WETLAND RESTORATION IN OREGON
ISSUES, OPTIONS, AND RECOMMENDATIONS

by

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Project Report

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INTRODUCTION

One of the legacies of Euro-American settlement of the North American continent has been the large-scale conversion of aquatic ecosystems-lakes, rivers and streams, and *wetlands*-to other landforms or uses through draining, diking, filling, excavation, damming, channelization, diversion, pollution, and other alterations. For wetland ecosystems, only an estimated 47% of the 221 million acres present in the 1780's in the conterminous United States remain today (Dahl, 1990). In Oregon, about 62% of an estimated 2.3 million acres of original wetlands remain (Figure 1, Dahl 1990).

Although these wetland conversions and alterations have provided many benefits to society, among them the most productive agricultural industry in the world, the ecological and economic costs have been staggering. Examples of these costs include loss or degradation of habitat for freshwater and marine fisheries, waterfowl, and other plants and animals; loss of biodiversity, including actual or threatened extinctions of species; altered hydrologic conditions that have increased both flood and drought potential in virtually all major river basins; and loss of water purification and other services of direct or indirect economic value to society. Few if any of these costs were accounted for in wetland alteration decisions. Although wetland losses continue today, they have been greatly slowed

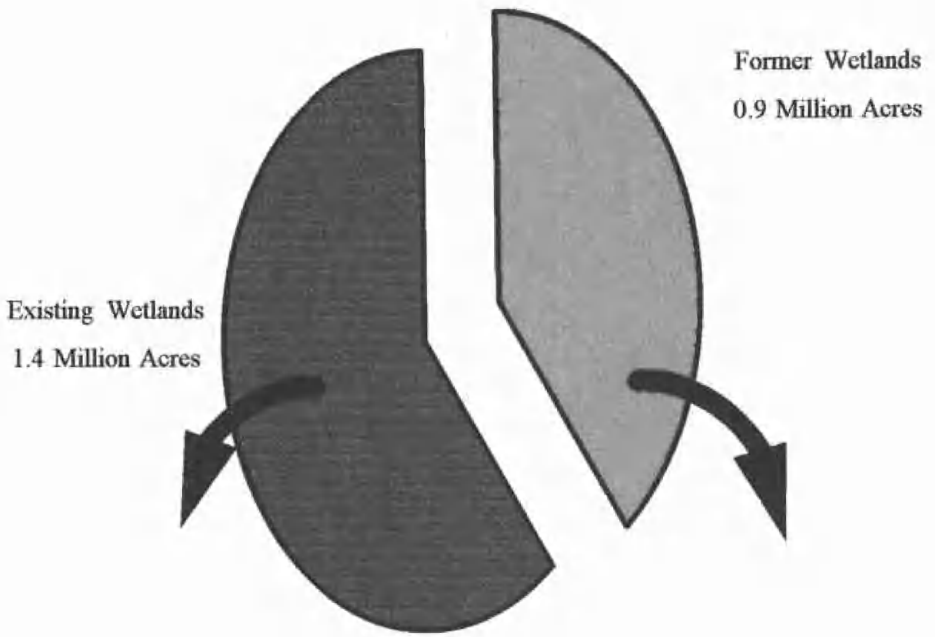
Figure 1

HISTORIC

ORIGINAL OREGON WETLAND AREA

2.3 Million Acres

PRESENT OR CURRENT



(Dahl, 1990)

FUTURE

<u>OPPORTUNITIES</u>

- Enhance Functions
- Enhance Values

<u>OPPORTUNITIES</u>

- Restore Functions
- Restore Values
- Add Acreage
- Increase Restoration Science Base

due to increased public awareness of wetland values and numerous local, state, and federal government initiatives to protect and preserve what remains. Public and private acquisition play important roles in wetland preservation, especially for critical or rare ecosystems, but not all valuable wetlands can be purchased outright.

Much of the remaining wetland resources in Oregon are on private lands. Government regulation of wetland alterations thus plays a critical (and often controversial) role in protecting what remains. This is accomplished primarily by promoting avoidance of wetlands when planning and by requiring compensatory mitigation for unavoidable losses. But regulation alone, even with "no-net-loss" mitigation policies being implemented at the federal and state levels, cannot reverse continued gradual decline (Weinmann and Kunz, 1992). Recent efforts by property rights activists to rewrite wetland laws and regulations further underscore the need for other approaches to help reverse wetland decline. Wetland restoration is one such approach.

Wetland restoration is defined simply as "returning the ecosystem to a close approximation of its condition prior to disturbance" (NRC 1992, 2). Although wetland restoration may be undertaken as compensatory mitigation for permitted development impacts, non-regulatory wetland restoration projects stand to have a much greater impact, whether the

measure be size, location with respect to present or historic landscape conditions, or functional capacity. Non-regulatory restoration activities are thus the emphasis in this report.

In the present-day planning environment, where terms like "ecosystem management," "landscape analysis," and "watershed approach" roll easily off the tongues of the scientist, resource manager, and politician alike, why should we be focusing on restoration of one element of the landscape, namely wetlands? There are several reasons:

- Wetlands are important ecosystems in their own right, serving a variety of ecological functions in the landscapes where they exist. Although some wetlands are isolated, most are directly or indirectly connected (e.g., through groundwater flow) to the network that makes up aquatic ecosystems-lakes, streams, rivers, riparian lands, estuaries, and the marine environment. Wetlands are often ecological "hotspots" in watershed aquatic ecosystems, playing a role disproportionate to their size in supporting endangered species and maintaining biodiversity in general. Any complete watershed "analysis" thus requires their explicit consideration.

- A large number of wetland-related government programs have emerged in the last two and a half decades, both regulatory and non-regulatory. Regulatory programs-the Clean Water Act and the Food Security Act at the federal level,

and the Removal-Fill Law and Land Use Law at the state and local level-have made wetlands a lightning rod for property rights activists and an important factor to consider in any land or watershed planning effort.

- Non-regulatory government programs and non-governmental wetlands preservation and restoration programs have also proliferated in recent years, but are not well-coordinated, particularly with respect to goals, objectives, and approaches to protection and restoration. These programs offer great opportunities for increasing the wetland resource base; better coordination would increase their cost-effectiveness and allow for more broad-based participation.

- Wetland restoration is not well integrated into other aquatic resource restoration programs and efforts-those focusing on streams, rivers, salmon recovery, and watersheds. This is reflected in the lack of explicit consideration of wetland restoration opportunities in current watershed analysis manuals, planning guidelines, and even the scientific literature on the subject. In fact, the word "wetlands" is rarely to be seen in watershed program materials (perhaps because of the controversies associated with it). It is thus unlikely that the growing number of watershed associations, communities, and others earnestly preparing watershed action or land use plans will give

sufficient consideration to the historic and potential future role of wetlands to healthy aquatic ecosystems.

- Finally, one of the recurring themes with the working group (the working group will be discussed thoroughly in subsequent sections) for this project was the need for improved coordination of wetland restoration efforts already occurring, from both an ecologic function and organizational perspective.

This report is organized as follows. First, the objectives and methods used are outlined. Background information follows, including what is known about the extent, past alterations, and condition of wetlands in Oregon today; the status of wetland restoration in the U.S. and in Oregon; definitions of important terms; the functions of wetlands and their importance in restoration planning and priority setting; and a general model for the role of restoration in overall wetlands management. Next is the slate of ecological, socioeconomic, and institutional principles that should be followed throughout policy formulation. This is followed by the heart of the report: a three-tiered, function-based framework for wetland restoration and priority setting in Oregon. Finally, responsibilities and methods for implementing the planning framework are outlined, primarily from an institutional perspective. Several appendices provide additional background and supporting information.

PROJECT OBJECTIVES AND METHODS

Although the roots of wetland restoration policy and planning go back to the late 1970s in Oregon, this report draws its principal inspiration from the 1989 Senate Bill (SB) 3, Oregon's Wetland Conservation Law. One goal in the law was to "establish the opportunity to increase wetland resources by encouraging wetland restoration and creation where appropriate" (ORS 196.672.5). Following this legislative directive, the Oregon Division of State Lands appointed a "wetlands restoration work group" to help prepare *Oregon's Wetland Conservation Strategy* (ODSL 1995). The wetlands restoration section of that strategy, in turn, provided the jumping off point for the present project.

Among the recommendations in the *Wetland Conservation Strategy* are several that are particularly relevant to this follow-up of the wetland restoration policy initiative:

Advisory Panel

- that the state should convene a restoration advisory panel to develop standards and guide wetland restoration efforts;

Standards

- that consistent wetland restoration standards be developed for application to both public and private lands;

Restoration Planning Program

- that a cooperative statewide wetland restoration planning program be undertaken to identify priority watersheds for immediate actions, and to develop a statewide restoration inventory for the long term;

Regional Strategy

- that regional priorities be established for restoration of wetland ecosystems within watersheds and wetland conservation planning areas;

Reference Sites

- that reference sites be established through research as a basis for establishing wetland restoration goals and monitoring criteria.

Project Objectives

The objectives of this project, building on *Oregon's Wetland Conservation Strategy* were threefold:

1) to reestablish and sustain a consensus-building dialogue among the public and private agencies and organizations involved in wetland restoration throughout Oregon;

2) to develop a technically sound framework for wetland restoration that considers historical conditions, present-day wetland functions and services, and desired future wetland conditions, and that is based on sound ecological and economic principles, likely growth and development scenarios, and political feasibility;

3) to establish a consensus on goals, policies, and technical procedures for wetland restoration that effectively integrate and coordinate the programs and actions of public and private agencies and organizations in the state.

