplished on another site or sites in the general region while still successfully avoiding or resulting in less adverse impact on a wetland; and

    b. All on-site alternative designs that would avoid or result in less adverse impact on a wetland or its buffer, such as a reduction in the size, scope, configuration or density of the project, are not feasible.

Full compensation for the loss of acreage and functions of wetland and buffers shall be provided under the terms established under the *Mitigation* section in this Title.

D. **Category IV Wetlands.** Activities and uses that result in unavoidable impacts may be permitted in Category IV wetlands and associated buffers in accordance with an approved critical area report and compensatory mitigation plan, and only if the proposed activity is the only reasonable alternative that will accomplish the applicant's objectives. Full compensation for the loss of acreage and functions of wetland and buffers shall be provided under the terms established under the *Mitigation* section in this Title.

Wetland Critical Area Report Criteria

A. **Preparation by a Qualified Professional.** A critical area report for wetlands shall be prepared by a qualified professional who is a certified Professional Wetland Scientist or a non-certified professional wetland scientist with a minimum of five (5) years experience in the field of wetland science with experience preparing wetland reports.

See Appendix 8-G for further information on what constitutes a qualified wetlands specialist.

B. **Minimum Standards for Wetland Reports.** The written report and the accompanying plan sheets shall contain the following information, at a minimum:

1. The written report shall include at a minimum:

   a. The name and contact information of the applicant, the name, qualifications, and contact information for the primary author(s) of the Wetland Critical Area report, a description of the proposal, and identification of all the local, state, and/or federal wetland related permit(s) required for the project, and a vicinity map for the project;

   b. A statement specifying the accuracy of the report, and all assumptions made and relied upon;

   c. Documentation of any fieldwork performed on the site, including field data sheets for delineations, functional assessments, baseline hydrologic data, etc.;

   d. A description of the methodologies used to conduct the wetland delineations, functional assessments, or impact analyses including references;

   e. Identification and characterization of all critical areas, wetlands, water bodies, shorelines, floodplains and buffers on or adjacent to the proposed project area. For areas off-site of the project site, estimate conditions within 300 feet of the project boundaries using the best available information;

   f. For each wetland identified on-site and within 300 feet of the project site, provide the wetland rating per the provisions of this Title, required buffers, HGM classification, wetland acreage based on a professional survey from the field delineation (acreages for on-site portion and entire wetland area including off-site portions), Cowardin classification of vegetation communities including vegetation characterization, habitat elements, soil conditions based on site assessment and/or soil survey information, and to the extent

possible, hydrologic information such as location and condition of inlet/outlets (if they can be legally accessed), estimated water depths within the wetland, estimated hydroperiod patterns based on visual cues (e.g., algal mats, drift lines, flood debris, etc.). Provide acreage estimates, classifications, and ratings based on entire wetland complexes, not only the portion present on the proposed project site;

g. A description of the proposed actions including an estimation of acreages of impacts to wetland and buffers based on the field delineation and survey, and an analysis of site development alternatives including a no development alternative;

h. An assessment of the probable cumulative impacts to the wetlands and buffers resulting from the proposed development;

i. A description of reasonable efforts made to apply mitigation sequencing pursuant to Mitigation Sequencing to avoid, minimize, and mitigate impacts to critical areas;

j. A discussion of measures, including avoidance, minimization, and mitigation, proposed to preserve existing wetlands and restore any wetlands that were degraded prior to the current proposed land use activity;

k. A habitat and native vegetation conservation strategy that addresses methods to protect and enhance on-site habitat and wetland functions, and;

l. Evaluation of functions for the wetland and adjacent buffer using a functions assessment method recognized by local or state agency staff and including the reference for the method and all data sheets.

2. A copy of the site plan sheet(s) for the project must be included with the written report and must include, at a minimum:

a. Maps (to scale) depicting delineated and surveyed wetland and required buffers on-site, including buffers for off-site critical areas that extend onto the project site; the development proposal; other critical areas; grading and clearing limits; areas of proposed impacts to wetland and/or buffer (include square footage estimates);

b. A depiction of the proposed stormwater management facilities and outlets (to scale) for the development, including estimated areas of intrusion into the buffers of any critical areas. The written report shall contain a discussion of the potential impacts to the wetland(s) associated with anticipated hydroperiod alterations from the project.

C. **Compensatory Mitigation Reports.** When a project involves wetland and/or buffer impacts, a compensatory mitigation report shall be required, meeting the following minimum standards:

1. **Preparation by Qualified Professional(s).** A compensatory mitigation report for wetland or buffer impacts shall be prepared by one or more qualified professional(s) including someone who is a certified Professional Wetland Scientist or a non-certified professional wetland scientist: either of them must have a minimum of five (5) years experience designing compensatory mitigation designs which have been installed and monitored for a minimum of 2 years to verify success. In addition, the design team may include civil engineers, landscape architects or landscape designers depending upon the complexity of the project.

2. **A Wetland Critical Area Report** must accompany or be included in the compensatory mitigation report and include the minimum parameters described in Section [#] of this Title (above).

3. **Compensatory Mitigation Report**. Must include a written report and plan sheets that must contain, at a minimum, the following elements. Full guidance can be found in the *Draft Guidance on Wetlands Mitigation in Washington State*, Part 2, 2004 (Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10; Ecology publication number 04-06-013B).

   a. The written report must contain, at a minimum:

      i. The name and contact information of the applicant, the name, qualifications, and contact information for the primary author(s) of the Compensatory Mitigation Report, a description of the proposal, a summary of the impacts and proposed compensation concept, and identification of all the local, state, and/or federal wetland related permit(s) required for the project, plus a vicinity map for the project;

      ii. Description of the existing wetland and buffer areas proposed to be impacted including: acreages (or square footage) based on professional surveys of the delineations; Cowardin classifications including dominant vegetation community types (for upland and wetland habitats); the results of a functional assessment for the entire wetland and the portions proposed to be impacted; wetland rating based on the provisions of this Title;

      iii. An assessment of the potential changes in wetland hydroperiod from the proposed project and how the design has been modified to avoid, minimize or reduce adverse impacts to the wetland hydroperiod;

iv. A description of the proposed conceptual compensation actions for wetland and upland areas. Describe future vegetation community types for years 1, 3, 5, 10 and 25 post-installation including the succession of vegetation community types and dominants expected. Describe the successional sequence of expected changes in hydroperiod for the compensation site(s) for the same time periods as vegetation success. Describe the change in habitat characteristics expected over the same 25 year time period.

v. An assessment of existing conditions in the zone of the proposed compensation, including: vegetation community structure and composition, existing hydroperiod, existing soil conditions, existing habitat functions. Estimate future conditions in this location if the compensation actions are NOT undertaken (i.e, how would this site progress through natural succession).

vi. The field data collected to document existing conditions and on which future condition assumptions are based for hydroperiod (e.g., existing hydroperiod based on piezometer data, staff/crest gage data, hydrologic modeling, visual observations, etc.) and soils (e.g., soil pit data - hand dug or mechanically trenched, soil boring data; do not rely upon soil survey data for establishing existing conditions);

vii. A discussion of ongoing management practices that will protect wetlands after the project site has been developed, including proposed monitoring and maintenance programs;

viii. A bond estimate for the entire compensatory mitigation including the following elements: site preparation, plant materials, construction materials, installation oversight, maintenance twice/year for up to 5 years, annual monitoring field work and reporting, and contingency actions for a maximum of the total required number of years for monitoring;

ix. Proof of establishment of Notice on Title for the wetlands and buffers on the project site, including the compensatory mitigation areas.

b. The scaled plan sheets for the compensatory mitigation must contain, at a minimum:

i. Existing wetland and buffer surveyed edges, proposed areas of wetland and/or buffer impacts, location of proposed wetland and/or buffer compensation actions;

ii. Existing topography, ground-proofed, at two-foot contour intervals in the zone of the proposed compensation actions if any grading activity is proposed to create the compensation area(s). Indicate existing cross-sections of on-site wetland areas that are proposed to be impacted. Provide cross-section(s) (estimated one-foot intervals) for the proposed areas of wetland or buffer compensation;

iii. Surface and subsurface hydrologic conditions including an analysis of existing and proposed hydrologic regimes for enhanced, created, or restored compensatory mitigation areas. Illustrate how data for existing hydrologic conditions were utilized to inform the estimates of future hydrologic conditions;

iv. Proposed conditions expected from the proposed actions on site including future HGM types, vegetation community types by dominant species (wetland and upland), and future hydrologic regimes;

v. Required wetland buffers for existing wetlands and proposed compensation areas. Identify any zones where buffers are proposed to be reduced or enlarged outside of the standards identified in this Title;

vi. A plant schedule including all species by proposed community type and hydrologic regime, size and type of plant material to be installed, spacing of plants, “typical” clustering patterns, total number of each species by community type, timing of installation;

vii. Performance standards (measurable standards reflective of years post-installation) for upland and wetland communities, monitoring schedule, and maintenance schedule and actions by each bi-annium.

D. **Additional Information.** When appropriate, the [director] may also require the critical area report to include an evaluation by the state Department of Ecology or an independent qualified expert regarding the applicant's analysis and the effectiveness of any proposed mitigating measures or programs, and to include any recommendations as appropriate.

1. If the development proposal site contains or is within a wetland area, the applicant shall submit an affidavit, which declares whether the applicant has knowledge of any illegal alteration to any or all wetlands on the proposed site and whether the applicant previously had been found in violation of this ordinance. If the applicant has been found previously in violation, the applicant shall declare whether such violation has been corrected to the satisfaction of the jurisdiction.

2. The [director] shall determine if the mitigation and monitoring plans and bonding measures proposed by the applicant are sufficient to protect the public health, safety, and welfare, consistent with the goals, purposes, objectives and requirements of this ordinance.

Compensatory Mitigation Requirements

A. Compensatory mitigation for alterations to wetlands shall achieve equivalent or greater biologic functions. Compensatory mitigation plans shall be consistent with the *Draft Guidance on Wetlands Mitigation in Washington State*, Part 2, 2004 (Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10; Ecology publication number 04-06-013B, or as revised).

B. **Mitigation Shall Be Required in the Following Order of Preference:**

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 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.

5. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments.

C. **Compensation for Lost or Affected Functions.** Compensation shall address the functions affected by the proposed project, with an intention to achieve functional equivalency or improvement of functions. The goal shall be for the compensatory mitigation to provide similar wetland functions as those lost, except when either:

1. The lost wetland provides minimal functions as determined by a site-specific function assessment, and the proposed compensatory mitigation action(s) will provide equal or greater functions or will provide functions shown to be limiting within a watershed through a formal Washington state watershed assessment plan or protocol; or

2. Out of kind replacement of wetland type or functions will best meet watershed goals formally identified by the [city/county], such as replacement of historically diminished wetland types.

D. **Preference of Mitigation Actions.** Methods to achieve compensation for wetland functions shall be approached in the following order of preference:

1. Restoration (re-establishment and rehabilitation) of wetlands.

2. Creation (Establishment) of wetlands on disturbed upland sites such as those with vegetative cover consisting primarily of non-native introduced species. This should only be attempted when there is an adequate source of water and it can be shown that the surface and subsurface hydrologic regime is conducive for the wetland community that is anticipated in the design.

3. Enhancement of significantly degraded wetlands in combination with restoration or creation. Such enhancement should be part of a mitigation package that includes replacing the impacted area and meeting appropriate ratio requirements.

See Appendices 8-C and 8-D for definitions of the types of compensatory mitigation actions (Restoration, Creation, Enhancement).

E. **Type and Location of Mitigation.** Unless it is demonstrated that a higher level of ecological functioning would result from an alternate approach, compensatory mitigation for ecological functions shall be either in-kind and on-site, or in-kind and within the same stream reach, subbasin, or drift cell (if estuarine wetlands are impacted). Mitigation actions shall be conducted within the same sub-drainage basin and on the site of the alteration except when all of the following apply:

1. There are no reasonable on-site or in-subdrainage basin opportunities (e.g., on-site options would require elimination of high functioning upland habitat), or on-site and in-subdrainage basin opportunities do not have a high likelihood of success based on a determination of the natural capacity of the site to compensate for the impacts. Considerations should include: anticipated wetland mitigation replacement ratios, buffer conditions and proposed widths, available water to maintain anticipated hydrogeomorphic classes of wetlands when restored, proposed flood storage capacity, potential to mitigate riparian fish and wildlife impacts (such as connectivity);

2. Off-site mitigation has a greater likelihood of providing equal or improved wetland functions than the impacted wetland; and

3. Off-site locations shall be in the same sub-drainage basin unless:

    a. Established watershed goals for water quality, flood storage or conveyance, habitat, or other wetland functions have been established by the [city/county] and strongly justify location of mitigation at another site; or

b. Credits from a state certified wetland mitigation bank are used as mitigation and the use of credits is consistent with the terms of the bank's certification.

F. **Timing of Compensatory Mitigation.** It is preferred that compensation projects be completed prior to activities that will disturb the on-site wetlands. At the least, compensatory mitigation shall be completed immediately following disturbance and prior to use or occupancy of the action or development. Construction of mitigation projects shall be timed to reduce impacts to existing fisheries, wildlife, and flora.

The [director] may authorize a one-time temporary delay in completing construction or installation of the compensatory mitigation when the applicant provides a written explanation from a qualified wetland professional as to the rationale for the delay. An appropriate rationale would include identification of the environmental conditions that could produce a high probability of failure or significant construction difficulties (for example, project delay lapses past a fisheries window; or plant installation should be delayed until the dormant season to ensure greater survivability of installed materials). The delay shall not create or perpetuate hazardous conditions or environmental damage or degradation, and the delay shall not be injurious to the health, safety, and general welfare of the public. The request for the temporary delay must include a written justification that documents the environmental constraints that preclude implementation of the mitigation plan. The justification must be verified and approved by the [city/county].

G. **Mitigation Ratios.** [insert acreage ratios; see shaded box below]

See Appendices 8-C and 8-D for recommended mitigation ratios and criteria for increasing or reducing ratios to be used with the *Washington State Wetlands Rating System.* Appendix 8-F provides the rationale for the recommended ratios.

H. **Preservation.** Impacts to wetlands may be mitigated by preservation of wetland areas when used in combination with other forms of mitigation such as creation, restoration, or enhancement at the preservation site or at a separate location. Preservation may also be used by itself, but more restrictions apply as outlined below.

1. **Preservation in combination with other forms of compensation.** Using preservation as compensation is acceptable when done in combination with restoration, creation, or enhancement, provided that a minimum of 1:1 acreage replacement is provided by restoration or creation and the criteria below are met:

   a. The impact area is small, and/or impacts are to a Category III or IV wetland;

   b. Preservation of a high quality system occurs in the same Water Resource Inventory Area (WRIA) or watershed basin as the wetland impact;

c. Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation; and

d. Mitigation ratios for preservation in combination with other forms of mitigation shall range from 10:1 to 20:1, as determined on a case-by-case basis, depending on the quality of the wetlands being mitigated and the quality of the wetlands being preserved.

2. **Preservation as the sole means of compensation for wetland impacts.** Preservation of at-risk, high-quality habitat may be considered as the sole means of compensation for wetland impacts when all of the following criteria are met:

a. Preservation is used as a form of compensation only after the standard sequencing of mitigation (avoid, minimize, and then compensate) has been applied;

b. Creation, restoration, and enhancement opportunities have also been considered, and preservation is the best mitigation option;

c. The impact area is small and/or impacts are to a Category III or IV wetland;

d. Preservation of a high quality system occurs in the same Water Resource Inventory Area (WRIA) or a watershed where the wetland impact occurs;

e. Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation;

f. The preservation site is determined to be under imminent threat, specifically, sites with the potential to experience a high rate of undesirable ecological change due to on-site or off-site activities. ("Potential" includes permitted, planned, or likely actions that are not adequately protected under existing regulations [for example, logging of forested wetlands]); and

g. The area proposed for preservation is of high quality and critical for the health of the watershed or basin. Some of the following features may be indicative of high quality sites:

i. Category I or II wetland rating;

ii. Rare wetland type (for example, bogs, mature forested wetlands, estuaries);

iii. Habitat for threatened or endangered species;

iv. Wetland type that is rare in the area;

v. Provides biological and/or hydrological connectivity;

vi. High regional or watershed importance (for example, listed as priority site in watershed plan); and

vii. Large size with high species diversity (plants and/or animals) and/or high abundance.

h. Mitigation ratios for preservation as the sole means of mitigation shall generally start at 20:1. Specific ratios should depend upon the significance of the preservation project and the quality of the wetland resources lost.

I. **Impacts to Wetland Buffers**

This section still needs to be developed. We are interested in any examples of how buffer impacts and mitigation have been addressed in local ordinances.

J. **Wetland Mitigation Banks**

1. Credits from a wetland mitigation bank may be approved for use as compensation for unavoidable impacts to wetlands when:

   a. The bank is certified under Chapter 173-700 WAC;

   b. The [director] determines that the wetland mitigation bank provides appropriate compensation for the authorized impacts; and

   c. The proposed use of credits is consistent with the terms and conditions of the bank's certification.

2. Replacement ratios for projects using bank credits shall be consistent with replacement ratios specified in the bank's certification.

3. Credits from a certified wetland mitigation bank may be used to compensate for impacts located within the service area specified in the bank's certification. In some cases, bank service areas may include portions of more than one adjacent drainage basin for specific wetland functions.

Subdivisions

The subdivision and short subdivision of land in wetlands and associated buffers is subject to the following:

A. Land that is located wholly within a wetland or its buffer may not be subdivided.

B. Land that is located partially within a wetland or its buffer may be subdivided provided that an accessible and contiguous portion of each new lot is:

1. Located outside of the wetland and its buffer; and

2. Meets the minimum lot size requirements of [locally adopted zoning dimensions].

C. Access roads and utilities serving the proposed subdivision may be permitted within the wetland and associated buffers only if the [city/county] determines that no other feasible alternative exists, consistent with this Title.

Signs and Fencing of Wetlands

A. **Temporary Markers.** The outer perimeter of the wetland buffer and the clearing limits identified by an approved permit or authorization shall be marked in the field with temporary "clearing limits" fencing in such a way as to ensure that no unauthorized intrusion will occur. The marking is subject to inspection by the [director] prior to the commencement of permitted activities. This temporary marking shall be maintained throughout construction and shall not be removed until permanent signs, if required, are in place.

B. **Permanent Signs.** As a condition of any permit or authorization issued pursuant to this Title, the [director] may require the applicant to install permanent signs along the boundary of a wetland or buffer.

1. Permanent signs shall be made of an enamel-coated metal face and attached to a metal post, or another non-treated material of equal durability. Signs must be posted at an interval of one (1) per lot or every fifty (50) feet, whichever is less, and must be maintained by the property owner in perpetuity. The sign shall be worded as follows or with alternative language approved by the director:

Protected Wetland Area
Do Not Disturb
Contact [Local Jurisdiction]
Regarding Uses, Restrictions, and Opportunities for Stewardship

2. The provisions of Subsection (1) may be modified as necessary to assure protection of sensitive features or wildlife.

C. **Fencing**

1. The [director] shall determine if fencing is necessary to protect the functions and values of the critical area. If found to be necessary, the [director] shall condition any permit or authorization issued pursuant to this Title to require the applicant to install a permanent fence at the edge

of the wetland buffer, when fencing will prevent future impacts to the wetland.

2. The applicant shall be required to install a permanent fence around the wetland or buffer when domestic grazing animals are present or may be introduced on site.

3. Fencing installed as part of a proposed activity or as required in this Subsection shall be designed so as to not interfere with species migration, including fish runs, and shall be constructed in a manner that minimizes impacts to the wetland and associated habitat.

Wetland Buffers

A. **Buffer Requirements.** [insert buffer requirements; see shaded box below]

See Appendices 8-C and 8-D for recommended buffer widths and criteria for increasing, reducing and averaging buffers to be used with the *Washington State Wetlands Rating System.* Appendix 8-E provides the rationale for the recommended buffers.

B. **Measurement of Wetland Buffers.** All buffers shall be measured from the wetland boundary as surveyed in the field. The width of the wetland buffer shall be determined according to the wetland category and the proposed land use as identified in this Title. The buffer for a wetland created, restored, or enhanced as compensation for approved wetland alterations shall be the same as the buffer required for the category of the created, restored, or enhanced wetland. Only fully vegetated buffers will be considered. Lawns, walkways, driveways, and other mowed or paved areas will not be considered buffers.

C. **Buffers on Mitigation Sites.** All mitigation sites shall have buffers consistent with the buffer requirements of this Title and based on the expected category of the wetland once the mitigation actions are completed.

D. **Buffer Maintenance.** Except as otherwise specified or allowed in accordance with this Title, wetland buffers shall be retained in an undisturbed or enhanced condition. Removal of invasive non-native weeds is required for the duration of the mitigation bond.

E. **Impacts to Buffers.** See Section [#] titled *Compensatory Mitigation Requirements.*

The buffer mitigation section has not yet been developed.

F. If buffers for two contiguous critical areas overlap (such as buffers for a stream and a wetland), the wider buffer applies.

G. Buffer Uses. The following uses may be permitted within a wetland buffer in accordance with the review procedures of this Title, provided they are not prohibited by any other applicable law and they are conducted in a manner so as to minimize impacts to the buffer and adjacent wetland:

1. **Conservation and Restoration Activities.** Conservation or restoration activities aimed at protecting the soil, water, vegetation, or wildlife.

2. **Passive Recreation.** Passive recreation facilities designed and in accordance with an approved critical area report, including:

   a. Walkways and trails, provided that those pathways that are generally parallel to the perimeter of the wetland shall be located in the outer twenty-five percent (25%) of the buffer area, and constructed with a pervious surface. Raised boardwalks utilizing non-treated pilings may be acceptable;

   b. Wildlife viewing structures.

3. **Stormwater Management Facilities.** Stormwater management facilities, limited to stormwater dispersion outfalls and bioswales, may be allowed within the outer twenty-five percent (25%) of the buffer of Category III or IV wetlands only, provided that:

   a. No other location is feasible; and

   b. The location of such facilities will not degrade the functions or values of the wetland; and

   c. Stormwater management facilities are not allowed in buffers of Category I or II wetlands.

Stormwater Management Impacts to Wetlands

A. **Protection of Wetland Hydrology.** Wetland hydrology shall be protected through the development process. Post-development wetland hydrology shall match pre-development wetland hydrology to the maximum extent feasible.

B. **Construction of New Surface Water Conveyance Systems.** Construction of new surface water conveyance systems in wetland buffers is allowed only if discharging at the wetland edge has less adverse impact upon the wetland or wetland buffer than if the surface water is discharged at the buffer edge and allowed to naturally drain through the buffer.

C. **Stormwater Facilities on Roads Adjacent to Wetlands and their Buffers.** Construction of new surface water flow control or surface water quality treatment facilities are only allowed in wetlands and buffers when such facilities are located in an

existing road right-of-way and conducted consistent with established road maintenance guidelines and best management practices.

D. **Limits on Use of Wetlands for Stormwater Detention.** Wetlands cannot be used for stormwater detention and treatment unless the project satisfies the guidance and criteria developed by the Puget Sound Wetlands and Stormwater Management Research Program (Azous and Horner, eds, 2001, *Wetlands and Urbanization: Implications for the Future*) and contained in Appendix I-D of the *Stormwater Management Manual for Western Washington* titled "Wetlands and Stormwater Management Guidelines."

Please note: At this point we are not aware of wetland management guidelines that have been developed to address stormwater issues specific to eastern Washington.

Unauthorized Alterations and Enforcement

A. When a wetland or its buffer has been altered in violation of this Title, all ongoing development work shall stop and the critical area shall be restored. The [city/county] shall have the authority to issue a stop work order to cease all ongoing development work, and order restoration, rehabilitation, or replacement measures at the owner's or other responsible party's expense to compensate for violation of provisions of this Title.

B. **Requirement for Restoration Plan.** All development work shall remain stopped until a restoration plan is prepared and approved by [city/county]. Such a plan shall be prepared by a qualified professional using the currently accepted scientific principles and shall describe how the actions proposed meet the minimum requirements described in Subsection (C). The [director] shall, at the violator's expense, seek expert advice in determining the adequacy of the plan. Inadequate plans shall be returned to the applicant or violator for revision and resubmittal.

C. **Minimum Performance Standards for Restoration.** The following minimum performance standards shall be met for the restoration of a wetland, provided that if the violator can demonstrate that greater functions and habitat values can be obtained, these standards may be modified:

1. The historic structural and functional values shall be restored, including water quality and habitat functions;

2. The historic soil types and configuration shall be replicated;

3. The wetland and buffers shall be replanted with native vegetation that replicates the vegetation historically found on the site in species types, sizes, and densities. The historic functions and values should be replicated at the location of the alteration; and

4. Information demonstrating compliance with other applicable provisions of this Title shall be submitted to the [director].

D. **Site Investigations.** The [director] is authorized to make site inspections and take such actions as are necessary to enforce this Title. The [director] shall present proper credentials and make a reasonable effort to contact any property owner before entering onto private property.

E. **Penalties.** Any person, party, firm, corporation, or other legal entity convicted of violating any of the provisions of this Title shall be guilty of a misdemeanor. Each day or portion of a day during which a violation of this Title is committed or continued shall constitute a separate offense. Any development carried out contrary to the provisions of this Title shall constitute a public nuisance and may be enjoined as provided by the statutes of the State of Washington. The [city/county] may levy civil penalties against any person, party, firm, corporation, or other legal entity for violation of any of the provisions of this Title. The civil penalty shall be assessed at a maximum rate of [amount] dollars per day per violation.

Appendix 8-C
Guidance on Widths of Buffers and Ratios for Compensatory Mitigation to be used with the Western Washington Wetland Rating System

This appendix provides guidance on buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetlands Rating System for Western Washington*. This guidance can be used to develop a program for protecting and managing the functions and values of wetlands through regulatory means. The recommendations are based on the analysis of the current scientific literature provided in Volume 1 of this two-volume report. The detailed rationale for the recommendations is provided in Appendices 8-E and 8-F.

The recommendations on buffer widths and mitigation ratios are general, and there may be some wetlands for which these recommendations are either too restrictive or not protective enough. The recommendations are based on the assumption that a wetland will be protected only at the scale of the site itself. They do not reflect changes in buffers and ratios that might result from regulations that are developed based on a larger scale, landscape approach.

Buffers

Requiring buffers of a specific width has been one of the primary methods by which local jurisdictions in Washington have tried to protect the functions and values of wetlands. Buffers are the uplands adjacent to an aquatic resource that can, through various physical, chemical, and/or biological processes, reduce impacts to the wetland from adjacent land uses. Buffers can also provide the terrestrial habitats necessary for many species of wildlife that use wetlands to meet some of their needs.

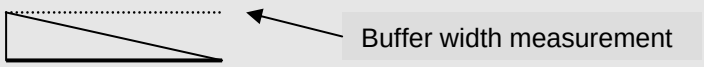
The primary purpose of buffers is to protect and maintain the wide variety of functions and values provided by wetlands. The physical characteristics of buffers—slope, soils, vegetation, and width—determine how well buffers reduce the adverse impacts of human development and provide the habitat needed by wildlife species that use wetlands. These characteristics are discussed in detail in Volume 1.

The review of the scientific literature has shown, however, that buffers alone cannot adequately protect all functions that a wetland performs. Guidance for protecting the functions and values of wetlands based on their category as determined through the rating system is provided below. The main focus, as in the past, is on buffers; however, additional information is provided on other ways in which wetlands can be regulated to provide some of the necessary protection that buffers alone do not provide.

Basic Assumptions for Using the Guidance on Buffer Widths

Recommendations for widths of buffers assume that:

- The wetland has been categorized using the *Washington State Wetlands Rating System*.
- The buffer is vegetated with native plant communities that are appropriate for the ecoregion, or with a plant community that provides similar functions.
- If the vegetation in the buffer is disturbed (grazed, mowed, etc.) or non-native, proponents who are planning changes to land use that will increase impacts to wetlands will have to rehabilitate the buffer with native plant communities that are appropriate for the ecoregion, or with a plant community that provides similar functions.
- The width of the buffer is measured in horizontal distance (i.e., along the horizontal plane; see drawing below). This is because the effectiveness of buffers at removing pollutants before they enter a wetland decreases as the slope increases.



- The buffer will remain relatively undisturbed in the future within the width specified.

Three alternatives for protecting the functions of wetlands using buffers are described and defined in the following sections. These include:

- Buffer Alternative 1: Width based only on wetland category;
- Buffer Alternative 2: Width based on wetland category and modified by impacts of proposed land use; and
- Buffer Alternative 3: Width based on wetland category, intensity of impacts, and wetland functions or special characteristics.

The buffer widths recommended for each alternative were developed based on the review of scientific information in Volume 1. This discussion represents a synthesis of the information about the types and sizes of buffers needed to protect functions and the special characteristics in wetlands.

Buffer Alternative 1: Width based only on wetland category

The first alternative is the simplest, in which the width of buffers is based only on the category of the wetland (Table 1). This alternative provides the least flexibility because many different types of wetlands and types of human impacts are combined. For example, not all wetlands that fall into Category I or II need a 300-foot buffer. If no distinctions are made between the types of wetlands that fall into Category I or II, all wetlands that fall into these categories have to be protected with a 300-foot buffer so

adequate protection is provided for those wetlands that do need a buffer this wide. Also, the buffer width indicated in this alternative is that which would be needed to protect the wetland from land uses that have the greatest impacts. The buffer recommended for each category of wetland in Alternative 1 is the widest recommended for that category in both Alternatives 2 and 3 (discussed below).

Table 1. Width of buffers needed to protect wetlands in western Washington if impacts from land use and wetland functions are NOT incorporated (Buffer Alternative 1).

Category of Wetland	Widths of Buffers
IV	50 ft
III	150 ft
II	300 ft
I	300 ft

Buffer Alternative 2: Width based on wetland category and modified by impacts of proposed land use

The second alternative increases the regulatory flexibility by including the concept that not all types of proposed land uses have the same level of impact (Table 2). For example, a new residence that is being built on 5 acres of land next to a wetland is expected to have a smaller impact than if 20 houses were being built on the same 5 acres. Three categories of impacts from proposed land uses are outlined: land uses that can create high impacts, moderate impacts, and low impacts to wetlands (types of land uses that can cause these levels of impacts are provided in Table 3).

Table 2. Width of buffers needed to protect wetlands in western Washington with consideration of impacts of proposed land uses (Buffer Alternative 2).

Category of Wetland	Low Impact Land Use*	Moderate Impact Land Use*	High Impact Land Use*
IV	25 ft	40 ft	50 ft
III	75 ft	110 ft	150 ft
II	100 ft	150 ft	300 ft
I	150 ft	225 ft	300 ft
* See Table 3 for types of land uses that can result in low, moderate, and high impacts to wetlands.			

Table 3. Type of land uses that can result in high, moderate, and low levels of impacts to adjacent wetlands.

Level of Impact from Proposed Change in Land Use	Types of Land Uses that Cause Impacts Based on Common Zoning Designations
High	• Commercial • Urban • Industrial • Institutional • Retail sales • Residential (more than 1 unit/acre) • New agriculture (high-intensity processing such as dairies, nurseries, greenhouses, raising and harvesting crops requiring annual tilling, raising and maintaining animals) • High-intensity recreation (golf courses, ball fields) • Hobby farms
Moderate	• Residential (1unit/acre or less) • Moderate-intensity open space (parks) • New agriculture (moderate-intensity such as orchards and hay fields) • Paved trails • Building of logging roads
Low	• Forestry (cutting of trees only) • Low-intensity open space (such as passive recreation and natural resources preservation) • Unpaved trails

Buffer Alternative 3: Width based on wetland category, intensity of impacts, and wetland functions or special characteristics

The third alternative provides the most flexibility by recommending buffers that are based on three factors: the wetland category, the intensity of the impacts (as used in Alternative 2), and the functions or special characteristics of the wetland that need to be protected (determined through the rating system). The recommended buffers are shown in Tables 4 – 7. In this case a wetland may fall into more than one category. For example, a bog of 0.3 acre may be a Category II wetland because it is a bog, but it may be a Category I wetland based on its functions (as determined from the Wetland Rating Data Form) if it is part of a larger wetland complex.

NOTE: If a wetland meets more than one of the criteria listed in Tables 4 – 7, the buffer needed to protect the wetland is the widest one. For example, if a Category I wetland scores 32 points for habitat and 27 points for water quality functions, it requires a 300-foot buffer because the requirements for habitat are more stringent than those for the other functions.

Table 4. Width of buffers needed to protect Category IV wetlands in western Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use	Other Measures Recommended for Protection
Score for functions less than 30 pts.	Low - 25 ft Moderate – 40 ft High – 50 ft	To be developed.

Table 5. Width of buffers needed to protect Category III wetlands in western Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use	Other Measures Recommended for Protection
Moderate level of function for habitat (score for habitat 20 - 28 pts.)	Low - 75 ft Moderate – 110 ft High – 150 ft	To be developed.
Not meeting above criteria	Low - 40 ft Moderate – 60 ft High – 80 ft	To be developed.