How this Report Was Developed

The first step in this project involved reestablishment of a wetland restoration work group that included many of the same individuals who were involved in developing the original *Wetland Conservation Strategy* (Appendix C). Three workshops were conducted with this group to provide input to the process. The first workshop dealt with wetland

restoration from a scientific and ecological perspective. The second focused on societal concerns: expected growth and development, economic costs and benefits of restoration, land use issues, and other similar issues. The final workshop focused on implementation issues-how to integrate wetland restoration into the existing institutional framework for watershed, wetland, and land use planning and restoration action programs. For each of the workshops, technical background papers were prepared and presented, followed by focused discussions that formed the basis for much of the content of this report.

How This Report Will be Used

The actual use of this report by the Division of State Lands, The U.S. Environmental Protection Agency, and by the public and private agencies and organizations that contributed to it has yet to be fully determined. Some of the recommendations are designed for easy implementation and will quickly improve wetland restoration efforts in the state. Other recommendations will require additional data gathering, analysis, formal policy initiation efforts by DSL or other agencies, or new implementation actions by local jurisdictions, watershed associations, state or federal agencies, and non-governmental organizations.

BACKGROUND

Definitions for Wetlands and Wetland Restoration

The authors of the recent National Research Council report, *Wetlands: Characteristics and Boundaries* (NRC 1995) provide a complete history of the evolution of both scientific and management definitions for the term "wetland," from mid-19th century swamp reclamation legislation, to the present-day debate over regulatory definitions that can be used to delineate wetland ecosystems from their upland counterparts. The NRC recognizes that there are three definitions of wetlands currently used in the United States, the first two of which are regulatory and the third used for inventory and mapping purposes:

1) 1977 U.S. Army Corps of Engineers (USACOE) definition under the Clean Water Act (33 CFR 323.2(c))

2) Natural Resources Conservation Service (NRCS) definition under the 1985 Food Security Act as modified by 1990 legislation

3) 1979 U.S. Fish and Wildlife Service (USFWS) definition (Cowardin et al. 1979)

For purposes of this report, a broad scientific definition of wetlands that also suggests attributes that might be sought in potential restoration sites is more useful. The broad reference definition developed by the

Committee on Wetlands Characterization (NRC 1995, 50) serves this purpose well:

> *A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development.*

The other key definition for this report is the term "wetland restoration." Although there is a long history of habitat manipulation for wildlife and waterfowl management, the concept of ecological restoration is relatively new. Definitions have proliferated in recent years, ranging from the simple to complex. A relatively simple definition that was suggested by the National Academy of Sciences Committee on Restoration of Aquatic Ecosystems, was quoted in part in the introduction and is reproduced below in full (NRC 1992, 18). This definition, written to be equally applicable to wetland, lake, river, and stream ecosystems, is particularly attractive here because the wetland restoration activities which this report promotes can not be logically separated from their associated aquatic ecosystems:

> *Restoration is defined as the return of an ecosystem to a close approximation of its condition prior to disturbance. In restoration, ecological damage to the resource is repaired. Both the structure and the functions of the ecosystem are recreated. Merely recreating the form without the functions, or the functions in an artificial configuration bearing little*

> *resemblance to a natural resource, does not constitute restoration. The goal is to emulate a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs. Often, natural resource restoration requires one or more of the following processes: reconstruction of antecedent physical hydrologic conditions; chemical cleanup or adjustment of the environment; and biological manipulation, including revegetation and the reintroduction of absent or currently nonviable native species.*

Another important definition of wetland restoration for this report comes from the *Oregon Wetland Conservation Strategy* (ODSL 1995, 33). Here, wetland restoration was defined as:

> *The process of intentionally altering a degraded or historic wetland to produce an attainable wetland ecosystem and associated ecosystem processes in order to achieve statewide, regional, or local ecological goals. The intent of the work is to emulate the natural hydrology, structure, functions, [bio]diversity, and dynamics of the defined or indigenous wetland system.*

This definition adds additional layers to the definition, recognizing that historic "natural" conditions may not be attainable (or desirable), and that specific goals against which success can be measured are important.

Finally, a relatively simple definition is proposed here that builds on the definitions above and on the work of the present wetland restoration work group. Wetland restoration is defined as:

> *Intentional, goal-directed actions that result in the reestablishment of the ecological integrity and biodiversity of wetlands (including their place and role in the larger landscape, and their composition, structure, and functions), in areas where wetlands have been altered, degraded, or destroyed.*

This definition is relatively simple, yet incorporates essential components: human interests and intervention, ecological imperatives, and historical geographic context. With respect to human interests, restoration actions are intentional and focused on specific goals, be they of global, national, statewide, regional, or local significance. Second is the emphasis on two closely interrelated ecological concepts; integrity and biodiversity. Ecological integrity is "the capability of supporting and maintaining a balanced, integrated community of adaptive organisms, having a species composition, diversity, and functional organization comparable to that of natural habitats in the region" (Karr and Dudley 1981). Biodiversity is a bit narrower, having to do with three interdependent aspects of wetland ecosystems: composition (e.g., kinds and number of species), structure (e.g., vegetation layering, snags, and down logs), and function (e.g., habitat and food web support, hydrologic, and biogeochemical) (Noss 1995). Ecological integrity is broader than biodiversity and more important as a management goal because it avoids the pitfalls of assuming that more biodiversity is better (Noss 1995). But both are important for restoration planning and priority setting. Ecological integrity as a concept is fundamental to the design of a regional network of wetlands to be preserved and restored (e.g., within a watershed), whereas biodiversity is most

valuable in site selection and priorities. Finally, the above definition of restoration applies to areas that in historic times were naturally occurring wetlands. This differentiates restoration from "creation."

Whereas restoration aims to return an ecosystem to a former, more natural condition, the terms "creation" and "enhancement" imply putting the landscape to a new or altered use to serve a particular human purpose. Lewis (1990, 418) defines wetland creation as follows:

> *The conversion of a persistent non-wetland area into a wetland area through some activity of man. This definition presumes the site has not been a wetland within recent times (100-200 years) and thus restoration is not occurring. Created wetlands are divided into two groups: artificial and man-induced.*

Wetland creation is differentiated from restoration primarily by where it takes place, namely in areas that were not wetlands in the past. Although wetlands have been artificially "created" in the past on a relatively large scale to provide habitat for waterfowl and other wildlife, today wetland creation is used most extensively in the regulatory process to provide "in-kind" compensation for unavoidable wetland loss associated with permitted development (Kentula et al. 1992). Unfortunately, most "creation" projects are relatively small, many lack adequate hydrology and other key landscape attributes, few actually replace habitat similar to what is being lost, and the scientific basis for wetland creation is questionable (Kentula et al. 1992). Consequently, wetland creation has in

both concept and practice been much maligned (Kusler and Kentula 1990). Nevertheless, wetland creation may play an important role in restoring the larger watershed, for example, by creating new corridors that hydrologically reconnect existing or restored wetlands that were previously connected in a way that is no longer available. This latter point illustrates an aspect of scale in our definition of restoration and the need for some flexibility in use of such terms.

"Enhancement" is another term that is used extensively in wetlands law, policy, and management, often as one of a string of activities to be pursued (e,g, to protect, preserve, restore, and enhance, etc.). The definition included in *Oregon's Wetland Conservation Strategy* (ODSL 1995) defined enhancement as follows:

> *The alteration, maintenance, or management of existing wetlands for long term improvement of particular functions or services (often to the detriment of other functions or services).*

Enhancement differs from restoration in that it has to do with existing wetlands, degraded or not. Restoration applies to lands that once were wetlands, but no longer are.

Definitions for other, less important terms used in this report, such as mitigation and mitigation banking, are provided in the glossary (Appendix A).

Wetland Functions and Services

At the most fundamental level, the ecological functions and societal services that wetlands perform in the landscape are a basis and rationale for both wetland protection and restoration. This is widely reflected in the literature on wetland restoration, much of which recommends recreating the ecological functions of wetlands that have been lost due to past alternations, rather than restoring specific wetland types or some other characteristic (TCF 1988; ODSL 1995). The restoration planning and priority-setting strategies and techniques proposed are largely based on such a *functions-oriented approach*. It is thus important to review these ecological functions, as well as the societal benefits and services associated with them.

Many books, manuals, reports, and articles on wetlands describe the ecological functions and societal services these valuable ecosystems perform (for example, NRC 1995; Wellman 1995; ODSL 1995; Mitsch and Gosselink 1993; Roth et al. 1993; Wilen 1992; NRC 1992; Adamus et al. 1991; Adamus and Stockwell 1983). Although there are a variety of methods that scientists and managers use to describe and group functions, most would agree that ecological functions can be divided into three general categories: hydrologic functions, biogeochemical [water quality] functions, and habitat and food web support functions. Table 1, which was borrowed from the recent National Academy of Science's report, *Wetlands:*

TABLE 1 *Wetland functions, related effects of functions, corresponding societal values, and relevant indicators of wetland functions* (NRC, 1995)

Functions	Effects	Societal Value	Indicator
Hydrologic			
Short-term surface water storage	Reduced downstream flood peaks	Reduced damage from floodwaters	Presence of floodplain along river corridor
Long-term surface water storage	Maintenance of base flows, seasonal flow distribution	Maintenance of fish habitat during dry periods	Topographic relief on floodplain
Maintenance of high water table	Maintenance of hydrophytic vegetation	Maintenance of biodiversity	Presence of hydrophtes
Biogeochemical			
Transformation, cycling of elements	Maintenance of nutrient stocks within wetland	Wood production	Tree growth
Retention, removal of dissolved substances	Reduced transport of nutrients downstream	Maintenance of water quality	Nutrient outflow lower than inflow
Accumulation of peat	Retention of nutrients, metals, and other substances	Maintenance of water quality	Increase in depth of peat
Accumulation of inorganic substances	Retention of sediments and some nutrients	Maintenance of water quality	Increase in depth of sediment
Habitat and Food Web Support			
Maintenance of characteristic plant communities	Food, nesting, cover for animals	Support for waterfowl, furbearers	Mature wetland vegetation
Maintenance of characteristic energy flow	Support for populations of vertebrates	Maintenance of biodiversity	High diversity of vertebrates

Characteristics and Boundaries (NRC 1995, 28), is one such categorization, having the added value of showing the relationship of functions to the effects they produce in the environment, the value they serve in society, and indicators of their presence. Another approach is suggested in Table 2 (Wellman 1995), which categorizes functions in terms of the economic goods and services they provide; ultimately, such a system suggests methods of economically valuing wetland functions. Both systems may be useful in wetland restoration planning and priority setting.

Assessment of Wetland Functions and Services

A variety of assessment methodologies have been developed to evaluate wetland functions, values, and services, such as those listed in Table 1. One of the earliest was developed for the Federal Highway Administration (Adamus et al. 1983). This system was subsequently modified and updated and published by the U.S. Army Corps of Engineers as WET-Wetland Evaluation Technique (Adamus et al. 1991). Several states have also developed tailored wetland functional assessment techniques, one of which is *Oregon's Freshwater Wetland Assessment Methodology*, hereafter,the Oregon Method (Roth et al. 1993). The Oregon Method assesses six wetland functions-wildlife habitat, fish habitat, water quality, hydrologic control, education, and recreation. It also assesses three "conditions"-sensitivity

TABLE 2 *Wetland functions which serve as final or intermediate economic goods and services* (Wellman, 1995)

Final Goods and Services (produce consumer satisfaction directly)

Recreational Opportunities:

- Consumptive uses (e.g., fishing and hunting)
- Nonconsumptive uses (e.g., camping, bird watching, hiking, boating)

Amenities:

- Scenic value
- Existence value
- Educational uses

Intermediate Goods and Services (serve as factors of production for other goods)

Commercial Factors:

- Support of commercial fisheries (e.g., fish habitat, food chain support)
- Provision of commercially harvested natural resources (e.g., timber, oysters)
- Water supply and storage
- Assimilation of wastes (e.g., tertiary treatment of municipal waste)

Damage Prevention Factors:

- Pollution assimilation/water purification
- Flood control
- Erosion prevention

Future Goods and Services (may fall into any of the categories above)

- Bequest value
- Option value
- Undiscovered goods and services
- Future high-value development

to impacts, enhancement potential, and aesthetics. The Oregon Method, as well as its predecessors, is designed to be applied to a set of individual wetlands. It is therefore most useful for planning (e.g., for general assessments of individual sites or multiple site assessments within a relatively small area, such as a Wetland Conservation Plan or Goal 5 area). However, the Oregon Method is of little use at statewide or even regional scales, such as the Willamette Valley or the John Day basin. The method is not designed for large area aggregation and is simply too intensive and time-consuming for such a broad-based application.

The newest and probably most technically sophisticated functional assessment system for wetlands is the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS) system (NCDEHNR 1994). Using digital data for a number of GIS data layers (wetland boundaries and types, soils, land use/cover, hydrology, watershed boundaries, endangered species occurrences, estuarine primary nursery areas, and water quality classifications), the NC-CREWS procedure system analyzes wetland functions at a landscape scale. The rating results can be used to set priorities for protection of significant wetlands. However, such a system requires a large financial investment in inventory, mapping, and digitizing of data on wetlands, land use, and other layers needed for the analysis. While some of these data layers are available for Oregon, it is unlikely that key

data sets (e.g., wetlands, land use, soils, etc.) will be available for many years. The Oregon Method is still likely to be the technique of choice when applied at a local, small-scale level. It is apparent that an alternative method for assessing wetland functions at the statewide and regional level in Oregon is needed.

Extending this assessment discussion to wetland restoration planning and priority setting at a statewide or regional scale, it would be desirable to have a functional assessment technique to evaluate two things:

1) the overall need for restoration (e.g., what functions and kinds of wetlands are in short supply compared to past conditions?); and

2) the potential functions of prospective wetland restoration sites in a region such as a watershed or sub-watershed.

The Oregon Method, discussed above, does consider the enhancement potential of existing wetlands, but it does not address the need for restoration overall nor is it designed to evaluate the potential functions of former wetlands that might be restored. This is consistent with the fact that state planning laws concerning wetlands, with the exception of estuary planning under Statewide Goal 16, do not require identification of potential wetland restoration sites. Basically, there are no standardized methods or requirements in Oregon for evaluating the restoration potential of an individual site or a set of sites within a functional landscape. Such procedures are needed in order to implement

wetland restoration planning at the scales envisioned in this report: statewide, watershed or sub-watershed, individual sites.

Again, in North Carolina, a process is underway to locate and evaluate the restoration potential of prospective restoration sites. Building on the NC-CREWS procedure outlined above and using similar GIS techniques, the potential for sites to perform the following functions are evaluated, scored, and combined to give an overall restoration potential rating (NCDEHC unpublished manuscript):

I. Hydrology Functions
   A. Floodwater/Surface Runoff Water Storage Function
   B. Shoreline Stabilization Function

II. Water Quality Functions
   A. Nonpoint Source Function
   B. Floodwater Cleansing Function
   C. Landscape and Watershed Attributes

III. Habitat Functions
   A. Endangered Species/Significant Natural Areas
   B. Terrestrial Wildlife Habitat
   C. Aquatic Life Habitat

IV. Practicality of Restoration
   A. Surrounding Land Use
   B. Site Conditions

For Oregon, a GIS-based system employing these methods is impractical, but an adaption of the North Carolina method may be possible for planning at the watershed, sub-watershed, or landscape scale. This is discussed later in the section on regional planning.

Wetland Restoration in the United States

As noted previously, wetlands provide an array of functions and values that are of significant ecological, economic, and social importance. There is broad based consensus that the continued loss of these natural ecosystems is not in the best interest of the nation and that efforts to restore lost viability is of the utmost concern. The United States has lost more than half of the wetland acreage that existed in the lower 48 States prior to European settlement (Dahl 1990). Much of this loss was due to agricultural policies from an earlier era that encouraged the drainage of wetlands in favor of workable farmland. In recent years however, attitudes have changed from a general disregard of wetlands to a desire to preserve and restore these unique systems. The first recorded attempts to restore aquatic ecosystems occurred as a result of the correlation between wetlands and the waterfowl that require them as habitat.

Origins of the Wetland Restoration Movement

Active restoration of wetlands is currently being performed by various individuals and organizations at the highest levels ever recorded (EPA 1994). This increase in restoration activity is a direct result of increased awareness that wetlands are a critical component of the landscape, providing a variety of ecological, social, and

aesthetic benefits. While restoration of wetlands has not always been so high on the national agenda, efforts to restore and enhance critical waterfowl habitat have been undertaken for over 50 years.

As early as the 1930's conservation groups concerned about declining waterfowl populations began calling for the replacement of 84 million acres of wetland habitat lost by drainage in the United States (Galatowitsch and van der Valk 1994). In 1937, Congress enacted the Federal Aid in Wildlife Restoration Act (P.L. 75-415), which was intended to lend financial aid for wildlife restoration projects (NRC 1992). The legislation was limited in scope, however, in that it dealt only with "..improvement of areas of land or water adaptable as feeding, resting, or breeding places for wildlife...". By the 1940's, further restoration activity in the name of increasing wildlife and waterfowl populations had been occurring throughout North America (Galatowitsch and van der Valk 1994). Wildlife managers from the northeastern United States called for the construction of small-scale water impoundments which were built mostly on publicly-owned wildlife management areas or private hunting tracts.

Over the past decade, however, there has been a growing awareness that wetlands are not only essential to waterfowl, but also to preserve and protect fisheries, provide water quality, and protect flood-prone areas. Wetland

conservation activities shifted their emphasis from the singular purpose of wildlife enhancement to more broad ecological contexts. One of the most decisive statements which illustrated the changing views on wetlands came from then-Vice-President George Bush: it shall be the explicit policy of the federal government to "achieve no overall net loss of the nation's remaining wetland base, as defined by acreage and function; and to restore and create wetlands where feasible, to increase the quality and quantity of the nation's wetland resource base" (The Conservation Foundation 1988). During the 1980s, Congress enacted legislation to implement wetland protection on a truly national scale (ICWRC 1992). The 1985 Food Security Act, the 1986 Tax Reform Act, the 1982 Coastal Barriers Resources Act all removed incentives that had previously encouraged wetland destruction. The Emergency Wetlands Resources Act of 1986 doubled the amount of guaranteed funding for federal wetlands acquisition.