Table 6. Width of buffers needed to protect Category II wetlands in western Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use (apply most protective)	Other Measures Recommended for Protection
High level of function for habitat (score for habitat 29 - 36 pts.)	Low - 150 ft Moderate – 225 ft High – 300 ft*	Maintain connectivity to other natural areas.
Moderate level of function for habitat (score for habitat 20 - 28 pts.)	Low - 75 ft Moderate – 110 ft High – 150 ft	To be developed.
High level of function for water quality improvement and low for habitat (score for water quality 24 - 32 pts.; habitat less than 20 pts.)	Low - 50 ft Moderate – 75 ft High – 100 ft	No additional discharges of untreated runoff.
Estuarine	Low - 75 ft Moderate – 110 ft High – 150 ft	To be developed.
Interdunal	Low - 75 ft Moderate – 110 ft High – 150 ft	To be developed.
Not meeting above criteria	Low - 50 ft Moderate – 75 ft High – 100 ft	To be developed.
* Fifty of the 122 wetlands used to calibrate the rating system for western Washington were Category II. Of these 50, only five (10%) would require 300-foot buffers to protect them from high-impact land uses. The maximum buffer width for the remaining 45 wetlands would be 150 feet.		

Table 7. Width of buffers needed to protect Category I wetlands in western Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use (apply most protective)	Other Measures Recommended for Protection
Natural Heritage Wetlands	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional discharges of surface water. No septic systems within 300 ft. Restore degraded parts of buffer.
Bogs	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional surface discharges. Restore degraded parts of buffer.
Forested	Buffer size to be based on score for habitat functions or water quality functions	If forested wetland scores high for habitat, need to maintain connectivity to other natural areas. Restore degraded parts of buffer.
Estuarine	Low - 100 ft Moderate – 150 ft High – 200 ft	To be developed.
Wetlands in Coastal Lagoons	Low - 100 ft Moderate – 150 ft High – 200 ft	To be developed.
High level of function for habitat (score for habitat 29 - 36 pts.)	Low – 150 ft Moderate – 225 ft High – 300 ft	Maintain connectivity to other natural areas. Restore degraded parts of buffer.
Moderate level of function for habitat (score for habitat 20 - 28 pts.)	Low – 75 ft Moderate – 110 ft High – 150 ft	To be developed.
High level of function for water quality improvement (24 – 32 pts.) and low for habitat (less than 20 pts.)	Low – 50 ft Moderate – 75 ft High – 100 ft	No additional discharges of untreated runoff.
Not meeting any of the above criteria	Low – 50 ft Moderate – 75 ft High – 100 ft	To be developed.

Special Conditions for a Possible Reduction in Buffer Widths

Condition 1: Reduction in buffer width based on reducing the intensity of impacts from proposed land uses

The buffer widths recommended for land uses with high-intensity impacts to wetlands can be reduced to those widths recommended for moderate-intensity impacts under the following conditions:

- For wetlands that score moderate or high for habitat (20 points or more), the width of the buffer around the wetland can be reduced if both of the following criteria are met:
  - A relatively undisturbed vegetated corridor at least 100 feet wide is protected between the wetland and any other Priority Habitats as defined by the Washington State Department of Fish and Wildlife (for current definitions see http://wdfw.wa.gov/hab/phshabs.htm). The corridor must be protected for the entire distance between the wetland and the Priority Habitat via some type of legal protection such as a conservation easement; and
  - Measures to minimize the impacts of different land uses on wetlands, such as the examples summarized in Table 8, are applied.
- For wetlands that score less than 20 points for habitat, the buffer width can be reduced to that required for moderate land use impacts if measures to minimize the impacts of different land uses on wetlands, as summarized in Table 8, are applied.

Table 8. Examples of measures to minimize impacts to wetlands from different types of activities. Note: This is not a complete list of options.

Examples of Disturbance	Examples of Measures to Minimize Impacts	Activities that Cause the Disturbance
Lights	Direct lights away from wetland.	Parking lots, warehouses, manufacturing, residential
Noise	Locate activity that generates noise away from wetland.	Manufacturing, residential
Toxic runoff*	Route all new runoff away from wetland. Establish covenants limiting use of pesticides within 150 ft of wetland. Apply integrated pest management.	Parking lots, roads, manufacturing, residential areas, application of agricultural pesticides, landscaping
Change in water regime	Infiltrate or treat, detain, and disperse new runoff into buffer.	Impermeable surfaces, lawns, tilling
Pets	Plant dense vegetation around buffer, such as rose, hawthorn, etc.	Residential areas
Human disturbance	Plant buffer with impenetrable natural vegetation appropriate for region.	Residential areas
Dust	Utilize best management practices to control dust.	Tilled fields
* These examples are not necessarily adequate to meet the rules for minimizing toxic runoff if threatened or endangered species are present at the site.		

Condition 2: Reductions in buffer widths where existing roads or structures lie within the buffer

Where a legally established, non-conforming use of the buffer exists (such as a road or structure that extends into the recommended wetland buffer), proposed actions in the buffer may be permitted as long as they do not increase the degree of non-conformity. In term of wetlands, this means no increase in the impacts to the wetland from activities in the buffer. For example, the widening of an existing road along its upland edge without any further roadside development would not likely change the nature or intensity of the impacts. If the road is only 50 feet from the edge of a Category II wetland, additional buffer is not needed to provide protection for the wetland. If, however, the proposal is to build a shopping center along the upland side of the road, the impacts will increase. This would require the developer to provide a standard buffer extending beyond the road.

Conditions for Increasing the Width of the Buffer or Enhancing It

Condition 1: Buffer is not vegetated with plants appropriate for the region

As stated above, the recommended widths for buffers are based on the assumption that the buffer is vegetated with a native plant community appropriate for the ecoregion or with one that performs similar functions. If the existing buffer is unvegetated, sparsely vegetated, or vegetated with non-native species that do not perform needed functions, the buffer should either be planted to create the appropriate plant community or the buffer should be widened to ensure that adequate functions in the buffer are provided. Generally, improving the vegetation will be more effective than widening the buffer.

Condition 2: Buffer has a steep slope

The review of the literature indicates that the effectiveness of buffers at removing pollutants before they enter a wetland decreases as the slope increases. If the buffer for a wetland is to be based on the score for its ability to improve water quality (see Tables 4 - 7) rather than habitat or other criteria, then the buffer should be increased by 50% if the slope is greater than 30% (a 3-foot rise for every 10 feet of horizontal distance).

Condition 3: Buffer is used by sensitive species

If the wetland provides habitat for a particularly sensitive species (such as a threatened or endangered species), the buffer width should be increased to provide adequate protection for the species based on its particular life history needs. Some buffer requirements of priority species are available on the Washington State Department of Fish and Wildlife web page (http://wdfw.wa.gov/hab/phsrecs.htm).

Buffer Averaging

The widths of buffers may be averaged if this will improve the protection of wetland functions, or if it is the only way to allow for reasonable use of a parcel. There is no scientific information available to determine if averaging of the widths of buffers does actually protect the functions. **Averaging may not be used in conjunction with the provisions for reductions in buffers listed above.**

- Averaging to **improve wetland protection** may be permitted when all of the following conditions are met:
  - The wetland has significant differences in characteristics that affect its habitat functions, such as a wetland with a forested component adjacent to a degraded emergent component or a “dual-rated” wetland with a Category I area adjacent to a lower rated area; and

  - The buffer is increased adjacent to the higher-functioning area of habitat or more sensitive portion of the wetland and decreased adjacent to the lower-functioning or less sensitive portion; and
  - The total area of the buffer after averaging is equal to the area required without averaging; and
  - The buffer at its narrowest point is never less than 3/4 of the standard width.

- Averaging to **allow reasonable use** of a parcel may be permitted when all of the following are met:
  - There are no feasible alternatives to the site design that could be accomplished without buffer averaging; and
  - The averaged buffer will not result in degradation of the wetland's functions and values as demonstrated by a report from a qualified wetland expert (see Appendix 8-G for a definition of a qualified wetland expert); and
  - The total buffer area after averaging is equal to the area required without averaging; and
  - The buffer at its narrowest point is never less than 3/4 of the standard width.

Ratios for Compensatory Mitigation

When the acreage required for compensatory mitigation is divided by the acreage of impact, the result is a ratio known variously as a "replacement," "compensation," or "mitigation" ratio. Using science, policy, and experience, regulatory agencies may develop a set of ratios that inform proponents of projects as to the approximate area of compensatory mitigation that is likely to be required.

Basic Assumptions for Using the Guidance on Ratios

- All ratios are based on the assumption that the proposed compensatory mitigation does not create, restore, or enhance an "atypical" wetland. This means that the project proposed does not alter the hydrogeomorphic (HGM) setting of the site, and the type of wetland proposed is appropriate for its position in the landscape. For example, excavating depressions to enhance a slope wetland is atypical because depressional wetlands do not naturally occur on slopes.
- The ratios are for a concurrent compensatory mitigation project. If the impacts to a wetland are to be mitigated by using an established mitigation bank, the rules and ratios applicable to the bank should be used.
- The ratios are based on the assumption that the HGM class of the wetland proposed as compensation is the same as the class of the impacted wetland (for example, impact to a riverine wetland is compensated by creating, restoring, or enhancing a riverine wetland).
- Ratios for projects in which the HGM class of wetlands proposed as compensation is not the same as that of the impacted wetland should be determined on a case-by-case basis using the recommended ratios as a starting point.
- The recommended ratios for compensatory mitigation are based on replacing a Category I or II wetland with a Category II wetland, and replacing a Category III or IV wetland with a Category III wetland.
- The ratio for using enhancement alone, without any replacement of wetland area, is 4 times that for restoration or creation.
- If the area of impacted wetland is replaced at a 1:1 ratio through restoration or creation, the remainder of the area needed to meet the ratio for restoration or creation can be replaced by enhancement at a 2:1 ratio. For example, impacts to 1 acre of a Category II wetland requiring a 3:1 ratio for creation can be compensated by creating 1 acre and enhancing 4 acres (instead of the additional 2 acres of creation that would be required).

These ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They are based on averaging the observations of mitigation success and risk at a programmatic level, and do not represent the specific risk of any individual project.

As noted in the shaded box above, the ratios for compensatory mitigation are based on replacing a Category I or II wetland with a Category II wetland, and replacing a Category III or IV wetland with a Category III wetland. The ratios may be adjusted either up or down if the category of the wetland proposed for compensation is different (for example, ratios may be lower if impacts to a Category IV wetland are to be mitigated by creating a Category II wetland).

On a case-by-case basis, it is possible to make use of the scores from the Wetland Rating Data Form of the wetland rating system to compare functions between the mitigation site and the impact site. This information may also be used to adjust replacement ratios. The scores from the *Methods for Assessing Wetland Functions* developed for specific wetland types in Washington State may be considered another option to establish whether the functions lost will be replaced if both the impacted site and the site used for compensation are of the same HGM class and subclass.

Definitions of Types of Compensatory Mitigation

The ratios presented here are also based on the type of compensatory mitigation proposed (enhancement, restoration, or creation). In its *Regulatory Guidance Letter 02-02*, the Corps of Engineers provided definitions for these types of compensatory mitigation. For the purpose of consistency, Ecology will use the same definitions for wetland projects as used in the Corps' guidance letter. These definitions are provided below.

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**: 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.
- **Rehabilitation:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions of a **degraded** wetland. Activities could involve breaching a dike to reconnect wetlands to a floodplain or return tidal influence to a wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

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. Activities typically involve excavation of upland soils to elevations that will produce a wetland hydroperiod, create hydric soils, and support the growth of hydrophytic plant species. Establishment results in a gain in wetland acres.

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.

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." Preservation does not result in a gain of wetland acres, may result in a gain in functions, and will be used only in exceptional circumstances.

Distinction between Rehabilitation and Enhancement

The distinction between rehabilitation and enhancement is sometimes difficult to understand. For the purposes of the rating system, Ecology further defines **rehabilitation** as:

- Actions that restore the original HGM class, or subclass, to a wetland whose current HGM class, or subclass, has been changed as a result of human activities.
- Actions that restore the water regime that was present and maintained the wetland before human activities changed it.

Any other actions taken in existing wetlands would be considered as **enhancement**. For example, a wetland that was once a forested riverine wetland was changed to a depressional, emergent wetland by the construction of a dike and through grazing. Rehabilitating the wetland would involve breaching the dike so the wetland becomes a riverine wetland again, removing the grazing, and reforesting the area. Removing the grazing and reforesting the wetland without reestablishing the links to the riverine system would be considered as enhancement.

Mitigation ratios for projects in western Washington that do not alter the HGM setting of the site used for mitigation are shown in Table 9 on the next page.

Table 9: Mitigation ratios for projects in western Washington that do not alter the hydrogeomorphic setting of the site used for mitigation.

These ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They are based on averaging the observations of mitigation success and risk at a programmatic level, and do not represent the specific risk of any individual project.

Category and Type of Wetland	Re-establishment or Creation	Rehabilitation**	1:1 Re-establishment or Creation (R/C) and Enhancement (E)	Enhancement Only
All Category IV	1.5:1	3:1	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 E	8:1
Category II Estuarine	Case-by-case	4:1 rehabilitation of an estuarine wetland	Case-by-case	Case-by-case
Category II Interdunal	2:1 Compensation has to be interdunal wetland	4:1 Compensation has to be interdunal wetland	1:1 R/C and 2:1 E	8:1
All other Category II	3:1	8:1	1:1 R/C and 4:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1 E	24:1
Category I based on score for functions	4:1	8:1	1:1 R/C and 6:1 E	16:1
Category I Natural Heritage site	Not considered possible*	6:1 rehabilitation of a Natural Heritage site	Case-by-case	Case-by-case
Category I Coastal Lagoon	Not considered possible*	6:1 rehabilitation of a coastal lagoon	Case-by-case	Case-by-case
Category I Bog	Not considered possible*	6:1 rehabilitation of a bog	Case-by-case	Case-by-case
Category I Estuarine	Case-by-case	6:1 rehabilitation of an estuarine wetland	Case-by-case	Case-by-case

* Natural Heritage sites, coastal lagoons, and bogs are considered irreplaceable wetlands, and therefore no amount of compensation would replace these ecosystems. Avoidance is the best option. In the rare cases when impacts cannot be avoided, replacement ratios will be assigned on a case-by-case basis. However, these ratios will be significantly higher than the other ratios for Category I wetlands.

** Rehabilitation ratios are based on the assumption that actions judged to be most effective for that site are being implemented.

NOTE: Preservation is discussed in the following section.

Conditions for Increasing or Reducing Replacement Ratios

Increases in replacement ratios are appropriate under the following circumstances:

- Uncertainty exists as to the probable success of the proposed restoration or creation; or
- A significant period of time will elapse between impact and establishment of wetland functions at the mitigation site; or
- Proposed mitigation will result in a lower category wetland or reduced functions relative to the wetland being impacted; or
- The impact was an unauthorized impact.

Reductions in replacement ratios are appropriate under the following circumstances:

- Documentation by a qualified wetland specialist (see Appendix 8-G) demonstrates that the proposed mitigation actions have a very high likelihood of success based on prior experience;
- Documentation by a qualified wetland specialist demonstrates that the proposed actions for compensation will provide functions and values that are significantly greater than the wetland being impacted; or
- The proposed actions for compensation are conducted in advance of the impact and are shown to be successful; or
- In wetlands where several HGM classes are found within one delineated boundary, the ratios can be decreased if:
  - Impacts to the wetland are all within an area that has a different HGM class from the one used to establish the category; and
  - The category of this area with a different class is “lower” than that of the entire wetland; and
  - The proponents provide adequate hydrologic and geomorphic data to establish that the boundary between the HGM classes lies outside of the footprint of the impacts.

Using Wetland Preservation for Compensatory Mitigation

Impacts to wetlands may be mitigated by preservation of wetland areas when used in combination with other forms of mitigation such as creation, restoration, or enhancement at the preservation site or at a separate location.

Preservation may also be used by itself, but more restrictions apply as outlined below.

1. **Preservation in combination with other forms of compensation.** Using preservation as compensation is acceptable when done in combination with restoration, creation, or enhancement, provided that a minimum of 1:1 acreage replacement is provided by restoration or creation and the criteria below are met:

   a) The impact area is small, and/or impacts are to a Category III or IV wetland;

   b) Preservation of a high quality system occurs in the same Water Resource Inventory Area (WRIA) or watershed basin as the wetland impact;

   c) Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation; and

   d) Mitigation ratios for preservation in combination with other forms of mitigation shall range from 10:1 to 20:1, as determined on a case-by-case basis, depending on the quality of the wetlands being mitigated and the quality of the wetlands being preserved.