There are many federal programs that are designed to assist both public and private entities in undertaking all levels of wetland restoration, enhancement, and creation. Partnerships have been developed among federal and state agencies, as well as public and private organizations to accelerate wetland conservation efforts (see appendices D and E). Some examples include the North American Waterfowl Management Plan, the Bureau of Land Management's Fish and

Wildlife 2000, the USFWS's Partners for Wildlife, the Stewardship Incentive Program of the US Forest Service, and the Oregon Coastal Wetlands Joint Venture. Data on total acreage of restored wetlands across the country vary a great deal, however a generally accepted figure provided by the Interagency Committee on Wetlands Restoration and Creation (1992) is approximately 1.3 million acres between the years of 1989 and 1993. This figure includes only those restoration and enhancement activities subsidized by the federal government.

Perhaps the two most successful restoration programs, in terms of total acreage affected, are the Conservation Reserve Program (CRP) and the Wetlands Reserve Program (WRP). In both programs, private landowners are offered financial incentives to retire marginal cropland in favor of the many functional benefits associated with having land in a conservation status. While WRP is directly targeted at protecting and enhancing wetlands, only about 15% of the 36.4 million acres enrolled in CRP are jurisdictional wetlands (ICWRC 1992). Both programs were authorized in 1985 under the Food Security Act and are administered by the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service). More complete information on these programs is available from NRCS, and contact names are provided in Appendix E.

Other methods for placing wetland acreage into conservation status exist for private citizens. However, landowners seeking financial and technical assistance for restoring wetlands are generally expected to remove the affected area from agricultural or commercial use. Land retirement options include long-term leases, permanent easements, and purchase agreements. For example the CRP was previously a 10-year lease program. Permanent easements and 30-year lease arrangements were added to FSA in 1990 as part of the Wetland Reserve Program. Nationally there are many non-governmental organizations (NGOs) who assist landowners in finding ways to conserve wetland resources. Chief among these associations are The Nature Conservancy, The Wetlands Conservancy, and Ducks Unlimited. In Oregon, the Pacific Coast Joint Ventures serves private and government wetland interests in order to increase waterfowl habitat and assist in the protection of high-priority sites.

Although lease and purchase agreements have traditionally been very popular ways to dedicate land for wetlands, permanent conservation easements are becoming increasingly common (EPA 1994). Ten-year leases give landowners chances to conserve wetlands even if they are unable or unwilling to make a permanent commitment of the land. These short-term options thus provide an effective method for introducing large numbers of landowners to wetland restoration. Leases are less attractive for large,

more complex projects because the costs of restoration are often too high to justify only a short-term restoration.

Easements are more costly for wetland conservation interests to obtain than a lease, but they are generally less expensive than purchase. They require a permanent commitment from the landowner, but only for certain activities. Easements involve the transfer of specific rights relating to the use of the property. These land management prescriptions are precise and designed to ensure that the quality and values of the site will be maintained. Besides describing restricted and allowed uses of the property, the terms of an easement include the length of time involved and provisions for monitoring the site.

Restoration in a Regulatory Context

Restoration of wetlands can take place within one of two contexts: regulatory or non-regulatory. Restoration within the regulatory context is usually carried out as compensatory mitigation for wetland losses permitted pursuant to Section 404(b)(1) of the Clean Water Act (CWA), which regulates discharge of dredge or fill material in the waters of the United States, including wetlands (40 CFR 230). Mitigating the harmful effects of development actions is a central premise of this legislation. Section 404 relies upon a sequential approach to mitigating harmful effects by first avoiding unnecessary impacts, then

minimizing environmental harm, and, finally, compensating for remaining unavoidable damage to wetlands and other waters through, for example, the restoration or creation of wetlands. The US Army Corps of Engineers (USACOE), in consultation with EPA and other relevant federal and state agencies, regulates wetland alteration through an often rigorous permit process.

A controversial component of the permit process is the "no-net-loss" goal of the regulating agencies. A lofty policy ambition, there are both endorsements and concerns about its implementation and actual practice. The goal reflects a national realization that the United States has lost enough of its wetland base and that a definitive regulatory standard is needed to stem further losses. Through its clear purpose, it can help coordinate government and private programs to better meet both environmental concerns and development interests. On the other hand, with no qualifications for wetland type and function, "no-net-loss" often results in proposals for wholesale destruction of resources followed by promises of future restoration and creation. Indeed some scientists believe that a "no-net-loss" goal in terms of functional equivalency is scientifically impossible to achieve.

The ultimate success of the Section 404 process is open to debate. One study indicated that over a 10 year period in Oregon, despite the efforts at a no-net-loss policy goal,

the state actually lost significant wetland resources (Kentula et al. 1992). The total area of wetlands permitted for alteration during the study was 74 ha, while the amount created or restored was only 42 ha, for a net loss of 32 ha, or 43%. Thousands of such permits are processed each year by USACOE in the United States, and decisions to permit or deny alteration are typically made on a case-by-case basis (Kentula et al. 1992). Further, wetland types that are created or restored pursuant to Section 404 are often not the same as those impacted. Thus there is an inadequate regulatory system that does not fully address wetland functional attributes, type, and overall acreage.

Restoration in a Non-Regulatory Context

The greatest opportunity for wetland restoration lies not within the regulatory context, but rather in non-regulatory public or cooperative public and private projects. Non-regulatory restoration occurs when individuals and organizations recognize any number of worthy needs for conservation and restore wetlands independent of any compensatory obligation. This type of restoration can occur on public or private land, within urban boundaries or on agricultural land. Non-regulatory restoration offers a significant chance to improve wetland functions and values where opportunities arise. All of the federal assistance programs described in previous sections are non-regulatory

in nature. Current programs have made it feasible for thousands of landowners throughout the country to restore wetlands. Landowners are compensated for long-term land retirement, and they can obtain technical assistance for planning and constructing a restoration project from local, state, or federal authorities. Additional support for habitat restoration projects is available from several conservation groups including Ducks Unlimited, The Wetlands Conservancy, and the Nature Conservancy. If the goal is to increase the wetlands resource base of Oregon, then the answer does not lie in the "no-net-loss" regulatory process, which can at best stem losses. The best chances for success can be achieved through systematic non-regulatory restoration, enhancement, and creation of wetlands wherever the opportunity arises.

Wetland Restoration in the United States

North Carolina

Meeting the information needs of resource managers in North Carolina has taken a decidedly technical approach. The coastal area of North Carolina encompasses over 9000 square miles, and in many areas over half of the total acreage consists of jurisdictional wetlands (NCDEHNR 1995). Although agricultural conversion is responsible for the

major proportion of historic loss, currently draining and filling for development purposes
represents the context for continuing loss. Conflicts between economic development and wetlands protection continue to be a major concern, with many coastal areas considering wetlands conservation to be a barrier to community development.

To address community concerns and the need for wetland resource conservation, the North Carolina Department of Environment, Health, Natural Resources established the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREW). NCDEHNR used Section 309 (Federal Coastal Zone Management Act) enhancement grants to create and implement a statewide Wetlands Conservation Plan in 1991. The strategy consisted of six (6) components: (1) wetlands mapping and inventory, (2) functional assessment of wetland resources, (3) wetland restoration, (4) coordination with wetland regulatory agencies, (5) development of coastal area wetland policies, and (6) standardization of local land use planning efforts (NCDEHNR 1995). The impetus provided, extensive wetland mapping for coastal areas was established utilizing Geographic Information Systems (GIS). Relevant GIS coverages include wetland type, area, local land use, endangered species occurrences, watershed water body classification, soil classification, stream networks, and more.

Analysis of these coverages in various combinations will yield significant results. NCDEHNR is assessing the ecological importance of all coastal wetlands to determine which of them are the most important for maintaining the environmental integrity of the state. The result will be a designation for each wetland polygon in the GIS coverage as being of high, medium, or low functional significance in the watershed in which it exists. These results can then yield information on the prioritization of potential wetland restoration sites. Maps for the remaining wetland resources of the state are currently being digitized. Wetland restoration prioritization based on functional analysis will be explored further in subsequent sections. What North Carolina has achieved should not be overlooked. They have established a series of GIS coverages which can be used for natural resource management and planning at any number of levels. Their commitment to the future is exemplified by the extent to which they placed resource analysis firmly in the 21st century.

Regional Efforts in the Mid-west

Throughout the early decades of the 20th century the prairie pothole region of the midwest was uniformly drained for agricultural purposes. Between 60% and 80% of overall wetland acreage was lost due to such hydromodifications as diking, tiling, and ditching (Galatowitsch and van der Valk

1994). So much was destroyed, in fact, that establishing reference sites and finding native seed banks for colonizing propagules were significant concerns during the early stages of region-wide restoration efforts. In 1991 the Institute for Wetlands and Waterfowl Research (IWWR) was established by the boards of directors of Ducks Unlimited (DU) in the United States, Canada, and Mexico. One of the primary missions of IWWR is to enhance the communication of the latest information on wetlands and waterfowl biology and conservation. Their first major publication was *Restoring Prairie Wetlands: An Ecological Approach*, which provided a comprehensive and technical basis for the restoration of wetlands in the southern prairie pothole region of the United States (Galatowitsch and van der Valk 1994). The book addresses the regional challenge of restoration to recreate wetlands comparable to those that existed over a century ago, but within today's agricultural landscape. This recognition of the significance of restoring wetland habitats from a regional perspective is critical to the national goal of a net gain in wetland resources.

The Pacific Northwest

The Columbia River estuary, one of the largest estuarine ecosystems in the country, encompasses an estimated 120,000 acres. The Columbia River Estuary Study Task Force (CREST) was created in 1975, as a local

organization whose mission it was to prepare and implement a regional management plan for the waters and shorelands of the estuary. Although the mandate of CREST includes consideration for economic development and land use planning for upland areas, the primary relevant focus is its direct bearing on the maintenance, use, and restoration of wetland ecosystems on the boundary between Oregon and Washington (Good 1979). The Columbia Estuary Regional Management Plan, while holding no separate legal authority, consists of policies and recommendations that are incorporated into local municipal plans and ordinances (McCreary and Adams 1995).

From 1870 to 1981, the Columbia River has undergone extensive alteration. Tidal marsh habitats declined 43%, forested tidal swamps decreased 77%, and hydromodifications for various reasons have halted or constricted tidal flow in many areas of the estuary (McCreary and Adams 1995). The development of the CREST plan is an example of how grassroots organization can provide a model for coastal and estuarine planning at the state level. Crest used an extensive outreach program that included hearings in each affected community.

Recognizing the substantial alteration within the system, the CREST plan establishes an overall policy that all habitat restoration projects should serve to return, replace, or otherwise enhance the estuarine ecosystem.

Priority should be given to projects that restore wetlands that are in shortest supply. They strongly discouraged creating shallow water habitats through dispersal of dredged material in water or wetlands. Breaching dikes to restore tidal flow was acceptable if no loss of productive farmland or other habitat occurred.

CREST continues to have solid local support and has become a critical channel for disbursement of federal funds for local planning assistance (McCreary and Adams 1995). Resource management through advanced planning and recognition of the importance of local citizen involvement in the process is very important. Wetlands are a critical component of virtually every watershed in the country. Perhaps the groundwork laid out by the CREST plan and resultant process can lead to increased awareness of the importance of natural resource conservation and advanced planning procedures.

Wetland Restoration in Oregon

Oregon's diverse geography and climate have forged a unique, diverse array of wetland types and sizes. Coastal estuarine marshes have garnered a significant amount of attention over past decades and the Willamette Valley boasts freshwater marshes and swamps typical of broad meandering river basin systems. Wet meadows, swamps and seeps are prevalent in the Coast Range and Cascades, while the drier

central and eastern regions support a host of riparian wetland areas.

Regulatory Authority

The state of Oregon recognizes the importance of wetlands and statutorily protects these systems in both its statewide comprehensive planning process and through the state and local permitting process. Regulatory authority outside forest lands is delegated to the Division of State Lands (DSL) which administers the State Removal/Fill Law (ORS 541.605-541.695). This legislation requires a permit from DSL for removal, fill, or any alteration of 50 cubic yards or more in any waters of the state. Administrative rule has broadly defined wetlands to be within this jurisdictional authority (DSL 1993). The Removal/Fill Law is similar in scope, but more comprehensive than the federal regulatory program administered by the Corps under authority of Section 404 of CWA.

Further wetlands conservation in Oregon is provided by the Statewide Land Use Planning Program (ORS 197). Of the 18 Goals, four (4) specifically address wetland issues: Goal 5 (Natural Resources), Goal 15 (Willamette River Greenway), Goal 16 (Estuarine Resources), and Goal 17 (Coastal Shorelands). Each goal requires an inventory and evaluation of wetland resources, but the degree to which the intent of the legislation is followed by local planners is suspect.

Goals 16 and 17 both offer broad compelling direction regarding the planning and use of their specific resources, including wetlands.

Goal 5 is presently under reauthorization by the Oregon Legislature. Currently, Goal 5 directs that all local planning will insure open space, protect scenic and historic areas and natural resources for future generations, and promote healthy and visually attractive environments. In addition, the location, quality, and quantity of local resources, including wetlands, should be inventoried. One of the problems associated with the practice of Goal 5 lies in the inventory process. Wetlands are provided with a status by each local government, their rank is either protection, conservation, or developable. The very wetlands that are most eligible to be restored, those wetlands that are degraded or highly altered, are the lands designated for development. Goal 5 may or may not offer an avenue of implementation for this policy; it remains to be seen what the results of reauthorization entail.

Wetland Trends in Oregon

It is difficult to verify trends and patterns involving wetland restoration in Oregon. Prior to 1991, when DSL established the General Application (GA) for non-compensatory wetland restoration, the only way to trace restoration activities as a whole is through the regulatory

permit process. The GA streamlined the permit process for restoration activities by shortening the time frame for approval and circumventing much of the regulatory material intended for development activities. Most permitted activity, however, is located west of the Cascades (Kentula et al. 1992). According to one study, 90% of the impacted, restored, and created wetlands were associated with the coast, an estuary, or navigable waterway. Close to 60% of the projects were within three (3) miles of an urban area with a population greater than 10,000 (Kentula et al. 1992). The average size of a permitted wetland restoration site is less than one (1) acre, and over 30% are simple water impoundments which list wildlife enhancement as a project goal.

The U.S. Fish and Wildlife Service (USFWS), under the National Wetlands Inventory Program (NWI) studied the trends and patterns in wetland habitats in the conterminous United States during the 20 year period between 1954 and 1974 to develop information on losses of specific wetland types (Frayer et al. 1983). Threatened areas from the national study were extrapolated to Oregon and three (3) problem areas were identified: (1)estuarine wetlands, (2)western riparian wetlands, and (3)urban wetlands.

Analysis of estuarine wetlands indicates losses of between 50% and 80% or greater of intertidal marshes within Oregon's larger estuaries (Boule and Bierly 1987). Diking

for agricultural purposes was listed as the primary culprit. Similarly, conversion of riparian vegetation to agricultural use constituted 80% of the loss of riparian cover in the Willamette Valley (Frenkel 1984). In the eastern region of the state, grazing by cattle and sheep appear to have caused a great deal of the riparian loss there. Finally, pressure from developers in urban areas result in significant wetland loss. Population growth is continuing in Oregon, and there is reason to suspect that further hydromodification in urban areas will result in more alteration.

Current Impetus for Wetland Restoration in Oregon

Senate Bill 3. Senate Bill 3 was legislatively established in 1989 and proposed to reform the way wetlands were managed in Oregon. It was enacted in response to concerns over delays and inequities in then-current state and federal regulatory programs, conflicts between those programs and local comprehensive plans established under Goal 5, and the lack of protection afforded to Oregon's remaining wetland resources by either regulation or planning (ODSL 1993). The primary provisions of SB 3 included establishment of uniform regulatory definitions for wetlands, a call for a statewide inventory of wetland resources, institution of a general authorization permit for activities deemed to have minimal impact to wetlands, exemption for alterations on agricultural land, and

organization of a statewide wetland conservation plan. Subsequently, pursuant to SB 3, the Oregon Division of State Lands (DSL) convened several advisory committees representing various governmental and private sector interests, and established what would become a uniform statewide effort to address wetland resources.

The Oregon Wetland Conservation Strategy is intended to provide the focus and "framework for an integrated state wetlands program designed to conserve, protect, and manage the state's wetland resource base" (ODSL 1993). The strategy focuses priorities for an integrated state wetland program with considerations for the following issues: regulatory integration, planning, public lands, protection, restoration, public information, and data needs. With these issues in mind, DSL established a goal for the strategy to:

> *Ensure the long term protection and management of the state's wetland resources through both regulatory and non-regulatory measures by a) providing protection of wetlands and restoration sites, b) conserving and managing functions, values, and acreage of wetlands, and c) encouraging restoration of wetlands for watershed, water quality, and/or wildlife objectives, while accommodating necessary economic activities. Also, manage Oregon's wetlands through partnerships that improve communication, cooperation, and consistency among agencies, organizations, and the public.*
> (ODSL 1993)

The Oregon Wetlands Conservation Strategy continues to serve the state by providing written policy on a highly controversial subject. It provided the impetus for this

project, and many others including the Stage I Watershed Assessment.

The Watershed Health Program. In 1993, the Oregon Legislature created the Watershed Health Program (WHP)as part of a new natural resources conservation strategy acknowledging the primary importance of watersheds to the state's ecological as well as economic health (OWRD 1995). The WHP was designed to maintain and restore watersheds and grew out of a recognition that many Oregon river basins no longer have the capacity or physical character to satisfy the demands placed on them by an ever increasing population base. Since the inception of the program, over 70 miles of riparian habitat has been restored through replanting of native vegetation n order to provide shade and minimize the effects of runoff. In addition, more than 270 structures have been placed within streams to slow currents and create habitat for increased fish recruitment (OWRD 1995).

Perhaps even more significant than the physical improvements to Oregon's rivers brought about by the Watershed Health Program, is the creation of a new management tool that involves citizens in voluntary actions to enhance regional aquatic conditions where they live. WHP creates local watershed councils to work in cooperation with local, tribal, state, and federal agencies to help solve myriad watershed problems. To date, 36 watershed councils

have been formed throughout the state, and they have been provided with a major impetus to become involved in the management decisions that affect their watersheds and the funding of restoration projects (OWRD 1995).