2. **Preservation as the sole means of compensation for wetland impacts.** Preservation of at-risk, high-quality habitat may be considered as the sole means of compensation for wetland impacts when all of the following criteria are met:

   a) Preservation is used as a form of compensation only after the standard sequencing of mitigation (avoid, minimize, and then compensate) has been applied;

   b) Creation, restoration, and enhancement opportunities have also been considered, and preservation is the best mitigation option;

   c) The impact area is small and/or impacts are to a Category III or IV wetland;

   d) Preservation of a high quality system occurs in the same Water Resource Inventory Area (WRIA) or a watershed where the wetland impact occurs;

   e) Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation;

   f) The preservation site is determined to be under imminent threat, specifically, sites with the potential to experience a high rate of undesirable ecological change due to on-site or off-site activities. ("Potential" includes permitted, planned, or likely actions that are not adequately protected under existing regulations [for example, logging of forested wetlands]); and

   g) The area proposed for preservation is of high quality and critical for the health of the watershed or basin. Some of the following features may be indicative of high quality sites:

i. Category I or II wetland rating;

ii. Rare wetland type (for example, bogs, mature forested wetlands, estuaries);

iii. Habitat for threatened or endangered species;

iv. Wetland type that is rare in the area;

v. Provides biological and/or hydrological connectivity;

vi. High regional or watershed importance (for example, listed as priority site in watershed plan); and

vii. Large size with high species diversity (plants and/or animals) and/or high abundance.

h) Mitigation ratios for preservation as the sole means of mitigation shall generally start at 20:1. Specific ratios should depend upon the significance of the preservation project and the quality of the wetland resources lost.

Replacement Ratios for Temporal Impacts and Conversions

When temporal impacts to wetlands occur and the wetlands are not permanently lost (for instance, clearing of wetland vegetation during pipeline construction), some mitigation for the temporal loss of wetland functions should be required. Although the wetlands will be revegetated and over time are anticipated to have their previous level of functioning restored, a long-term loss of functions will occur. In addition, there is some risk of failure associated with the impact or alteration, especially when deep excavation is required to accommodate drilling equipment.

Generally, the ratios for **temporal impacts** should be half of the recommended ratios for permanent impacts, provided that the following measures are applied:

- An explanation is provided of how hydric soil, especially deep organic soil, is handled in the areas where the soil profile will be severely disturbed for a fairly significant depth and/or time;
- Groundwater flow patterns and how draining the wetlands will be avoided must be identified and described;
- A 10-year monitoring and maintenance plan must be provided for restored forest and shrub wetlands;
- Disturbed buffers are to be revegetated and monitored; and
- The hydroseed mix to be applied on disturbed restored areas must be identified. However, if the impacts are to non-native emergent wetlands (e.g., reed

canarygrass wetlands), restoration of the site after construction is generally all that is required.

Replacement of lost functions due to the **conversion of wetlands** from one type to another should also be required. When wetlands are not completely lost, but are converted to another type, such as a forested wetland converted to an emergent or shrub wetland, some functions are lost or reduced. Replacement ratios should vary based on the degree of the alteration but should generally be less than those required for permanent losses of wetland.

Appendix 8-D
Guidance on Widths of Buffers and Ratios for Compensatory Mitigation to be used with the Eastern Washington Wetland Rating System

This appendix provides guidance on buffers, ratios for compensatory mitigation, and other measures for protecting wetlands that are linked to the *Washington State Wetlands Rating System for Eastern Washington*. This guidance can be used to develop a program for protecting and managing the functions and values of wetlands through regulatory means. The recommendations are based on the analysis of the current scientific literature provided in Volume 1 of this two-volume report. The detailed rationale for the recommendations is provided in Appendices 8-E and 8-F.

The recommendations on buffer widths and mitigation ratios are general, and there may be some wetlands for which these recommendations are either too restrictive or not protective enough. The recommendations are based on the assumption that a wetland will be protected only at the scale of the site itself. They do not reflect changes in buffers and ratios that might result from regulations that are developed based on a larger scale, landscape approach.

Buffers

Requiring buffers of a specific width has been one of the primary methods by which local jurisdictions in Washington have tried to protect the functions and values of wetlands. Buffers are the uplands adjacent to an aquatic resource that can, through various physical, chemical, and/or biological processes, reduce impacts to the wetland from adjacent land uses. Buffers can also provide the terrestrial habitats necessary for many species of wildlife that use wetlands to meet some of their needs.

The primary purpose of buffers is to protect and maintain the wide variety of functions and values provided by wetlands. The physical characteristics of buffers—slope, soils, vegetation, and width—determine how well buffers reduce the adverse impacts of human development and provide the habitat needed by wildlife species that use wetlands. These characteristics are discussed in detail in Volume 1.

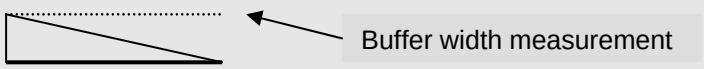
The review of the scientific literature has shown, however, that buffers alone cannot adequately protect all functions that a wetland performs. Guidance for protecting the functions and values of wetlands based on their category as determined through the rating system is provided below. The main focus, as in the past, is on buffers; however,

additional information is provided on other ways in which wetlands can be regulated to provide some of the necessary protection that buffers alone do not provide.

Basic Assumptions for Using the Guidance on Buffer Widths

Recommendations for widths of buffers assume that:

- The wetland has been categorized using the *Washington State Wetlands Rating System*.
- The buffer is vegetated with native plant communities that are appropriate for the ecoregion, or with a plant community that provides similar functions.
- If the vegetation in the buffer is disturbed (grazed, mowed, etc.) or non-native, proponents who are planning changes to land use that will increase impacts to wetlands will have to rehabilitate the buffer with native plant communities that are appropriate for the ecoregion, or with a plant community that provides similar functions.
- The width of the buffer is measured in horizontal distance (i.e., along the horizontal plane; see drawing below). This is because the effectiveness of buffers at removing pollutants before they enter a wetland decreases as the slope increases.



- The buffer will remain relatively undisturbed in the future within the width specified.

Three alternatives for protecting the functions of wetlands using buffers are described and defined in the following sections. These include:

- Buffer Alternative 1: Width based only on wetland category;
- Buffer Alternative 2: Width based on wetland category and modified by impacts of proposed land use; and
- Buffer Alternative 3: Width based on wetland category, intensity of impacts, and wetland functions or special characteristics.

The buffer widths recommended for each alternative were developed based on the review of scientific information in Volume 1. This discussion represents a synthesis of the information about the types and sizes of buffers needed to protect functions and the special characteristics in wetlands.

Buffer Alternative 1: Width based only on wetland category

The first alternative is the simplest, in which the width of buffers is based only on the category of the wetland (Table 1). This alternative provides the least flexibility because

many different types of wetlands and types of human impacts are combined. For example, not all wetlands that fall into Category I need a 250-foot buffer. If no distinctions are made between the types of wetlands that fall into Category I, all wetlands that fall into this category have to be protected with a 250-foot buffer so adequate protection is provided for those wetlands that do need a buffer this wide. Also, the buffer width indicated in this alternative is that which would be needed to protect the wetland from land uses that have the greatest impacts. The buffer recommended for each category of wetland in Alternative 1 is the widest recommended for that category in both Alternatives 2 and 3 (discussed below).

Table 1: Width of buffers needed to protect wetlands in eastern Washington if impacts from land use and wetland functions are NOT incorporated (Buffer Alternative 1).

Category of Wetland	Widths of Buffers
IV	50 ft
III	150 ft
II	200 ft
I	250 ft

Buffer Alternative 2: Width based on wetland category and modified by impacts of proposed land use

The second alternative increases the regulatory flexibility by including the concept that not all types of proposed land uses have the same level of impact (Table 2). For example, a new residence that is being built on 5 acres of land next to a wetland is expected to have a smaller impact than if 20 houses were being built on the same 5 acres. Three categories of impacts from proposed land uses are outlined: land uses that can create high impacts, moderate impacts, and low impacts to wetlands (types of land uses that can cause these levels of impacts are provided in Table 3).

Table 2. Width of buffers needed to protect wetlands in each category in eastern Washington with consideration of impacts of proposed land uses (Buffer Alternative 2).

Category of Wetland	Low Impact Land Use*	Moderate Impact Land Use*	High Impact Land Use*
IV	25 ft	40 ft	50 ft
III	75 ft	110 ft	150 ft
II	100 ft	150 ft	200 ft
I	125 ft	190 ft	250 ft
* See Table 3 for types of land uses that can result in low, moderate, and high impacts to wetlands.			

Table 3. Type of land uses that can result in high, moderate, and low levels of impacts to adjacent wetlands.

Level of Impact from Proposed Change in Land Use	Types of Land Uses that Cause Impacts Based on Common Zoning Designations
High	• Commercial • Urban • Industrial • Institutional • Retail sales • Residential (more than 1 unit/acre) • New agriculture (high-intensity processing such as dairies, nurseries, greenhouses, raising and harvesting crops requiring annual tilling, raising and maintaining animals) • High-intensity recreation (golf courses, ball fields) • Hobby farms
Moderate	• Residential (1unit/acre or less) • Moderate-intensity open space (parks) • New agriculture (moderate-intensity such as orchards and hay fields) • Paved trails • Building of logging roads
Low	• Forestry (cutting of trees only) • Low-intensity open space (such as passive recreation and natural resources preservation) • Unpaved trails

Buffer Alternative 3: Width based on wetland category, intensity of impacts, and wetland functions or special characteristics

The third alternative provides the most flexibility by recommending buffers that are based on three factors: the wetland category, the intensity of the impacts (as used in Alternative 2), and the functions or special characteristics of the wetland that need to be protected (determined through the rating system). The recommended buffers are shown in Tables 4 – 7. In this case a wetland may fall into more than one category. For example, a bog of 0.3 acre may be a Category II wetland because it is a bog, but it may be a Category I wetland based on its functions (as determined from the Wetland Rating Data Form) if it is part of a larger wetland complex.

NOTE: If a wetland meets more than one of the criteria listed in Tables 4 – 7, the buffer needed to protect the wetland is the widest one. For example, if a Category I wetland scores 32 points for habitat and 27 points for water quality functions, it requires a 200-foot buffer because the requirements for habitat are more stringent than those for the other functions.

Table 4. Width of buffers needed to protect Category IV wetlands in eastern Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use	Other Measures Recommended for Protection
Score for functions less than 30 pts.	Low - 25 ft Moderate – 40 ft High – 50 ft	To be developed.

Table 5. Width of buffers needed to protect Category III wetlands in eastern Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use	Other Measures Recommended for Protection
Moderate level of function for habitat (score for habitat 20 - 28 pts.)	Low - 75 ft Moderate – 110 ft High – 150 ft	To be developed.
Vernal pool	Low - 40 ft Moderate – 60 ft High – 80 ft	No intensive grazing or tilling in wetland or its buffer.
Not meeting above criteria	Low - 40 ft Moderate – 60 ft High – 80 ft	To be developed.

Table 6. Width of buffers needed to protect Category II wetlands in eastern Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use (apply most protective)	Other Measures Recommended for Protection
High level of function for habitat (score for habitat 29 - 36 pts.)	Low - 100 ft Moderate – 150 ft High – 200 ft	Maintain connectivity to other natural areas.
Moderate level of function for habitat (score for habitat 20 - 28 pts.)	Low - 75 ft Moderate – 110 ft High – 150 ft	To be developed.
High level of function for water quality improvement and low for habitat (water quality 24 - 32 pts.; habitat less than 20 pts.)	Low - 50 ft Moderate – 75 ft High – 100 ft	No additional discharges of untreated runoff.
Vernal pool	Low - 100 ft Moderate – 150 ft High – 200 ft OR Develop a regional plan to protect the most important vernal pool complexes – buffers of vernal pools outside protection zones can then be reduced to: Low - 40 ft Moderate – 60 ft High – 80 ft	No grazing in wetland.
Forested	Buffer width to be based on score for habitat functions or water quality functions	Riparian forest wetlands need to be protected at a watershed or subbasin scale (protection of the water regime in the watershed). Other protection based on needs to protect habitat and/or water quality functions.
Not meeting above criteria	Low - 50 ft Moderate – 75 ft High – 100 ft	To be developed.

Table 7. Width of buffers needed to protect Category I wetlands in eastern Washington (Buffer Alternative 3).

Wetland Characteristics	Buffer Widths by Impact of Land Use (apply most protective)	Other Measures Recommended for Protection
Natural Heritage Wetlands	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional discharges of surface water. No septic systems within 300 ft. Restore degraded parts of buffer.
Bogs	Low - 125 ft Moderate – 190 ft High – 250 ft	No additional surface discharges. Restore degraded parts of buffer.
Forested	Buffer size to be based on score for habitat functions or water quality functions	If forested wetland scores high for habitat, need to maintain connectivity to other natural areas. Restore degraded parts of buffer.
Alkali	Low – 100 ft Moderate – 150 ft High – 200 ft	No additional surface discharges. Restore degraded parts of buffer.
High level of function for habitat (score for habitat 29 - 36 pts.)	Low – 100 ft Moderate – 150 ft High – 200 ft	Maintain connectivity to other natural areas. Restore degraded parts of buffer.
Moderate level of function for habitat (score for habitat 20 - 28 pts.)	Low – 75 ft Moderate – 110 ft High – 150 ft	To be developed.
High level of function for water quality improvement (24 – 32 pts.) and low for habitat (less than 20 pts.)	Low – 50 ft Moderate – 75 ft High – 100 ft	No additional discharges of untreated runoff.
Not meeting any of the above criteria	Low – 50 ft Moderate – 75 ft High – 100 ft	To be developed.

Special Conditions for a Possible Reduction in Buffer Widths

Condition 1: Reduction in buffer width based on reducing the intensity of impacts from proposed land uses

The buffer widths recommended for land uses with high-intensity impacts to wetlands can be reduced to those widths recommended for moderate-intensity impacts under the following conditions:

- For wetlands that score moderate or high for habitat (20 points or more), the width of the buffer around the wetland can be reduced if both of the following criteria are met:
  - A relatively undisturbed vegetated corridor at least 100 feet wide is protected between the wetland and any other Priority Habitats as defined by the Washington State Department of Fish and Wildlife (for current definitions see http://wdfw.wa.gov/hab/phshabs.htm). The corridor must be protected for the entire distance between the wetland and the Priority Habitat via some type of legal protection such as a conservation easement; and
  - Measures to minimize the impacts of different land uses on wetlands, such as the examples summarized in Table 8, are applied.
- For wetlands that score less than 20 points for habitat, the buffer width can be reduced to that required for moderate land use impacts if measures to minimize the impacts of different land uses on wetlands, as summarized in Table 8, are applied.

Table 8. Examples of measures to minimize impacts to wetlands from different types of activities. Note: This is not a complete list of options.

Examples of Disturbance	Examples of Measures to Minimize Impacts	Activities that Cause the Disturbance
Lights	Direct lights away from wetland.	Parking lots, warehouses, manufacturing, residential
Noise	Locate activity that generates noise away from wetland.	Manufacturing, residential
Toxic runoff*	Route all new runoff away from wetland. Establish covenants limiting use of pesticides within 150 ft of wetland. Apply integrated pest management.	Parking lots, roads, manufacturing, residential areas, application of agricultural pesticides, landscaping
Change in water regime	Infiltrate or treat, detain, and disperse new runoff into buffer.	Impermeable surfaces, lawns, tilling
Pets	Plant dense vegetation around buffer, such as rose, hawthorn, etc.	Residential areas
Human disturbance	Plant buffer with impenetrable natural vegetation appropriate for region.	Residential areas
Dust	Utilize best management practices to control dust.	Tilled fields
* These examples are not necessarily adequate to meet the rules for minimizing toxic runoff if threatened or endangered species are present at the site.		

Condition 2: Reductions in buffer widths where existing roads or structures lie within the buffer

Where a legally established, non-conforming use of the buffer exists (such as a road or structure that extends into the recommended wetland buffer), proposed actions in the buffer may be permitted as long as they do not increase the degree of non-conformity. In term of wetlands, this means no increase in the impacts to the wetland from activities in the buffer. For example, the widening of an existing road along its upland edge without any further roadside development would not likely change the nature or intensity of the impacts. If the road is only 50 feet from the edge of a Category II wetland, additional buffer is not needed to provide protection for the wetland. If, however, the proposal is to build a shopping center along the upland side of the road, the impacts will increase. This would require the developer to provide a standard buffer extending beyond the road.

Conditions for Increasing the Width of the Buffer or Enhancing It

Condition 1: Buffer is not vegetated with plants appropriate for the region

As stated above, the recommended widths for buffers are based on the assumption that the buffer is vegetated with a native plant community appropriate for the ecoregion or with one that performs similar functions. If the existing buffer is unvegetated, sparsely vegetated, or vegetated with non-native species that do not perform needed functions, the buffer should either be planted to create the appropriate plant community or the buffer should be widened to ensure that adequate functions in the buffer are provided. Generally, improving the vegetation will be more effective than widening the buffer.

Condition 2: Buffer has a steep slope

The review of the literature indicates that the effectiveness of buffers at removing pollutants before they enter a wetland decreases as the slope increases. If the buffer for a wetland is to be based on the score for its ability to improve water quality (see Tables 4 - 7) rather than habitat or other criteria, then the buffer should be increased by 50% if the slope is greater than 30% (a 3-foot rise for every 10 feet of horizontal distance).