Many of the recognized watershed councils have initiated thorough watershed action plans. The Coquille Watershed Association Action Plan addresses their primary issue of natural resource management in relation to declining anadramous fish populations (CWA 1994). While the focus of the Coquille organization is restoring fish habitat, they recognize the critical importance of broad aquatic ecosystem restoration including the re-establishment of functional wetland floodplains (CWA 1994). Similarly, the Little Butte Creek Watershed Council Action Plan has a primary goal of restoring fisheries resources while recognizing the importance of functioning wetland systems as rearing areas (LBWC 1995). The degree to which the individual watershed councils address the need for wetland restoration as an integral component of overall watershed health remains to be seen.

The Bradbury Plan. Another strategy for addressing watershed level aquatic ecosystem restoration is the so-called Bradbury Plan, named for former Oregon State Senate Legislature President Bill Bradbury, who championed its funding. The framework, organized by the Pacific Rivers

Council, was developed by individuals from various levels of government, science, and the private sector. According to the project summary, the primary concern of these individuals was to utilize the best available science for making watershed level policy decisions (PRC 1994).

The framework's goal is to "protect and restore native fishes by focusing on strategies that provide the greatest ecological benefits for native fishes and ecosystems" (PRC 1994). To many, native fish stocks are an indicator of general ecosystem health. That is, if a watershed is in a healthy state, then it will contain a viable population of native fishes.

Some critical concepts justified and guided the development of the framework established by the Pacific Rivers Council. First, protection of intact areas must be the initial priority. It is far less expensive to protect what has not been significantly degraded than it is to restore severely altered systems. Second, protection and restoration must address ecological diversity at many spatial scales. The vast number of native species can best be protected by conserving different geographical areas across the landscape. Last, the primary focus of the prioritization should be on areas with high levels of diversity and high salmonid productivity (PRC 1994).

Several problems with the Bradbury Plan exist with respect to wetland restoration. There is no recognition

within the text of the document that specifically addresses the need for wetland restoration, creation, or enhancement. If wetlands are recognized as critical rearing and nursery habitats for juvenile salmonids (Pearce 1985; Roth 1993; Boule 1987), then why are they not a vital component of the prioritization plan? It may be implied that wetlands are an integral element in healthy functioning watersheds, but it is not stated clearly. Perhaps the most important consideration made by the Bradbury Plan is the recognition that protection of relatively intact areas must be carried out prior to the overall success of any restoration strategy.

Wetland Restoration Activity Occurring in Oregon

Salmon River Estuary. A 55 acre diked pasture in Oregon's Salmon River estuary was restored to tidal influence in 1978 through partial dike removal. The restoration site is on US Forest Service land and is managed as part of the Cascade Head Scenic Research Area with the objective of reestablishing the natural saltmarsh (Frenkel and Morlan 1990). The project involved a baseline investigation following the dike breaching, and then a subsequent evaluation of the restoration processes.

The study concludes that the diked pasture has been successfully restored to a functioning saltmarsh system, although not the same as planned. Tidal circulation has

been effectively reestablished, natural Pacific Northwest saltmarsh vegetation returned rapidly without planting efforts, and the restored and revitalized marsh is highly productive, according to research (Frenkel and Morlan 1990).

This restoration effort is important for a number of reasons. It involves a critical partnership between the federal government and Oregon State University, who conducted the research. The science of wetland restoration has been advanced a great deal through the continued monitoring of the site by Bob Frenkel and his colleagues for the past 17 years. As a large scale restoration effort, the Salmon River project supplies information on a wide variety of wetland species and processes.

Warner Valley. In southeast Oregon in the Warner Valley, the Bureau of Land Management administers one of the largest wetland and potential wetland complexes on the Pacific Flyway (ICWRC 1992). The Warner wetlands have a long history of disturbance resulting from massive agricultural conversion. Beginning in the 1930s the natural overflow from Hart Lake into the adjacent wetland systems was decreased by a diking project along the north shore. The dike system has been raised three times to accommodate the increased need for irrigation and water storage capacity of the lake. Each effort resulted in the further isolation of the wetlands from their natural recharge.

A multi-year and multi-resource management plan for the Warner wetlands was developed by the BLM in 1989 (ICWRC 1992). Using a combination of federal money ($66,000) and money raised by the private sector ($56,000), BLM has restored over 15,000 acres of wetlands. The entire project consists of 30,000 acres of public land, containing 19,000 total acres of wetlands, 7,500 of which were acquired.

The continuing success of the Warner wetlands project establishes a partnership between public and private interests that is critical to the ongoing increase of the wetland resource base. Further, the project shows that broad waterfowl population enhancement goals can also dovetail with wetland restoration objectives. The health of the Pacific Flyway is important not only for the birds of Oregon, but also for those that only pass through.

Dixon Creek Demonstration Project. In Corvallis, the city authorities, in conjunction with Pacific Habitat Services and Jefferson Elementary School have completed the Dixon Creek Demonstration Project. This project has enhanced a reach of Dixon Creek and its riparian area with emphasis on improving the habitat for aquatic and terrestrial wildlife, with particular attention to minimizing flood damage. The work included stream and bank excavation plus the addition of several native plant species.

Some of the project objectives were to restore fish habitat in Dixon Creek by creating scour pools and adding vegetative cover to the stream, to enhance water quality and stabilize stream banks against erosion, and to restore aesthetic value to the adjacent neighborhood by improving the appearance of the stream. The City of Corvallis Public Works Department acted as the sole source of funding for the duration of the project.

The Dixon Creek Project has served many capacities for the city of Corvallis. It has provided an impetus for public involvement in streamside and habitat restoration, it has served as a platform for education of the students at the Jefferson School, and potentially will serve the same capacity for additional regional schools. It will also act to clean up water quality both in the reach and in the downstream portions of Dixon Creek.

Other Projects. Of course there are a significant amount of other wetland restoration projects occurring in Oregon. They are products of compensatory mitigation requirements, partnerships between public and private entities, and components of national restoration strategies. A more thorough list of selected wetland restoration projects in Oregon is listed in Appendix F.

The Role of Restoration in Wetland Management

Restoration of wetlands is a management strategy that has the potential to stop or even reverse the gradual decline of wetlands and the valuable functions and services they perform, here in Oregon and elsewhere. But restoration is only one part of the overall management framework. To understand how restoration can best contribute to the health and integrity of wetland ecosystems, it is necessary to establish and understand the context for restoration from several perspectives: historic, present-day, and some desired future. We need to understand historic conditions of wetlands around the time of Euro-American settlement; we need to understand the changes in wetlands that occurred and that are still occurring; we need to consider other wetland management strategies and tools that are available; and finally, we need to establish some clear, achievable goals based on these understandings. Figure 1 is an attempt to characterize these relationships and the context for restoration. There are a number of basic assumptions and principles that can be derived from it.

1) Wetlands are but a part of broader aquatic ecosystems, and in a restoration context, cannot be physically, functionally, or conditionally separated from the streams, lakes, and rivers with which they are associated.

2) It must be assumed that present wetland resources which contribute to important global, regional, or local functions and values will be protected or conserved using available regulatory and non-regulatory measures, but that some wetlands will continue to be converted as the human population increases.

3) Future wetland resources will be the sum of wetlands loss (hopefully a small figure) and wetlands restored (the larger figure). Wetland enhancement and particularly wetland creation are likely to play relatively minor roles in the overall size and health of wetland ecosystems.

4) Wetland restoration planning at a greater than site scale demands at least some understanding of historic conditions at some larger landscape scale, such as an ecoregion, a watershed, or some subunit thereof. The key to the desired future, with respect to wetland condition, lies in part in this understanding.

5) Most of the historic changes in wetlands can be attributed to some physical alteration: damming, diking, filling, channelization and so on. Restoration actions should focus on undoing these past actions to reestablish the physical conditions and connectivity needed for wetlands to redevelop.

6) Often the clues to the past are found in present-day, altered landscapes, as well as in natural resource and other data that deal with these areas. Soils data may be

particularly useful in identifying areas that once were wetlands but no longer are because of altered hydrology or other physical change.

PRINCIPLES FOR WETLAND RESTORATION

Only relatively recently in American history has society recognized wetlands as valuable and vulnerable ecosystems which are worthy of protection from anthropogenic modifications. The restoration of wetlands, no matter what the scope and scale being addressed, should have the same general goal: returning the wetland to a viable, healthy ecosystem that is persistent and self-sustaining in its composition and functioning. At any planning level, restoration priorities should be established using considerations for a variety of ecological, socioeconomic, and legal-institutional principles. Establishment of these principles, coupled with the functional analysis being performed at the state and regional levels, will guide planners as they seek to prioritize sites within their individual sub-regions. Subsequent principles should be examined relative to each potential site and taken into consideration. Some principles will not be applicable to every site, but examination of the individual merit of each should be an integral practice of each regional planning team.

Ecological Principles

Wetlands have a variety of valued ecological functions within the larger landscape. Because ecosystem health and

integrity depend on the maintenance of ecological processes, it is imperative that the principles of their existence be examined thoroughly. Wetland functions such as habitat, water quality maintenance, and hydrolologic control are relatively intact in some areas, degraded in others, and lost entirely in many areas. Ecologically then, it is important to protect these valued functions where they remain undisturbed, enhance them where they have been degraded, restore them where they have been lost, and even create them in areas which may be favorable.

The ecological principles listed below are not exhaustive by any measure, but they represent the minimum regional considerations deemed necessary by the work group. Each principle should be taken into consideration when undertaking prioritization of potential sites.

- All natural wetlands of comparable size *do not* have inherent equivalence of ecological functioning thus, a variety of factors needs to be considered in wetland restoration.

  Wetland restoration requirements often make no effort to account for the variation in ecological quality among wetland types. Considerations should be made for such factors as quality of habitat, degree of water quality enhancement, extent of hydrologic control, and

others. Expert wetland scientists and managers should be consulted when making these critical comparisons.

- Focus for restoration and enhancement efforts should be aimed at specific wetland types .

  Priorities should be set using such criteria as relative rareness, representativeness, relative at-risk state, and regional scale of importance. The State should establish a fully representative reserve network which would contain examples of all habitats, plant communities, hydrologic regimes, etc. Regional entities could utilize the network, which would serve as a slate of reference sites. It is still unclear whether ecologically diverse and biologically sound wetland communities can be totally created by humans. Therefore restoration of natural wetland systems should have priority over the creation of artificial ones.

- Consideration for the position and role of a potential or restorable wetland in the broader regional landscape should be taken when contemplating restoration.

  Examination of the potential and recognized ecological character of the wetland should take place prior to undertaking a specific restoration planning process.

- Comprehensive wetland conservation/restoration strategies should incorporate consideration of biodiversity at genetic, population, species, community, ecosystem, and landscape scales..

  Species composition, geographic distribution, relative abundance, and other qualitative factors are essential components of a wetland "value" assessment strategy.

- Provisions should be made in regional planning for frameworks which take into account transient or migratory species in addition to resident members of the wetland community.

  When analyzing and prioritizing potential wetland restoration sites, it is critical to include the use of these aquatic systems by species which do not reside there on an annual basis. In many cases the wetlands themselves are transitional in nature, but this does not detract from their regional importance in either structure or function.

- Wetland species which are well distributed across their native range are less susceptible to extinction than species confined to small portions of their range.

  Widely distributed species are less likely to experience a catastrophe, categorical disturbance, or other negative influence across its entire range at

once. Considerations should be made for flora and fauna to be distributed as evenly as possible in the restored or enhanced system.

- Large blocks of wetland habitat, containing large populations of a target species, are superior to small blocks of wetland habitat containing small populations.

The ecological principle of "big" being better than "small" is a universally accepted generalization. A larger block is less likely to undergo a catastrophic alteration than a smaller block. This principle should be weighed against the principle of inherent equivalency. Large blocks of heavily degraded wetlands may not be more beneficial ecologically than small blocks of intact and diverse systems.

- Blocks of wetland habitat that are close together are better than those which are far apart.

Many organisms are able to cross narrow units of unsuitable habitat; far fewer are able to traverse long distances. Habitat blocks that are closer together will allow more interchange between units, and are thus considered to be functionally united. This concept of adjacency is more easily considered at the regional scale. Prioritization of sites should include examination of proximity to viable wetland systems.

- Wetland habitat in contiguous blocks is better than fragmented habitat.

  Fragmentation results in a reduction of size and increase in isolation of habitats. The hydrology of a wetland network is often altered to the point where the patches can no longer maintain their structural, functional, and compositional integrity. Habitats that are functionally connected by natural movements of organisms and unaltered hydrologic regimes have many advantages over fragmented

- Blocks of wetland habitat that are not easily accessible to humans are better than roaded and accessible habitat blocks.

  Roads create a host of potential dangers for wetlands and their inhabitants. They provide human access for easy exploitation of resources; they increase mortality of organisms from roadkill, they are a source of sedimentation and/or pollution, and they can prohibit movement for smaller species. Perhaps the most notable effect that roads can have on wetlands is an alteration of hydrology. In urban settings, the entire hydrologic regime has been irrevocably altered due to filling, draining, ground water extractions, damming, diking, or other anthropogenic modifications. Water quality is often degraded by both point and nonpoint source

pollutants. Sediment yields can be high while buffers or other transitional components may be absent altogether. While it is illogical to rule out urban wetland restoration completely, ecologically there is little foundation for continued activity.

- Wetland restoration strategy should not treat all species as equal but must focus on species and habitats threatened by human activity or those which are scarce from a restoration perspective.

The most appropriate target species for conservation are generally those most sensitive to human disturbance. Do not waste time or money managing species that do not require our efforts.

- Peripheral habitats and populations of species are not only more likely to be genetically impoverished but also are more likely to be genetically distinct than are central populations.

Marginal populations do not receive the same gene flow as interior ones and are thus increasingly subject to

- Wetland restoration plans should incorporate large ecological landscapes and time frames to ensure long term integrity.

Wetland restoration planning boundaries should generally be determined by ecological considerations, not political determinations. Topography, geology, hydrology, soils, and a host of other factors create discontinuity within the landscape. Restoration planning should be defined by vegetation, watersheds, or physiography, not by political lines drawn long ago for varying reasons. Regional entities should be established using the watershed planning approach, or some other sub-regional method for getting together those participants who can seize the opportunity to enhance their environment with a minimal amount of time involved. Benefits of a sound regional approach far outweigh those offered from a site by site strategy.

- Wetland restoration management must be adaptive, that is, information gained subsequent to policy implementation should be used to adjust future decision making in a desired direction.

Much land management is done based on a trial and error basis, with the errors not being recognized until long after any damage is done. Research and monitoring should be coordinated with intelligent land management practices in order to adjust management in a new, and more effective direction.

- Nature should be used as a template, wherever possible, for all levels of wetland restoration.

  Recognition that natural ecological integrity is one of the most important components of wetland restoration projects is a critical step in the planning process. Restoration should be encouraged at sites where the potential for self-sustainability is highest. Human disturbances that mimic or simulate natural processes are less likely to threaten species than are disturbances radically different from the natural regime. Drastic alterations to physical processes or biological integrity can devastate biodiversity. If sincere thought into avoidance and minimization is applied before development occurs, the chance for genetic impoverishment is diminished.

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- An understanding of, and ability to reconstruct, the historic hydrology of a watershed or site is the cornerstone to a successful wetland restoration project.

Wetland communities are determined by hydrology. Use of historic data can provide indications or measurements of trends in the hydrologic regime. When combined with an understanding of how the physical system is responding, historic data can be used for establishing trends in wetland acreage and functioning. Success of wetland restoration depends upon examination and understanding of various complex and constantly evolving criteria. As previously discussed, wetlands respond in various ways to changes in the physical, chemical, and ecological processes which shape their structure. They can be altered by both natural processes and anthropogenic modifications at many spatial and temporal scales. Given that the site requires restoration or enhancement, the existing state is probably significantly different from the "natural" state, which existed prior to degradation. Analysis at some level, of prior physical functions and conditions of a proposed wetland restoration site should be a consideration of each regional entity. It is imperative to utilize all available relevant information when endeavoring to perform such historic

analysis. Relevant materials would include, but not be limited to, old airphotos, soil surveys, NWI maps, floodplain maps, and land surveys.

- Use of historic data should be used in creating and identifying restoration priorities.

Oregon is unique in that its post-European development occurred primarily in a time which paralleled the advancement of photography. There is a host of relevant, usable material at disparate locations throughout the state. Thresholds for management actions and decisions can be established through the use of historic information. Appropriate decision making thresholds could be set up using an adaptive management process which periodically reviews relevant historic material (Williams 1995). Historic analysis can be used to establish potential sites where minimum alterations would be necessary for achieving desired goals. Information exists which could begin to uncover potential wetland restoration sites where passive, and thus not costly, efforts could be initiated. Where there are reasonably removed obstructions to the hydrologic regime, take them out. Historic analysis of river floodplain ecosystems provides indicators for developing basin-wide restoration strategies. The character of river floodplains may be established

through historic analysis and thus be utilized in watershed restoration planning and prioritization. Examination of connectivity and historic loss provide information which could be used to in the planning process at the regional or sub-watershed level.

- Although physical processes drive wetland systems, biota cannot be considered a passive component.

We live within a managed landscape, and thus are subject to an altered hydrologic system. Categorical changes to the existing equilibrium should be considered before proceeding with restoration efforts.

Many of these ecological principles are taken directly from Reed Noss' paper which he delivered at the first meeting of the policy working group.

Socioeconomic Principles

It would be impractical to develop or implement a wetland restoration process in most areas of Oregon without explicitly considering the influence of humans. Consequently, regional planning should reflect both human behavior and needs, as well as the ecological goals of the affected areas. Socioeconomic principles can begin to address the complex interaction between man, his laws and policies, and the environmental resources of Oregon. Questions which need to be addressed include: what are the

implications of present and projected land use patterns and trends on wetlands in urbanizing areas? in rural areas?; what land use management strategies and techniques might be successfully employed to integrate wetland restoration into local plans and ordinances?; how might economic considerations play into an overall wetland restoration policy process?; how should economic analysis be used in wetland restoration planning at the regional level?

The socioeconomic principles listed below include concepts and strategies for addressing very complex man/environment interactions. Some of the suggestions, including thorough economic analysis of restoration potential, may not be feasible for every regional entity. However, there are some economic considerations which are not rigorous, and should be performed by each participating group.

- Land tenure system together with different perspectives of property and individual ownership is a significant constraint to community-based decision making and the application of sound ecological principles.