Condition 3: Buffer is used by sensitive species

If the wetland provides habitat for a particularly sensitive species (such as a threatened or endangered species), the buffer width should be increased to provide adequate protection for the species based on its particular life history needs. Some buffer requirements of priority species are available on the Washington State Department of Fish and Wildlife web page (http://wdfw.wa.gov/hab/phsrecs.htm).

Buffer Averaging

The widths of buffers may be averaged if this will improve the protection of wetland functions, or if it is the only way to allow for reasonable use of a parcel. There is no scientific information available to determine if averaging of the widths of buffers does actually protect the functions. **Averaging may not be used in conjunction with the provisions for reductions in buffers listed above.**

- Averaging to **improve wetland protection** may be permitted when all of the following conditions are met:
  - The wetland has significant differences in characteristics that affect its habitat functions, such as a wetland with a forested component adjacent to a degraded

emergent component or a "dual-rated" wetland with a Category I area adjacent to a lower rated area; and

- The buffer is increased adjacent to the higher-functioning area of habitat or more sensitive portion of the wetland and decreased adjacent to the lower-functioning or less sensitive portion; and
- The total area of the buffer after averaging is equal to the area required without averaging; and
- The buffer at its narrowest point is never less than 3/4 of the standard width.

- Averaging to **allow reasonable use** of a parcel may be permitted when all of the following are met:
  - There are no feasible alternatives to the site design that could be accomplished without buffer averaging; and
  - The averaged buffer will not result in degradation of the wetland's functions and values as demonstrated by a report from a qualified wetland expert (see Appendix 8-G for a definition of a qualified wetland expert); and
  - The total buffer area after averaging is equal to the area required without averaging; and
  - The buffer at its narrowest point is never less than 3/4 of the standard width.

Ratios for Compensatory Mitigation

When the acreage required for compensatory mitigation is divided by the acreage of impact, the result is a ratio known variously as a "replacement," "compensation," or "mitigation" ratio. Using science, policy, and experience, regulatory agencies may develop a set of ratios that inform proponents of projects as to the approximate area of compensatory mitigation that is likely to be required.

Basic Assumptions for Using the Guidance on Ratios

- All ratios are based on the assumption that the proposed compensatory mitigation does not create, restore, or enhance an "atypical" wetland. This means that the project proposed does not alter the hydrogeomorphic (HGM) setting of the site, and the type of wetland proposed is appropriate for its position in the landscape. For example, excavating depressions to enhance a slope wetland is atypical because depressional wetlands do not naturally occur on slopes.
- The ratios are for a concurrent compensatory mitigation project. If the impacts to a wetland are to be mitigated by using an established mitigation bank, the rules and ratios applicable to the bank should be used.
- The ratios are based on the assumption that the HGM class of the wetland proposed as compensation is the same as the class of the impacted wetland (for example, impact to a riverine wetland is compensated by creating, restoring, or enhancing a riverine wetland).
- Ratios for projects in which the HGM class of wetlands proposed as compensation is not the same as that of the impacted wetland should be determined on a case-by-case basis using the recommended ratios as a starting point.
- The recommended ratios for compensatory mitigation are based on replacing a Category I or II wetland with a Category II wetland, and replacing a Category III or IV wetland with a Category III wetland.
- The ratio for using enhancement alone, without any replacement of wetland area, is 4 times that for restoration or creation.
- If the area of impacted wetland is replaced at a 1:1 ratio through restoration or creation, the remainder of the area needed to meet the ratio for restoration or creation can be replaced by enhancement at a 2:1 ratio. For example, impacts to 1 acre of a Category II wetland requiring a 3:1 ratio for creation can be compensated by creating 1 acre and enhancing 4 acres (instead of the additional 2 acres of creation that would be required).

These ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They are based on averaging the observations of mitigation success and risk at a programmatic level, and do not represent the specific risk of any individual project.

As noted in the shaded box above, the ratios for compensatory mitigation are based on replacing a Category I or II wetland with a Category II wetland, and replacing a Category III or IV wetland with a Category III wetland. The ratios may be adjusted either up or down if the category of the wetland proposed for compensation is different (for example, ratios may be lower if impacts to a Category IV wetland are to be mitigated by creating a Category II wetland).

On a case-by-case basis, it is possible to make use of the scores from the Wetland Rating Data Form of the wetland rating system to compare functions between the mitigation site and the impact site. This information may also be used to adjust replacement ratios. The scores from the Methods for Assessing Wetland Functions developed for specific wetland types in Washington State may be considered another option to establish whether the functions lost will be replaced if both the impacted site and the site used for compensation are of the same HGM class and subclass.

Definitions of Types of Compensatory Mitigation

The ratios presented here are also based on the type of compensatory mitigation proposed (enhancement, restoration, or creation). In its Regulatory Guidance Letter 02-02, the Corps of Engineers provided definitions for these types of compensatory mitigation. For the purpose of consistency, Ecology will use the same definitions for wetland projects as used in the Corps' guidance letter. These definitions are provided below.

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:** 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.

- **Rehabilitation:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural or historic functions of a **degraded** wetland. Activities could involve breaching a dike to reconnect wetlands to a floodplain or return tidal influence to a wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres.

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. Activities typically involve excavation of upland soils to elevations that will produce a wetland hydroperiod, create hydric soils, and support the growth of hydrophytic plant species. Establishment results in a gain in wetland acres.

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.

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." Preservation does not result in a gain of wetland acres, may result in a gain in functions, and will be used only in exceptional circumstances.

Distinction between Rehabilitation and Enhancement

The distinction between rehabilitation and enhancement is sometimes difficult to understand. For the purposes of the rating system, Ecology further defines **rehabilitation** as:

- Actions that restore the original HGM class, or subclass, to a wetland whose current HGM class, or subclass, has been changed as a result of human activities.
- Actions that restore the water regime that was present and maintained the wetland before human activities changed it.

Any other actions taken in existing wetlands would be considered as **enhancement**. For example, a wetland that was once a forested riverine wetland was changed to a depressional, emergent wetland by the construction of a dike and through grazing. Rehabilitating the wetland would involve breaching the dike so the wetland becomes a riverine wetland again, removing the grazing, and reforesting the area. Removing the grazing and reforesting the wetland without reestablishing the links to the riverine system would be considered as enhancement.

Mitigation ratios for projects in eastern Washington that do not alter the HGM setting of the site used for mitigation are shown in Table 9 on the next page.

Table 9: Mitigation ratios for projects in eastern Washington that do not alter the hydrogeomorphic setting of the site used for mitigation.

These ratios were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. They are based on averaging the observations of mitigation success and risk at a programmatic level, and do not represent the specific risk of any individual project.

Category and Type of Wetland	Re-establishment or Creation	Rehabilitation**	1:1 Re-establishment or Creation (R/C) and Enhancement (E)	Enhancement Only
All Category IV	1:5:1	3:1	1:1 R/C and 2:1 E	6:1
All Category III	2:1	4:1	1:1 R/C and 2:1 E	8:1
Category II Forested	4:1	8:1	1:1 R/C and 6:1 E	16: 1
Category II Vernal pool	2:1 Replacement has to be seasonally ponded wetland	4:1 Replacement has to be seasonally ponded wetland	Case-by-case	8:1
All other Category II	3:1	8:1	1:1 R/C and 4:1 E	12:1
Category I Forested	6:1	12:1	1:1 R/C and 10:1	24:1
Category I based on score for functions	4:1	8:1	1:1 R/C and 6:1 E	16:1
Category I Natural Heritage site	Not considered possible*	6:1 rehabilitation of a Natural Heritage site	Case-by-case	Case-by-case
Category I Alkali	Not considered possible*	6:1 rehabilitation of an alkali wetland	Case-by-case	Case-by-case
Category I Bog	Not considered possible*	6:1 rehabilitation of a bog	Case-by-case	Case-by-case

*Natural Heritage sites, alkali wetlands, and bogs are considered irreplaceable wetlands, and therefore no amount of compensation would replace these ecosystems. Avoidance is the best option. In the rare cases when impacts cannot be avoided, replacement ratios will be assigned on a case-by-case basis. However, these ratios will be significantly higher than the other ratios for Category I wetlands. Criteria for determining appropriate ratios in these circumstances will be forthcoming.

**Rehabilitation ratios are based on the assumption that actions judged to be most effective for the site are being implemented.

NOTE: Preservation is discussed in the following section.

Conditions for Increasing or Reducing Replacement Ratios

Increases in replacement ratios are appropriate under the following circumstances:

- Uncertainty exists as to the probable success of the proposed restoration or creation; or
- A significant period of time will elapse between impact and establishment of wetland functions at the mitigation site; or
- Proposed mitigation will result in a lower category wetland or reduced functions relative to the wetland being impacted; or
- The impact was an unauthorized impact.

Reductions in replacement ratios are appropriate under the following circumstances:

- Documentation by a qualified wetland specialist (see Appendix 8-G) demonstrates that the proposed mitigation actions have a very high likelihood of success based on prior experience;
- Documentation by a qualified wetland specialist demonstrates that the proposed actions for compensation will provide functions and values that are significantly greater than the wetland being impacted; or
- The proposed actions for compensation are conducted in advance of the impact and are shown to be successful; or
- In wetlands where several HGM classes are found within one delineated boundary, the ratios can be decreased if:
  - Impacts to the wetland are all within an area that has a different HGM class from the one used to establish the category; and
  - The category of this area with a different class is “lower” than that of the entire wetland; and
  - The proponents provide adequate hydrologic and geomorphic data to establish that the boundary between the HGM classes lies outside of the footprint of the impacts.

Using Wetland Preservation for Compensatory Mitigation

Impacts to wetlands may be mitigated by preservation of wetland areas when used in combination with other forms of mitigation such as creation, restoration, or enhancement at the preservation site or at a separate location.

Preservation may also be used by itself, but more restrictions apply as outlined below.

1. **Preservation in combination with other forms of compensation.** Using preservation as compensation is acceptable when done in combination with restoration, creation, or enhancement, provided that a minimum of 1:1 acreage replacement is provided by restoration or creation and the criteria below are met:

   a) The impact area is small, and/or impacts are to a Category III or IV wetland;

   b) Preservation of a high quality system occurs in the same Water Resource Inventory Area (WRIA) or watershed basin as the wetland impact;

   c) Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation; and

   d) Mitigation ratios for preservation in combination with other forms of mitigation shall range from 10:1 to 20:1, as determined on a case-by-case basis, depending on the quality of the wetlands being mitigated and the quality of the wetlands being preserved.

2. **Preservation as the sole means of compensation for wetland impacts.** Preservation of at-risk, high-quality habitat may be considered as the sole means of compensation for wetland impacts when all of the following criteria are met:

   a) Preservation is used as a form of compensation only after the standard sequencing of mitigation (avoid, minimize, and then compensate) has been applied;

   b) Creation, restoration, and enhancement opportunities have also been considered, and preservation is the best mitigation option;

   c) The impact area is small and/or impacts are to a Category III or IV wetland;

   d) Preservation of a high quality system occurs in the same Water Resource Inventory Area (WRIA) or a watershed where the wetland impact occurs;

   e) Preservation sites include buffer areas adequate to protect the habitat and its functions from encroachment and degradation;

   f) The preservation site is determined to be under imminent threat, specifically, sites with the potential to experience a high rate of undesirable ecological change due to on-site or off-site activities. ("Potential" includes permitted, planned, or likely actions that are not adequately protected under existing regulations [for example, logging of forested wetlands]); and

g) The area proposed for preservation is of high quality and critical for the health of the watershed or basin. Some of the following features may be indicative of high quality sites:

i. Category I or II wetland rating;

ii. Rare wetland type (for example, bogs, mature forested wetlands, estuaries);

iii. Habitat for threatened or endangered species;

iv. Wetland type that is rare in the area;

v. Provides biological and/or hydrological connectivity;

vi. High regional or watershed importance (for example, listed as priority site in watershed plan); and

vii. Large size with high species diversity (plants and/or animals) and/or high abundance.

h) Mitigation ratios for preservation as the sole means of mitigation shall generally start at 20:1. Specific ratios should depend upon the significance of the preservation project and the quality of the wetland resources lost.

Replacement Ratios for Temporal Impacts and Conversions

When temporal impacts to wetlands occur and the wetlands are not permanently lost (for instance, clearing of wetland vegetation during pipeline construction), some mitigation for the temporal loss of wetland functions should be required. Although the wetlands will be revegetated and over time are anticipated to have their previous level of functioning restored, a long-term loss of functions will occur. In addition, there is some risk of failure associated with the impact or alteration, especially when deep excavation is required to accommodate drilling equipment.

Generally, the ratios for **temporal impacts** should be half of the recommended ratios for permanent impacts, provided that the following measures are applied:

- An explanation is provided of how hydric soil, especially deep organic soil, is handled in the areas where the soil profile will be severely disturbed for a fairly significant depth and/or time;
- Groundwater flow patterns and how draining the wetlands will be avoided must be identified and described;
- A 10-year monitoring and maintenance plan must be provided for restored forest and shrub wetlands;

- Disturbed buffers are to be revegetated and monitored; and
- The hydroseed mix to be applied on disturbed restored areas must be identified. However, if the impacts are to non-native emergent wetlands (e.g., reed canarygrass wetlands), restoration of the site after construction is generally all that is required.

Replacement of lost functions due to the **conversion of wetlands** from one type to another should also be required. When wetlands are not completely lost, but are converted to another type, such as a forested wetland converted to an emergent or shrub wetland, some functions are lost or reduced. Replacement ratios should vary based on the degree of the alteration but should generally be less than those required for permanent losses of wetland.

Appendix 8-E
Rationale for Draft Guidance on Buffers and Other Protection for Wetlands

The guidance for protecting the functions and values of wetlands is based on the review of the scientific literature presented in Volume 1. The information provided here is structured to link with the measures recommended for protecting and managing wetlands using the *Washington State Wetlands Rating System*, presented in Appendices 8-C and 8-D.

The information is also organized by function and by the type of wetland rather than by wetland category to avoid repeating the same information. For example, a wetland rated as a Category I wetland with excellent habitat functions needs the same buffer as a wetland rated Category II if their scores for habitat in the rating system are the same. The buffers required to protect habitat are usually larger than those needed to protect other functions such as water quality improvement. The hydrologic functions of flood storage, groundwater recharge, and reducing erosion are not significantly influenced by the width of the buffer. These functions need to be protected at the scale of the watershed or sub-basin in which the wetland is found.

Wetlands that function well as habitat for wildlife
(29 - 36 pts. on the questions for habitat functions in the rating system)

Buffers:

<u>In eastern Washington</u>: 200 feet for land uses with high impacts; 150 feet for moderate impacts; 100 feet for low impacts

<u>In western Washington</u>: 300 feet for land uses with high impacts, 225 feet for moderate impacts; 150 feet for low impacts

Wetlands with a high score for their habitat functions (29 - 36 points) have both the physical structures (vegetation, open water, etc.) and the connections to other natural habitats that are necessary for a wide range of species, including birds, mammals and amphibians. This means that the wetland is very likely to be providing habitat for one or more species that needs a larger buffer. In the absence of direct evidence to the contrary, it is necessary to assume that wildlife that requires a large buffer is using the wetland. The review of the literature presented in Chapter 5 of Volume 1 indicates that buffers necessary to protect wildlife habitat functions of wetlands range from 100 to 600 feet or more (Sheldon et al. 2003). Most authors who have synthesized the buffer literature with respect to wildlife habitat recommend buffers of 200 to 300 feet for wetlands with

high habitat functions. One synthesis recommended a buffer of 200 feet as adequate to protect most species found in wetlands in eastern Washington and 300 feet in western Washington adjacent to high-intensity land uses (Castelle et al. 1992). This difference between eastern and western Washington was based on literature that showed that wildlife species tend to concentrate more around wetlands and streams in arid climates. The specific buffer widths proposed for the different types of land uses falls within the recommendations based on a review of the scientific literature (Volume 1, Chapter 5).

Thirteen of the 90 wetlands in eastern Washington (14%) used to calibrate the rating system had scores of 29 or higher for the habitat functions. These were judged to provide the best habitat potential and would require a buffer of 200 feet. Thirteen of the 122 wetlands in western Washington (11%) had scores of 29 or greater and would require a 300-foot buffer.

NOTE: A 200-foot or 300-foot buffer alone will not protect the habitat functions of a wetland with a high score for habitat. The connectivity to other natural areas needs to be maintained (see below).

Other protection needed to maintain habitat functions: Maintaining connectivity to other natural areas

Wetlands with a high score for their habitat functions have the connections to other natural habitats that are necessary for a wide range of species. The scientific information summarized in Chapter 3 of Volume 1 points out that fragmentation and the disruption of the vegetated corridors between undeveloped areas are a major cause of the loss of species richness (biodiversity). Existing connections and corridors need to be protected. This can be accomplished by regulating the type and nature of road crossings in the corridor and by limiting changes in land use in the corridor. Such protection is best accomplished as part of a regional planning effort that identifies critical habitat corridors and protects the natural mosaic of different ecosystems.

Wetlands that have a moderate level of habitat functions

(20 - 28 pts. on the questions for habitat functions in the rating system)

Buffers:

<u>In both eastern and western Washington</u>: 150 feet for land uses with high impacts; 110 feet for moderate impacts; 75 feet for low impacts

Wetlands with a moderate score for their habitat functions (20 - 28 points out of 36) have some of the physical structures (vegetation, open water, etc.) and some connections to other natural habitats that are necessary for a wide range of species. This means that the wetland is less likely to be providing habitat for species that need the largest buffers. On

the other hand, wetlands that score in this range do provide habitat for a wide variety of species, some of which, such as waterfowl, still need a relatively large buffer to protect them from disturbance.

Wetlands that function well to improve water quality

(24 – 32 points on the questions relating to water quality improvement in the rating system)

Buffers:

In both eastern and western Washington: 100 feet for land uses with high impacts; 75 feet for moderate impacts; 50 feet for low impacts

The functions of water quality improvement within a wetland can be degraded if excess pollutants (sediments, nutrients, toxic materials) enter the wetland. Buffers of 100 feet are recommended for wetlands that are currently performing these functions well to prevent any further degradation. Reviews of existing data indicate that a buffer of 30 m (approximately 100 feet) will remove 70% or more of the sediment and pollutants from surface runoff before they reach the wetland (Desbonnet et al. 1994).

Other protection needed to maintain functions that improve water quality: No additional surface discharges of untreated runoff

Buffers will not adequately protect the water quality improvement functions if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. To protect these functions it is necessary to limit the introduction of any additional pollutants from new development or other activities that might enter the wetland through untreated runoff that bypasses the buffer.

Natural Heritage Wetlands

Buffers:

In both eastern and western Washington: 250 feet for land uses with high impacts; 190 feet for moderate impacts; 125 feet for low impacts

Natural Heritage wetlands contain rare plants or those that are particularly sensitive to disturbance. These types of species are very sensitive to nutrient enrichment (eutrophication) that results from the input of nutrient-rich waters (see Chapter 4 of Volume 1). The buffer needs to remove excess nutrients before they reach the wetland. The most efficient vegetated buffer, based on width-to-removal ratios, is about 60 m (197 feet) for removal of nitrogen and 75 m (253 feet) for phosphorus (Desbonnet et al.

1994). A buffer of 250 feet is, therefore, recommended for Natural Heritage wetlands that could be affected by land uses that have high impacts.

NOTE: A 250-foot buffer alone may not protect the rare or sensitive plants in the wetland if the watershed has high nutrient loadings or a water regime that is unstable. These factors may allow invasive plant species to come into a wetland and overwhelm the rare species.

Other protection needed for Natural Heritage Wetlands: No additional surface discharges to wetland or its tributaries

Buffers will not adequately protect the rare plants in a wetland if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. To protect the plants it is necessary to limit the introduction of additional nutrients that might bypass the buffer and enter the wetland through untreated runoff from new development or changes in land use. Furthermore, discharges of stormwater and changes in the water regime from development will change the wetland plant communities (see Chapter 4 of Volume 1). Such changes might impact the populations of the rare species in the wetland.

Other protection needed for Natural Heritage Wetlands: No septic systems within 300 feet of wetland

Septic systems do not prevent nitrates, a major plant nutrient, in wastewater from entering groundwater. Many wetlands in Washington have at least some of their water, if not all, coming from groundwater. This means that nutrients released by septic systems can enter a wetland and impact rare or sensitive species in the same way as surface water. By keeping septic systems at least 300 feet from the wetland edge there is a better chance that impacts from nutrients will be minimized. There is no “safe” setback for septic systems if there is a direct groundwater connection (underground flow) between the septic system and the wetland. A 300-foot setback, however, will increase the chance that the nitrogen will be diluted before it reaches the wetland.

Bogs

Buffers:

<u>In both eastern and western Washington</u>: 250 feet for land uses with high impacts; 190 feet for moderate impacts; 125 feet for low impacts

Bogs are particularly sensitive to nutrient enrichment (eutrophication) that results from the input of nutrient-rich waters. The buffer needs to remove excess nutrients before they reach the wetland. The most efficient vegetated buffer, based on width-to-removal ratios, is about 60 m (197 feet) for removal of nitrogen and 75 m (253 feet) for phosphorus (Desbonnet et al. 1994).

NOTE: A 250-foot buffer alone may not protect the rare or sensitive plants in the bog if the watershed has high nutrient loadings, and the nutrients are transported into the bog in a stream.

Other protection needed for bogs: No surface discharges to wetland

Buffers will not adequately protect the functions of a bog if polluted waters bypass the buffer and enter the wetland via pipes, ditches, or other channels. To protect the bog, it is necessary to limit the introduction of additional nutrients that might come in through untreated runoff that bypasses the buffer.

Forested Wetlands

Buffers:

Buffer size for forested wetlands is to be based on the score for habitat functions or water quality functions.

Forested wetlands are given special consideration because they are difficult to replace through compensatory mitigation. The protection they need should be based on the functions they provide. Buffers and other measures to protect the functions, therefore, should be determined by how well the wetland scores for habitat or water quality functions.

Other protection needed for forested wetlands: Protect water regime in watershed

If the wetland is a riparian forest, it needs protection at a watershed scale. Buffers alone will not protect riparian forest wetlands because they are directly connected to the water flow and dynamics in the watershed. Changes in the water regime of the watershed that result from changes in land use have a significant impact on riparian wetlands.

Alkali Wetlands

Buffers:

<u>In eastern Washington</u>: 200 feet for land uses with high impacts; 150 feet for moderate impacts; 100 feet for low impacts

The ecological process that maintains an alkali wetland is the dynamic between water inflow and evaporation. Buffers have little impact on maintaining this process. The 200-foot buffer recommended for alkali wetlands is based on their habitat functions. Alkali wetlands in eastern Washington are a major resource for migratory shorebirds and

other water-dependent birds. The 200-foot buffer recommended is to protect these birds, and minimize disturbance, during their migrations and feeding (see Chapter 5 in Volume 1).

Other protection needed for alkali wetlands: No additional surface discharges

The routing of additional surface water to alkali wetlands will change the balance between inflow and evaporation because the incoming water will usually be less salty than that in the wetland itself. No information was found, however, on the impacts this may have on the ecosystem in the alkali wetland. There is a significant risk, therefore, that the ecosystem may be impacted if discharges are allowed into alkali wetlands. The recommendation is that no surface discharges (stormwater, irrigation, etc.) be allowed.

Vernal Pools (Category II)

Buffers:

Vernal pools that are currently relatively undisturbed are very important for migratory waterfowl during a short period in the early spring. The review of the literature indicated that waterfowl need at least 200 feet of buffer during that short period to protect them from disturbance. The rest of the time the vernal pools provide little habitat for larger animals that require larger buffers.

Wetlands in Estuaries and Coastal Lagoons

Wetlands in estuaries and coastal lagoons are part of the marine ecosystem. As a result, information about them was not included in the review of the literature in Volume 1. It is not possible to make recommendations that reflect an extensive review of the current scientific information at this time.

The buffers recommended in Tables 6 and 7 of Appendix 8-C for estuarine wetlands and coastal lagoons in western Washington are based on generally accepted habitat functions. Coastal wetlands are a major resource for migratory shorebirds and other water-dependent birds (Simenstad 1983). The widths of buffers recommended are to protect these birds, and minimize disturbance, during their migrations and feeding (see Chapter 5 in Volume 1 for a discussion of buffers generally needed to protect birds).

Interdunal Wetlands

Wetlands in coastal dune systems of Washington are part of the coastal marine ecosystem. As a result, information about them was not included in the review of the

literature in Volume 1. It is not possible to make recommendations that reflect an extensive review of the current scientific information at this time.

The buffers recommended in Table 6 of Appendix 8-C for interdunal wetlands in western Washington are based on generally accepted habitat functions. These wetlands are considered to be a major resource for migratory shorebirds (Wiedemann 1984). The buffers recommended are to protect these birds (see Chapter 5 in Volume 1 for a discussion of buffers generally needed to protect birds).

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Appendix 8-F
Rationale for the Draft Guidance on Ratios for Compensatory Mitigation to be Used with the Wetland Rating System

The acreage of creation, restoration, or enhancement that is required by regulatory agencies to compensate for impacts to wetlands is usually greater than the acreage of impact. This difference is expressed as a ratio (the mitigation ratio) of the area required for compensation vs. the area of impact. Ecology and Fish and Wildlife are providing guidance on ratios to use for compensatory mitigation that is linked to the *Washington State Wetlands Rating System* (see Appendices 8-C and 8-D). This appendix provides the rationale behind this guidance.

There are two major reasons why the ratios are greater than 1:1. The first is based on risk of mitigation failure and the second on temporal loss of functions. All of the studies done on compensatory mitigation (see Sheldon et al. 2003, Chapter 6) indicate that some percentage of mitigation projects fail to replace the functions lost. Overall, there continues to be a net loss of wetlands and their functions. Thus, more wetlands need to be created or restored than are impacted at a programmatic level to ensure that wetland functions and area are adequately replaced. The second factor is temporal loss. The studies reviewed in Volume 1 also indicate that functions in wetlands may take decades, if not centuries, to develop fully. By requiring a ratio larger than 1:1, we provide for more acreage of mitigation wetland that may not be functioning as well as the impacted wetland during the decades required for functions to fully develop at the mitigation site.

Thus, mitigation ratios are established based on risk of failure and temporal loss of functions. If mitigation is done in advance of impacts and can be demonstrated to be fully successful, it is reasonable to require ratios as low as 1:1. However, higher ratios should be set if there is an increasing risk of not adequately compensating for the functions lost, and as the time needed to establish the lost functions increases. Kusler (2003) has summarized some of the factors that should be considered in establishing the risk of unsuccessful mitigation:

1. **The functions present in the impacted wetland and those proposed for the "replacement" wetlands.** Larger ratios are justified where a replacement wetland will have fewer functions and values or perform the functions at a lower level. The net loss of function per acre of wetland has to be compensated by increasing the area of mitigation required.

2. **The overall ecological conditions of the impacted wetland and the "replacement" wetland.** Larger ratios are justified where a "replacement" wetland will be less persistent, diverse, or have less ecosystem integrity than the

original wetlands. The risk of losing ecological integrity has to be compensated by increasing the area of mitigation required.

3. **The probable success for wetlands of the type proposed as "replacement."** Larger ratios are justified for wetland types that have proven difficult to restore or create, thereby increasing the risk of failure.

4. **The expertise and experience of the agency or consultant proposing to carry out the project.** Larger ratios are justified for proponents who are less expert and less experienced. Lack of experience increases the risk that the project will not be successful.

5. **Threats to the "replacement" site.** Larger ratios are justified where there are threats to the site such as possible changes to the water regime, sedimentation, or pollution. These threats increase the risk that functions will be impaired in the future (see Chapters 3 and 4 in Volume 1).

6. **Whether the site will be susceptible to "mid-course" corrections**. Larger ratios are justified where the site has little capability for correcting problems as they develop, and smaller ratios are justified where that capability exists. Projects where problems have been corrected tend to be more successful than those that have not (Johnson et al. 2002).

The ratios discussed in this appendix were developed to provide a starting point for further discussions with each proponent of compensatory mitigation. The rationale for the ratios is based on the factors listed above and described in more detail below. **These ratios are based on averaging the observations of mitigation success and risk at a programmatic level and do not represent the specific risk of any individual project.**

Premises Used in Establishing Ratios

Baseline Ratios

The study by Johnson et al. (2002) summarized in Volume 1, Chapter 6, found that projects for compensatory mitigation in Washington State that created or restored wetlands were "moderately successful" or "successful" at replacing the functions lost only about half of the time. This means that overall there is about a 50% risk of failure. Other studies of the success of mitigation projects (summarized in Chapter 6 of Volume 1) suggest the risk of failure is even higher. These data would suggest that a minimum ratio of 2:1 is needed to ensure "no net loss of functions" at a programmatic level.

This ratio also needs to be adjusted to account for the temporal loss of functions described above. There are no scientific studies that have tried to quantify the temporal loss in terms of how many acres of additional wetlands this represents. Trying to

quantify this experimentally is not possible because the data are not compatible: One cannot equate time with area. As a result, the additional area required to compensate for the temporal loss of functions is a value judgment. How highly do we value the loss of some functions for 5 to 10 years, some for 30 years, and others for 100 years or more? As a starting point for discussion, Ecology and Fish and Wildlife suggests that the compensation for the temporal loss of functions be equal to the area of impact**. Thus, the basic 2:1 ratio proposed to compensate for the risk of mitigation failure should be increased to 3:1 to account for the temporal loss of functions.**

If enhancement is used as the only form of compensation, there will always be a net loss of wetland area. Furthermore, only about 10% of the enhancement projects analyzed in Washington State were even moderately successful at replacing the functions lost (Johnson et al. 2002). This means that the risk is significantly higher than for creation or restoration, justifying a higher ratio for enhancement. **The ratios recommended for enhancement are twice that needed for creation or restoration** because the risks of not replacing the functions are much higher using enhancement, and there is a net loss of wetland area.

The basic ratios for creation/restoration and enhancement may be modified if the conditions for the proposed mitigation are different from the "average" condition. The *Washington State Wetlands Rating System* categorizes wetlands, and this information can also be used to increase or reduce the ratio. This information was used to develop the expanded recommendations for mitigation ratios presented in Appendices 8-C and 8-D. The following discussion summarizes the logic that was used to develop the ratios.

Incorporating Wetland Categories into Ratios

The basic mitigation ratio for creation and reestablishment is 3:1 as described above. This ratio is based on the assumption that the impacts are to a Category II wetland and the created or restored site will also become a Category II wetland and provide for full replacement of functions and integrity over time. The ratio for Category I wetlands is higher because it is assumed that it is much more difficult to create or restore a wetland to the high level of function represented by a Category I wetland, and there will be a net loss of function on a per acre basis.

Ratios for impacts to Category III wetlands, on the other hand, are lower because it is assumed that the risks are lower. It is assumed that there is a better chance for a successful creation or restoration of a Category III wetland than a Category II wetland. The ratio for a Category IV wetland is even lower because it is assumed that the replacement wetland will be a Category III wetland with higher levels of functions.

Ratios for Forested Wetlands

Studies of mitigation projects have shown that forested wetlands may take over 100 years to become established. The ratio recommended is designed to compensate for the

additional temporal loss of the functions of a forested wetland during the long time it takes to establish this type of wetland.

Ratios for Wetlands that are Difficult to Create (Natural Heritage, Bogs, Alkali Wetlands, Estuarine Wetlands, Wetlands in Coastal Lagoons)

Ecology and Fish and Wildlife assumes that it is not possible to create Natural Heritage wetlands, bogs, alkali wetlands, estuarine wetlands, or wetlands in coastal lagoons from uplands or to enhance other wetlands to reproduce their characteristics.

No data are available for mitigation projects that involved creating Natural Heritage wetlands, alkali wetlands, estuarine wetlands, or wetlands in coastal lagoons from uplands. Bogs are the only type of wetland for which such information exists, and this information indicates that it is not possible to recreate the necessary physical, hydrologic, and chemical conditions needed to replace a bog through compensatory mitigation (see Chapter 6 in Volume 1). As a result, Ecology and Fish and Wildlife recommends that compensation for impacts to these types of wetlands should involve the rehabilitation of degraded wetlands of a similar type, rather than creation or enhancement.

Although estuarine wetlands are the only type that has been successfully rehabilitated, it is assumed that rehabilitation of the other types is also feasible. It is more feasible, at least, than if the compensation involves creating such a wetland or enhancing a wetland of another type to recreate the necessary ecological conditions. In the absence of any definitive information on the success of such rehabilitation, the ratio for compensation is set at 6:1 to be consistent with the other ratios. Projects that propose enhancement as compensation for impacts to these sensitive wetlands will have to be evaluated on a case-by-case basis. Enhancement would involve a net loss of acreage as well as an extremely high risk that the functions represented by the sensitive wetland types will not be replaced.

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Appendix 8-G
Hiring a Qualified Wetlands Specialist

When Is A Qualified Wetlands Specialist Needed?

Qualified wetlands specialists are usually hired as consultants to identify and delineate wetlands, assess the functions and values of a particular wetland, provide assistance with wetland regulations and permits, often including completion of necessary application forms, and provide advice about designing wetland compensatory mitigation projects. They are generally hired by landowners or developers who want to do something on their property that may affect a wetland. Many local governments hire consultants to provide third-party review services. Some consultants are self-employed; others work for larger environmental consulting firms. The recommendations included here are intended to assist in locating consultants who can help with wetland issues.

What Is A Qualified Wetlands Specialist?

There is no government-sanctioned program for certifying someone as a "qualified wetlands specialist." Generally, the term means a person with professional experience and comprehensive training in wetlands 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 (SWS) 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 wetlands specialist. 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 qualifications. However, the following criteria are indicators of someone who may be qualified to perform the wide range of tasks typically required of a wetlands specialist:

- At a minimum, a Bachelor of Science or Bachelor of Arts or equivalent degree in hydrology, soil science, botany, ecology, or related field. A graduate degree in one of these fields is an indication of more advanced expertise.

- At least two years of full-time work experience as a wetlands 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 wetlands 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 on 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 with the collective expertise to address all aspects of the project.

How To Find A Wetlands Consultant

There are a number of ways to find the names of wetlands consultants. Finding a qualified consultant can be difficult since "wetland consultants" are not required to be certified, licensed, or bonded. One approach is to look in the Yellow Pages of the phone directory (or the directories of the closest cities) under "Environmental and Ecological Services." You can also contact the local government planning office and ask if they know of any local wetlands consultants. Some local governments maintain lists of wetland professionals they consider to be well qualified. Consultants 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.

Selecting A Wetlands Consultant

A number of factors should be considered before hiring a wetlands consultant. When interviewing consultants, 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 consultant have training or experience in the use of the 1987 federal or 1997 Washington State wetlands delineation manual? The selected consultant should have the ability to apply wetland identification methods used by state and federal agencies. Make sure that the consultant can identify wetlands and their boundaries consistent with regulating agencies.

- Has the consultant had additional training or expertise in related fields such as hydrology, soil science, botany, or ecology?
- Is the consultant familiar with local, state, and federal wetland regulations?
- How long has the consultant 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 consultant worked in the part of the state where you propose to develop? Ask the consultant for examples of previous work similar to the services being requested. Can the consultant take you to a successful wetland mitigation project they designed and/or implemented?
- Does the consultant have experience working with regulatory agencies? Ask the consultant to describe their working relationship with the agencies that will be reviewing and/or permitting your project.
- Does the consultant have experience working on a team? Given the complexity of some projects, it is expected that a wetland consultant will team with others who have experience in related fields such as water quality, wildlife, stormwater management, and hydrogeology. Ask the consultant for a list of people they have teamed with in the past.
- Who were some of the consultant's past clients? Were they satisfied customers? Call them and find out who they worked with from the consulting firm and how they liked working with them. Ask whether there were any problems that occurred during or after the project, how the consultant 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.
- Request references that include clients who have had projects reviewed and approved by the regulatory agencies (Corps, Ecology, and local government).
- Ask colleagues and other businesses, such as real estate, development, homebuilding, etc. that are routinely involved in wetland concerns. Ask them about their experiences and knowledge regarding the consultant being considered.
- Who will be working on your project? Will it be the principal consultant with the years of experience, or someone with less experience who works for them?
- How much will the consultant 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 consultant who charges more may end up saving money by reducing permit-processing delays.

Society of Wetland Scientists Professional Certification Program

Another option is to check whether the consultant under consideration is a Certified Professional Wetland Scientist. The 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.

References

Washington State Department of Ecology, U.S. Army Corps of Engineers, and U.S. Environmental Protection Agency. 2004. *Guidance on Wetland Mitigation in Washington State: Part 1 - Laws, Rules, Policies, and Guidance Related to Wetland Mitigation* (Ecology Publication 04-06-013a, April 2004).

Appendix 9-A
Additional Information on Preservation, Conservation, and Restoration

This appendix provides additional background information in three areas: (1) the significant role local government can play in conservation and preservation; (2) land trusts as potential partners for local governments; and (3) considering threshold effects for planning restoration.

A Role for Local Governments: Conservation and Preservation in Lower Elevation Lands

Creating a diversified system of preserved areas must include local governments and the private landowners who hold the most underrepresented ecosystems in our preservation system. The legacy of land preservation in the United States has been weighted toward high-elevation or least productive lands (Scott et al. 2001). A recent study conducted by the Interagency Committee for Outdoor Recreation (IAC) (2001) found that over half of all public and tribal reservation lands are located above 3,000 feet. However, species richness tends to be greatest at lower, more productive elevations. Greater than 60% of the federally listed threatened and endangered species occur on private, lower elevation lands.

In addition, the IAC (2001) found that 40% of the state's 45.9 million acres are owned by federal, state, tribal, and local public entities, with federal lands making up the bulk of public land ownership. Only 6% of this acreage is aquatic, while 94% is upland. It is interesting to note that, as stated in IAC's report, Washington has the smallest amount of major public and tribal lands in the 11 western states, as well as the second lowest overall percentage of public and tribal lands following Montana. They add that although Washington is the smallest of the 11 western states, it has the second highest population in the West and the second highest population density following California.

Local governments could play a key role in conserving and preserving important lands in the lower elevations. In their paper *The Role of Local Government in the Conservation of Rare Species*, Press et al. (1996) make three claims about the need for local government involvement in land preservation:

> *(1) the scale of local and regional land use control and open-space acquisitions matches the range sizes of many rare, endemic species, (2) land acquisition is the most attractive approach to conserving many rare taxa, especially endangered flora, and (3) at least some local governments and non-governmental organizations have the policy capacity necessary to identify, acquire, and manage critical habitats for endangered species.*

They go on to acknowledge that conservation is always a local land use matter that requires local support. Local governments can add benefit by brokering larger land deals with other partners than they themselves could purchase outright, acquiring some smaller areas of habitat that add to a larger conservation landscape, and fostering local sympathies for wildlife and habitats.

DeFreese (1995) recognizes that partnership with local government complements and enhances state and federal initiatives in conservation efforts. Brumback and Brumback (1988) critique early land acquisition programs in three states (New Jersey, Florida, and California), concluding that land acquisition efforts can overcome the legal and sociopolitical constraints of regulation and make it possible to reserve environmentally significant lands for the future.

Ian McHarg in 1969 was an early proponent of acquiring development rights, maintaining that "planned growth is more desirable, and just as profitable, as unplanned growth." He saw purchase as a way to make plans for development more acceptable to the public (Buckland 1987). "The need is growing for policies and institutions that can balance the requirements of economic development with the benefits of species, habitat, and open-space conservation" (Boyd et al. 1999).

Land Trusts Are Growing and Can Help

National land trusts such as The Nature Conservancy (TNC) and The Trust for Public Land (TPL) are working more closely in partnerships with local communities. Land trusts provide an opportunity for partnerships since they are growing in popularity and in numbers, thereby being able to preserve and manage more lands.

The National Land Trust Alliance's census of land trusts counted 1,263 land trusts in existence across the country, a 42% increase from the decade before (www.lta.org). The census documented the record of permanently preserved private land was approximately 6.4 million acres by the end of 2000. This was triple the 1.9 million acres preserved nationally by 1990. Of the 6.4 million acres, 52% was wetlands. In Washington State, land trusts have also grown significantly with 29 land trusts now while only 19 existed a decade ago.

TNC notes that the work of preservation is changing. They identify the need to target larger, and presumably more functional, preservation sites and to place a greater emphasis on representing all communities and ecological systems (Czech 2001).

Considering Threshold Effects for Restoration

In examining Pacific Northwest efforts to recover salmon habitat, Wu and Skelton-Groth (2002) offer some insights to the preservation and restoration efforts that are now underway. Conducting an empirical analysis that focuses on investments in riparian habitat for salmon recovery, they show that a large portion of conservation benefits would be lost when threshold effects are ignored. To explain the threshold effect, imagine a stream temperature that is necessary for healthy salmon populations. Until that

temperature is reached, salmon populations cannot survive, so the habitat has no value to salmon until the threshold is achieved.

Wu and Skelton-Groth state, "When a threshold effect is present, the marginal benefits of conservation efforts may be zero or increase slowly at first, and then more rapidly as conservation efforts approach the threshold. After the threshold is reached, additional efforts may have little effect on environmental benefits." They add, "When threshold effects are ignored, funds may be overly dispersed geographically, and funding levels in any given program area may be inadequate to reach the threshold needed for a significant environmental improvement." They argue that funds should be allocated such that the total value of environmental benefits is maximized, not the total amount of resources protected. To target funding based on physical criteria measured on site (such as erosion or water quality) ignores the threshold effect of conservation efforts in degraded systems.

For example, when addressing temperatures in streams, priority would be given to streams closer to threshold levels rather than those far from it, unless of course enough funding were available to do additional work in a stream with significantly warmer temperatures to successfully reach the threshold level.

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Appendix 10-A
Example of a Characterization of the Risks to Wetlands

As part of revisions to its critical areas ordinance, King County has prepared an *Assessment of Proposed Ordinances* that describes the risks to resources from the proposed regulatory and non-regulatory actions. This appendix reproduces Section 2.9 from Chapter 2 of the King County report, which describes the risks to the wetland resource from actions such as specified buffers, allowed alterations, classification (rating), and mitigation requirements. The full report is available on the web at http://www.metrokc.gov/ddes/cao/.

POLICY DISCUSSION:

King County has an obligation to protect wildlife species through Federal, State and local regulations. The King County Comprehensive Plan requires a comprehensive approach to protecting wildlife species while balancing other requirements.

2.9 WETLANDS

Wetland Classification

Standard –Wetland Classification:

Wetlands are categorized based on the Washington State Wetland Rating System for Western Washington (DOE #93-74, 1993).

The standard wetland protection proposed for the CAO is in large part based on the Department of Ecology's classification and rating system for wetlands. Although DOE's classification system is more comprehensive than King County's current SAO system, this proposed DOE method is outdated and does not accurately reflect the current state of scientific understanding i.e., BAS of wetland ecology and conservation. Recognizing this weakness DOE is reviewing wetland BAS and concomitantly revising the rating system with expected completion by late 2004 (McMillan pers. com.). King County has tried to overcome weaknesses in the DOE method by augmenting the existing classification-only approach with additional regulations covering wetland complexes, and landscape approaches including clearing and impervious area restrictions.

There are many ways of classifying wetlands for ecological and regulatory purposes with no one method being, or remaining, the optimum method. As scientists learn more about wetland characteristics and functions, classification and ranking methods change accordingly to better protect wetland functions. Currently, the science of classification is moving from the more descriptive historical assessment methods towards newer process-oriented, functional methods. The proposed CAO does not reflect this more comprehensive and empirical approach of classifying wetlands and consequently there is a high certainty that King County's chosen classification system will not adequately protect certain wetland types (e.g., fragmented wetlands, bogs) or some wetland functions (e.g., wildlife habitat).

In general, the level of risk to wetland functions and values will decrease from existing levels because the proposed CAO standards are more restrictive than the current SAO standards. However, risks remain because additional buffer widths may not provide adequate protection depending on wetland, adjoining area and watershed topography, soils, ground water, surface hydrology and vegetation conditions. The proposed DOE's ranking and classification system is also based mainly on habitat functions, with little emphasis on other wetland functions, which are important to protect. Hence these other functions may not be protected by fixed buffers to the extent that habitat is protected.

It is difficult to assess the potential effect of implementing the proposed CAO Classification System and its associated buffers on wetland functions, as King County's current information regarding wetland distribution, abundance, and characterization is incomplete. This fact is especially true for smaller wetlands and for forested wetlands, which are difficult to find through remote sensing techniques. There is little information regarding the functions that wetlands provide. Reasonably reliable habitat classification data exists (Cowardin et al., 1979) for most large, open water wetlands and select other wetlands that were surveyed in the past. Specific data on wetland habitat condition and data on other wetland functions are unavailable because formalized functional analysis did not exist during King County's historical wetland surveys in the late 1980s. Since these surveys, adjoining area and watershed development suggest that wetlands may be much different than twenty years ago. As a result, much of King County's assessment of wetland functions is based on historical descriptions and extrapolations, augmented by more recent remote sensing interpretations. Site-specific data can be gleaned from some project (e.g., development, restoration) specific reports, however, the overall lack of critical data necessary to assess specific wetland functions results in uncertainty when assessing the adequacy of fixed buffers for protecting wetland functions, and other standards, in the proposed CAO.

In summary, the chosen wetland rating system poses risks to wetland protection because it does not identify, consider, or rank the multiple functions that wetlands may exhibit. Included are relatively few and are biased towards habitat characteristics. Therefore the associated fixed-buffer widths and mitigation measures that are based on classification and rating may fail to adequately protect those functions not identified. Without adequate information on the additional functions needing protection, the level of risk remains high.

Buffers

Standard – Minimum Buffer Widths:

Minimum buffer widths of 300, 200, 100, and 50 ft. shall protect Category I-IV wetlands, respectively, in rural areas or within the Urban Growth Area if not a subdivision, short subdivision, urban planned development or binding site plan, with the exception of permitted alterations.

Minimum buffer widths of 100, 50, 50, and 25 ft. shall protect Category I-IV wetlands, respectively, within the Urban Growth Area provided a functional assessment of the wetland and buffers is provided and approved. Restoration and enhancement will be required to restore the wetlands and its buffer to a fully functioning condition.

Assessment:

This standard for minimum buffer widths in rural areas is within the range of recommendations in the BAS literature, while the standard in urban areas are lower and depart from the larger buffers suggested by BAS. However, BAS also indicates that wetland protection by fixed buffer widths alone may be insufficient. Specifically, fixed buffers are essential but inadequate to protect wetland functions because the buffers may not encompass the processes that drive respective wetland functions. Moreover, fixed buffers also allow development and other disturbances to completely encircle wetlands, thereby isolating such wetlands and segregating them from other

wetlands, aquatic habitats, and from essential upland habitats. Eventually such isolation leads to a shift in their wildlife and possibly the alteration of hydrology and other wetland functions.

Under ideal geologic, soil, and vegetation conditions, BAS suggests the recommended fixed buffers may be sufficiently wide to protect water quality of Category I and II wetlands in rural areas or Category I wetlands that have been enhanced per the report requirements in the urban areas. Buffers adjoining Category III, and IV wetlands in rural areas and Category II, III and IV in urban areas are at the narrow width limit for protecting wetlands from anthropogenic water quality impacts. Moreover, proposed buffers widths are insufficient to protect unique wetland vegetation and fragile wildlife that are sensitive to microclimatological changes associated with clearing or altering adjoining land. Proposed buffers may also not protect certain features of wetland hydrology and groundwater interactions, as these functions (given all conditions being equal) are proportional to buffer widths.

Level of Risk to Function and Values

In general, most wetland functions may be at some risk by only protecting wetlands in rural areas with standard, fixed 50 to 300 ft. wide buffers. Wetlands in urban areas will be at high risk for most or all wetland functions even with the enhanced buffer approach with the possible exception of water quality enhancement under unique conditions. Water quality enhancement functions on level terrain and for a well-vegetated, grass, shrub, and tree buffers, would exhibit the least level of risk. For wetlands greater than 500 feet from each other (i.e., non-complex wetlands), the greatest risk would be to maintain the full suite of wildlife functions as fixed buffers may not provide sufficient habitat for wetland species if development encircles wetlands. This level of risk in the rural area would be more difficult to judge because narrower buffers than in the urban area provide less remaining habitat and greater edge effect, although enhancement of the buffer itself could provide habitat features of benefit to some wildlife. Clearly, it would depend on the condition of the adjoining area, as a high quality, narrow rural buffer would not benefit from enhancement and would only be detrimentally impacted by narrower widths.

The risk of declines and local extinctions of native species increases as wetlands get physically isolated from each other by roads, development, and other potential barriers to migration. These risks would be greatest for amphibian and mammal populations as development, agriculture, forest practices, roads and other actions encircle entire wetlands, thereby isolating them from life-support habitat found at other wetlands and in upland watershed locations. The risk of declines would accelerate as populations become increasingly smaller from deterministic (e.g., pollution), and random (e.g., drought, freezing), and inbreeding. The risk to amphibians, birds, small mammals may also increase with urbanization beyond fixed buffers as bullfrogs, rats, cats, and dog populations increase and roam through buffers to prey on, or "play" with vulnerable wetland wildlife. The risk is highest in the urban areas where buffer widths are inadequate to provide protection from non-native wildlife.

BAS also suggests that the proposed maximum 300-ft buffer for rural areas is inadequate in most situations to protect microclimate (wind, humidity, temperature, soil moisture, etc.) within these and narrower buffers. Microclimate can not be protected in the urban area, even with the maximum 100-foot buffers for wetlands. Hence the existing soil conditions (e.g., organics, bacteria, mycorrhizal associates and fungi of decomposition) and vegetation associations in the buffer (mosses, herbs) most likely will change in proportion to buffer width. Often these climatological and soil changes enable non-indigenous species to outcompete and replace the

original biota. The risk to wetland groundwater and hydrological functions will vary widely depending on geology, soils, vegetation, topography and watershed size and condition. Therefore, the risk to wetland functions by the proposed buffers is conjectural, although with all things being equal, the least risk occurs to either of these two functions, microclimate and hydrology, when the buffers are largest and the greatest risk occurs in the urban areas.

Level of Uncertainty

Specific information relative to urbanization impacts to wetlands in King County does not exist regarding the optimum widths of buffers adjacent to wetlands and their respective effectiveness in protecting wetland functions. The best information covers buffer widths required to protect water quality enhancement functions of streams but even this data is mostly extrapolated from agricultural and silvicultural studies. Some data exists on the widths of various stream buffers and their wildlife following clearcutting of adjacent forests however these studies are relatively recent and therefore have not yet monitored wildlife for sufficient lengths of time. Moreover, clearcutting and subsequent reforestation impacts are significantly different than the permanent primary and secondary impacts of urbanization. Consequently, there is a high degree of uncertainty regarding the ability of 50-300-ft. buffer widths in rural areas to protect wetland hydrology, groundwater interchange, and fish, wildlife and habitat functions of specific wetlands from adjoining area and watershed urbanization. In contrast for wetlands in general within an urbanizing area, BAS suggests that wetland functions will definitely decline with only fixed buffers of 25 to 100 ft.

Standard – Buffer Averaging:

> *Minimum buffer widths may be modified on a case-by-case basis. There would be no net loss of buffer area and the buffer width is not reduced to less than 75 percent of the standard buffer width.*

Assessment:

Buffer averaging is consistent with BAS if implemented to increase widths and wetland functions at specific sites and concurrently not harm functions from reduced widths elsewhere. For this select situation, there would be equal total buffer area and a net increase in select functions, a goal supported by BAS.

Level of Risk to Function and Values

Buffer averaging provides the opportunity to decrease the level of risk to wetland functions if buffer widths are reduced where they are not necessary and increased where they would be beneficial. However, buffer averaging could pose an increased risk to functions if averaging increased buffers for one function at the expense of another. For example, at a wetland with low flood control function and high wildlife function, buffer averaging to increase the flood control function could pose a risk to wildlife function.

Level of Uncertainty

The implementation of ecologically supported buffer averaging may prove difficult without standardized empirically and scientifically accepted methods of consistently identifying and determining functions. In general, wetland ecologists do not have the tools to trade off buffer widths with a high degree of certainty unless adequate information has been obtained. Any certainty that does exist depends on function to be gained by increasing buffers. Consequently, the certainty of improved water quality enhancement function by wider grass, shrub, and tree buffer is greater than the certainty of improving groundwater recharge or wildlife functions. Clearly, it would take considerable studies of groundwater recharge capacities, including the presence and flow of aquifers, to reduce the uncertainty in providing groundwater interchange functions within an enlarged buffer. Finally, the increase in wetland buffers allowed by buffer averaging might only marginally benefit functions. For example, wildlife may additionally be protected from adjoining noises and other disturbances by wider buffer widths at certain locations but most likely will not benefit appreciably by the relatively small increases in habitat from buffer averaging.

Standard – Grazed and Tilled Wet Meadows:

Existing grazing and tilling activities may continue in wet meadows.

Assessment:

Wet meadows exhibit the ability to provide significant groundwater recharge, flood control, water quality enhancement, and wildlife functions depending on their vegetation, morphometry, soil porosity and subsurface geology. BAS suggests that grazing in wet meadows is compatible with BAS if best management practices (BMPs) are used (see Chapter 3, Section 3.2 Farm Planning). For example, if meadows are used for nesting or foraging by waterfowl and waterbirds, grazing may only be permitted at times when wildlife is not present or at locations where livestock will not harm wildlife.

Level of Risk to Function and Values

The timing and density of grazing can significantly increase the risk to wet meadow functions, particularly to water quality and wildlife functions The timing of grazing is controlled by the proposed BMPs therefore the risk from livestock may be low if animal units, timing and other aspects of meadow use are appropriate for the site. High livestock numbers however, can result in high nutrient concentrations within meadows and in runoff, potentially causing large algal blooms, anoxic conditions (of detriment to macrophytes, invertebrates, waterfowl and other taxa) and other eutrophic situation in nearby wetlands and other aquatic areas. Overgrazing may also lead to increase soil compaction, soil erosion and other disturbances leading to higher water quality and associated ecological risks from sediment runoff.

Level of Uncertainty

Compliance with BMPs would provide important certainty to protecting wet meadows from overgrazing and other detrimental agricultural effects. Storage sheds barns and additional

residences however may continue to be built on wet meadows reducing or eliminating the functions the replaced wet meadows may have been serving.

Mitigation

Standard – Mitigation Ratios:

Under special situations mitigation ratios shall be used to mitigate adverse impacts and will vary based on wetland location and category.

Assessment:

The proposed CAO provides restoration and replacement ratios for wetland impacts and losses that are based on "best professional judgement", as there are no scientific studies that identify empirically determined mitigation ratios. The NRC (2001) references studies that imply a '1.5 to 1' ratio of 'mitigation to lost acreage' would be needed to equal the area lost (if all other permit conditions are met including functional equivalency). However, these ratios are often additionally adjusted to reflect temporal loss of wetland functions, functional values of the impact site, and other factors. Specifically, replacement ratios increase proportionately with the length of time it takes to reach equivalent function. Higher ratios are also suggested for replacing pristine wetlands with higher functional values than that for mitigating severely degraded wetlands, which essentially reflects scientific uncertainties in replicating certain kinds of wetlands. King County's proposed mitigation ratios are within the ratio range of BAS by requiring equivalent or greater function for impacts. However, King County ratios may be lower than what is implied by BAS when recognizing and considering the temporal lag in replacement of wetland functions. It is also lower than BAS in situations were equivalent or greater function is not possible, as for example, when replacing a mature forested wetland with a new shrub-scrub wetland.

The proposed CAO standard also differs from BAS in that it is based on wetland category, with the assumption that wetland category is a surrogate for function which may not necessarily be the case. BAS further notes that preferences for on-site and in-kind mitigation should not be automatic, but rather based on an analytical assessment method of the wetland needs in the watershed, and the potential for the compensatory wetland to persist over time (NRC 2001). Although King County has considered similar functional criteria in their mitigation process no formalized assessment tool is currently proposed.

Level of Risk to Function and Values

Mitigating for lost wetland acreage is difficult and highly risky. Functional replacement is even more difficult and requires extensive training, information gathering and monitoring. BAS indicates that mitigated wetlands have not yet succeeded in replacing lost acreage or functions with any predictability. Consequently the risk to replacement of wetland acreage and their functions and values remains high. Mitigation has not met the "no-net loss of area, function and values" goal in King County's Comprehensive Plan and if past performance is an indicator of future success the risks remain high. Wetland enhancement and restoration, regardless of proposed ratio, as mitigation for wetland losses always results in a decline of wetland acreage.

The risks of replacing lost functions and values depend at least on two factors: (1) the availability of restoration sites; and (2) the complexity of functions and values required to be replaced. If restoration sites are unavailable within the same basin as the impacted wetland then the risk is high that some of the irreplaceable functions that the wetland provided (e.g., groundwater interactions, habitat for wildlife, vegetation, recreation etc.) will be lost to that basin. It also remains uncertain whether flood control, water quality enhancement and other wetland functions that are lost by permitted activities can adequately be replaced through engineered projects. Regardless, a loss of functions remains between the time the permitted wetland is altered and the mitigated wetland provides the full capacity of the suite of functions of the original wetland.

Level of Uncertainty

The level of uncertainty in wetland mitigation in general does not lie in the ratios. Rather, to a large degree, success lies in the extent of project planning, construction, monitoring, and overall oversight. Consequently, with proper funding and other resources the uncertainty of success can be decreased and minimized regardless of ratios.

Standard – Mitigation Banking:

> *The department may approve mitigation in advance of unavoidable adverse impacts to wetlands caused by the development activities through an approved wetland mitigation bank.*

Assessment:

Wetland mitigation banking is a valuable compensatory mitigation tool to stem the loss of wetland functions and values. Mitigation Banking has been implemented in other regions in the U.S. and in Washington is being used by the Department of Transportation (WSDOT). King County has one mitigation bank. As recommended in the BAS literature, banks are established and fully functional prior to permitted losses at existing sites. In practice however, credits are released incrementally as hydrological performance and other developmental and functional stages are attained. When done carefully and according to specified standards such as those developed in the King County Mitigation Banking Rules, mitigation banking may successfully implement siting as recommended by BAS literature. The replacement of small, marginal wetlands of low, single function such as small totally isolated wetlands and those adjacent to roads and highways with larger wetlands of higher and potentially multiple functions is consistent with BAS. Nevertheless, concerns regarding replacement ratios (see previous section), in-kind versus out-of-kind replacement and bank sighting when projects are permitted that harm or destroy higher quality wetlands remain. Although BAS suggests that a wide diversity of banks, bank sizes and bank functions should be created, the economy of scale benefits may not be realized unless banks are of certain minimum size and in certain economically-determined locations. The proposed CAO provides the flexibility to mitigate with a diversity of bank sizes and functions and hence there is no departure from BAS. In practice however, market forces result in larger, easily constructed wetland types. Finally, mitigation banks are relatively new and have not been monitored long enough to ecologically assess their success or failures. Although wetland losses are mitigated by mitigation banking, empirically determined success of specific targeted goals for hydrology, water quality, vegetation, and wildlife functions are limited to only a few sites and not commonly undertaken.

Level of Risk to Function and Values

Decreases in total wetland acreage always occur when wetland enhancement and restoration mitigate wetland acreage loss. Otherwise mitigation banking poses a low level of risk as full functions are required to be demonstrated at the bank site prior to loss of any wetland functions at the permitted site. Currently however, restoration is not ideal, and credits are released prior to full wetland mitigation resulting in loss of wetland acreage and functions. Moreover, wetlands may not be replaced within the watershed in which they are situated; thereby posing risks to the remaining watersheds for unreplaced transferred functions. Risks of lost functions may accrue in areas of high mitigation pressure such as in urban areas as mitigation for lost functions moves elsewhere.

Level of Uncertainty

Generally there is less compliance uncertainty with mitigation banks than other wetland restoration programs because of their larger size and diverse institutional oversight. Larger sites also provide a greater economy of scale than smaller projects and potentially enables a more carefully thought out process considering all aspects of project design, construction and monitoring presumably leading to greater certainty in success. Uncertainty increases with respect to bank complexity and habitat types with permanent, smaller seasonal and semi-permanently flooded banks being difficult to create. Scientific uncertainty remains high regarding the best method for achieving overall functional benefits.

Allowed Alteration

Standards – Development Standards and Alterations:

> *Alterations identified in the proposed CAO (K.C.C. 21A.24.) are allowed within a wetland or wetland buffer if the alteration complies with all applicable requirements, standards, and mitigation requirements established in the proposed CAO.*

Assessment:

The County allows numerous actions that allow activities within a wetland or wetland buffer. For some situations, these allowed alterations might be inconsistent with recommendations suggested by BAS. These include some rural activities and the building of roads, utilities, and other necessary infrastructure. Data to the extent to which these activities influence wetland functions and are adequately mitigated is unavailable. Tree removal in buffers, for whatever reason, influences water budgets through transpiration and nutrient storage as mentioned in the literature review. The removal of trees and other vegetation influences microclimate, which in turn influences remaining plants and wildlife. Incrementally, and collectively these exemptions continue to erode the wetland base in King County and therefore reduce the multiple functions they may provide.

Reasonable Use Exemptions also may enable encroachment on wetlands and their functions if no other on-site development possibilities are available. Consequently, the non-mitigated exemptions and allowed alterations are not consistent with BAS for wetland protection if they

lead to incremental, cumulative losses in wetland area, functions and values. Conditions on allowed alterations may lessen these impacts but do not mitigate for their losses.

Level of Risk to Functions and Values

Individually departures under exemptions and allowed alterations are small and may seem not to pose any risk. Collectively however, they contribute to the cumulative loss of wetland functions and values because for the most part, these losses are permitted without mitigation. Consequently the immediate risk to wetlands may be small and localized although cumulatively over many years the risks increase and spread over larger areas. For many allowed alterations such as the construction of large roads and powerline corridors the impacts to wetland functions and values may not be mitigatable. For example, the groundwater interchange and wildlife functions of roads cannot readily be mitigated on site or replaced elsewhere. Roads and utility corridors may result in permanent habitat loss, reduced habitat quality and permanently fragment wildlife habitat resulting in smaller isolated populations and therefore increased risks of extinction. Roads additionally kill wildlife through animal vehicle collisions or harm animals through altered wildlife behavior. Roads and utility corridors also indirectly pose high risk to wetlands because of their large direct and indirect watershed and landscape effects.

In summary, BAS indicates that permitted activity whether residential, non-residential, silvicultural, agricultural or infrastructure related may have negative impacts on wetlands and their functions. In King County, some of these impacts do not have to be mitigated, and for the ones that do have to be mitigated, information indicates that the existing mitigation strategy is not working. Without specific assessments of departures, we should assume that larger projects and cumulatively smaller projects might continue to lead to wetland aerial and functional loss.

Level of Uncertainty:

Data on the number of exemptions and allowed alterations and their influence on wetland acreages and functions and values are unavailable. Hence the prevalence of risk to wetland functions and values remain undetermined. Conditions on allowed alterations may lessen these impacts but impacts nevertheless occur. There is little uncertainty in the ongoing and cumulative loss of wetland functions and values from unmitigated permitted activities.

POLICY DISCUSSION:

Buffers are one tool that King County is proposing in conjunction with clearing restrictions, rural stewardship, and other regulatory and incentive based provisions. The adopted King County Comprehensive Plan provides guidance as to the management strategy for protection of wetland functions:

> E- 132 King County's overall goal for the protection of wetlands is no net loss of wetland functions within each drainage basin. Acquisition, enhancement, regulations, and incentive programs shall be used independently or in combination with one another to protect and enhance wetland functions.
>
> E- 133 Development adjacent to wetlands shall be sited such that wetland functions are protected, an adequate buffer around the wetlands is provided, and significant adverse impacts to wetlands are prevented

The proposed ordinance requires that within the Urban Growth Area the applicant complete a critical area report showing that the wetland and its adjoining buffer are fully functioning, or have a restoration/ enhancement plan that will be implemented to achieve a fully functioning wetland and buffer.

Balancing of King County's other responsibilities under the Growth Management Act further influence the widths of buffers proposed, particularly within the Urban Growth Area. These responsibilities, outlined in the King County Comprehensive Plan are:

- ***Preserve the high quality of life*** by balancing infrastructure needs with social, cultural, educational, recreational, civic, health and safety needs.
- ***Spend money wisely and deliver services efficiently*** by:
- Concentrating infrastructure investments and service delivery to support the regional development pattern near cities where a full range of local services are located or can be made available;
- Solving service deficiencies within the County to meet existing service needs and phasing service improvements for the needs of future growth;
- Looking to King County to provide countywide facilities and services, and;
- Relying primarily upon cities and special purpose districts as the providers of local facilities and services appropriate to serve those local needs, except where the County is the local service provider (e.g., Rural Area).
- ***Continue our economic prosperity*** by promoting a strong and diverse economy for King County residents through policies and programs that encourage new business opportunities, increase family wage jobs and create a predictable regulatory environment for businesses and citizens.
- ***Increase the housing choices for all residents*** by permitting a wide variety of home styles and by increasing housing opportunities for all residents in locations closer to jobs.
- ***Ensure that necessary transportation facilities and services are available to serve development at the time of occupancy and use*** by targeting road and transit investments where growth is desired and for equitable contributions to the transportation system by new development.
- ***Balance urban uses and environmental protection*** through careful site planning that maximizes developable land while respecting natural systems.
- ***Preserve rural, resource and ecologically fragile areas for future generations*** by maintaining low residential densities in the rural areas and in areas containing regionally and nationally important ecosystems for fish and wildlife and by recognizing that resource lands, such as farms and forests, provide economic, social and environmental benefits.

With regard to grazed wet meadows and other agricultural practices, the proposed ordinance exempts existing agricultural activities. To apply standards retroactively would not only be detrimental to existing agricultural enterprises but also inconsistent with how other existing activities are regulated by this ordinance. In addition, King County Comprehensive Plan policies support ongoing agricultural activities as part of a diverse landscape.

> R- 503 King County shall promote and support forestry, agriculture, mining and other resource-based industries as a part of a diverse, regional and sustainable economy.
>
> R- 504 Well-managed forestry and agriculture practices are encouraged because of their multiple benefits, including natural resource protection.

References for Chapters 1 - 12

Note: The references for Chapter 2 are included as footnotes to the chapter and are not repeated here. The references for the appendices are included at the end of the appendix in which they are cited.

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