  The question of private property ownership and subsequent involvement in watershed assessment and planning creates inherent conflicts between what is "right" for the community and what is "best" for the landowner individually (Pease, 1995). Perhaps these

issues are best dealt with in the preliminary stages of coalition formation and potential conflicts could be immeasurably reduced by active participation from a broad cross-section of stakeholders.

- Understanding local or regional values and knowledge is important in management decisions which affect the community.

  The value systems held by resource managers often conflict with those held by the local community as well as other stakeholders (McCool and Stankey, 1993). Developing programs which allow citizens to participate in regional planning provides managers at the very least with a reference point upon which to make their decisions, increasing the opportunity for public support.

- Scientific perceptions of ecological functions and values are likely rooted in social constructs.

  It is imperative to recognize that defining the need for wetland restoration on a solely technical, ecological, or physical basis, without the appropriate citizen involvement, may lead to narrow or misleading policy and perhaps ultimately inappropriate and ineffective solutions. Use local participants to serve as liaisons between the often complicated scientific

community and the often intimidated and threatened citizens.

- Recognition that restored wetland services satisfy human needs creates the potential for broad-based support at appropriate scales.

  Restoration of wetlands benefits humans directly in many ways, including increased water quality and quantity, flood control, recreation, education and research. Implicit in each regional plan should be the recognition of these crucial services for the benefit of those downstream as well as folks throughout the watershed.

- Wetland restoration planning should be conducted as a proactive measure.

  In order to prevent or minimize adverse impacts to potential restoration sites and to resolve or avoid land use conflicts, wetland restoration regional strategies should be designed proactively. Advanced planning for conservation and protection of existing connected hydrologic systems would allow for more passive and less costly restoration at a later point.

- Wetland functions and services are not easily recognized by the public and are often underestimated by resource managers.

  Values of wetland services or beneficial functions, while accepted as real and important in meeting human needs, are systematically underestimated because they are public goods and not traded in the marketplace. This systematic undervaluing of wetland resources leads to the ease with which they are being drained and filled. Only complex, rigorous economic valuation can establish a fraction of a wetlands true net economic worth.

- Values are often assigned to various tangible, on-site resource services potentially with disregard for aggregate wetland functions.

  Economists often focus only on the components of a wetland which have direct value omitting or disregarding significant ecologic and hydrologic functions. Changes in ecosystems occur over large spatial and temporal scales, and are very difficult to accurately assess. Once again, complex economic analysis needs to be performed in order to establish the true "value" of wetland systems.

- Natural system boundaries frequently make subsystem economic valuation decisions inappropriate or incomplete.

  Because of varying natural ecosystem boundaries, the economic valuation of a site-specific entity, such as a single wetland, may be inappropriate for restoration planning and management if there is a failure to consider the interrelatedness of the watershed (Wellman 1995).

- Properly applied, strategic benefit-cost analysis can play a role in the determination of wetland restoration priorities at the regional level.

  The objective of strategic benefit-cost analysis is to set priorities and make trade-offs across a range of alternative choices (Wellman 1995). The results can assist in answering such questions as: how much should we restore? what level of investment should we make in wetland restoration in one area of the watershed versus another? Beneficial choices are selected and put together to construct an overall policy or framework for the watershed.

- The variability in degradation among potential restoration sites provides ideal for opportunities different economic evaluation techniques.

Restoration efforts should be targeted towards those sites which have the most potential payoff from their restoration for the functions derived from the watershed or region as a whole. Deciding on what the best potential payoff is may be a very difficult task.

- Use of flexible building specifications, zoning options, and urban best management practices are potentially beneficial methods for creating opportunities to restore wetlands.

Recognition that development is going to occur may be a healthy realization for proponents of wetland restoration. The opportunities brought about during the building permit process create options and alternatives for both the permittee and the permitor. Performance standards (development rights transfer, density transfer, and density bonuses), conservation easements, and cost-sharing all represent such options. Creativity among various land planners and managers should be encouraged.

- Secondary lands provide a unique opportunity to restore wetlands.

The development of secondary lands could provide a means of applying incentives for restoration where they did not exist before. Despite the fact that they may

be low on the priority list, they may nevertheless be inexpensive and achievable means of restoration.

- There are unclear linkages between wetland services and human behavior, and ultimately societal values.

  There will be changes in human behavior resulting from the alterations of wetland restoration activity. What are the changes in human use and non-use as a result of modifications to the physical, chemical, and biological functions and services of wetlands? How will a municipality or watershed react following completion of a restoration project?

- There are fundamental differences between public and private lands, and they should be addressed accordingly.

  Restoration policy should recognize the distinction between public and private lands. The laws governing the use of the property vary dramatically with respect to ownership. Incentives for private landowners to restore degraded wetlands on their property should be encouraged at both the state and regional levels. Restoration on public lands should be publicized so that educational opportunities do not go unnoticed.

- Development pressures will continue to rise, both inside and outside Urban Growth Boundaries (UGBs), increasing the urgency for protection and restoration.

The impact of growth pressure affects both the urban and rural wetland systems. Growth pressure inherently uncovers resource conflicts, which need to be recognized and addressed. All of these pressures fortunately fall within the Oregon land use program, and as mentioned previously, provide opportunities for wetland restoration.

Legal and Institutional Principles

Legal constraints often determine where restoration can occur and how effective individual projects will be. Legal issues concern land ownership and regulatory processes. Wetlands have been restored in several non-regulatory contexts such as the creation of waterfowl impoundments using water control structures, the removal of dikes from coastal and estuarine marshes, reclamation of previously farmed agricultural lands, and the contouring of defunct mining operations (National Research Council, 1992).

The majority of wetland restoration, however, has occurred as a result of federal, state, or local regulatory actions (NRC 1992). In these contexts, public or private landowners seeking permits for various types of development involving wetlands, are required to either create, enhance,

or restore wetlands on-site following damages, or to restore wetlands at other sites to compensate for degradation at the development site. For a host of reasons, wetlands restored in regulatory contexts are much less likely to achieve restoration goals, and therefore the risk of failure is much greater.

Although a "no-net-loss" policy for U.S. wetlands was advocated in 1988 George Bush, its overall implementation has been suspect. The policy intended only to provide no further loss in aggregate wetland function and area. However, it also meant no net return of lost or degraded ecological functions and no increase in the nation's wetland area. If the goal of Oregon's wetland restoration policy is to increase the state's wetland resource base in function and area, then certain legal and institutional considerations should be addressed.

- Non-regulatory contexts for wetland restoration are essential for the success of any comprehensive policy.

  Non-regulatory measures, including cooperative restoration programs, acquisition of land through easements or tax incentives, coordinated public land management, and education, all offer opportunities for Oregon to increase its priority wetland base. NGO's should be provided with incentives to restore and enhance wetlands for a variety of reasons.

Additionally, public and private funding of non-regulatory restoration efforts should be made more available to individuals and organizations involved in the restoration process.

- A systems context is needed for wetland restoration to lend continuity, consistency, and legitimacy to statewide efforts.

A wetland systems approach to land use policy could accomplish an important step toward ecosystem planning for the Oregon land use program.

- Regulatory programs need to undergo significant modification.

Although voluntary restoration should be encouraged and thus reduce the need for regulation, compensatory mitigation will nevertheless continue to play a critical role in restoration efforts. Current programs are too cumbersome and the responsibilities are too diffuse to guarantee anyone-the regulated community, landowners, conservationists, or even the regulators themselves-consistency, predictability, timeliness, or effectiveness.

- Information and education regarding wetland restoration is inadequate and relatively difficult to access.

To be effective, wetland restoration plans require a sound information base and a good public understanding of their purpose and operation. Of critical importance is educating wetland owners and the general public about wetlands and how best to undertake protection and restoration (The Conservation Foundation, 1988). Information needs to be more widely available to those involved in restoration and management, and should include regional project descriptions and levels of success or failure.

- Education of the public and of managers and planners to the importance of wetland functional values, and thus the need for increased restoration efforts, is a worthy goal.

Along with encouraging or requiring adaptive management strategies at both the site and regional scale, continuing education should be taking place at all levels of government and at the citizen level as well.

- Efforts aimed at wetland restoration can be facilitated through improved coordination between local, state, and federal levels of government.

Duplication of the permitting process and long duration delays in obtaining water rights often dissuade those who might otherwise restore wetlands. Coordination

among the various levels of government could certainly ease some difficulty.

Although these considerations for wetland restoration are not exhaustive, they should nevertheless be addressed as some component of thorough planning efforts.

SETTING PRIORITIES FOR WETLAND RESTORATION IN OREGON

Overall Conceptual Framework

One of the principal goals of this project has been to develop a sound basis and workable procedures for setting wetland restoration priorities for Oregon. The proposed process has three interrelated tiers: a state level, a regional level, and an individual site or project level. At each level, the need for restoring wetland functions and associated societal services are the principal basis for setting priorities and drawing up restoration plans.

At the *state level*, restoration priorities for wetland functions would be based on an analysis of historic versus present conditions within ecological regions (hereafter ecoregions). Ecoregions, discussed in more detail later, are areas with similar physical, biological and human use attributes. The principal products of this state-level analysis would be wetland function restoration priorities and a set of reference wetlands that might serve as benchmarks for guiding individual restoration projects within that ecoregion.

At the *regional level* (watersheds or subwatersheds), state-level wetland restoration priorities for each ecoregion would serve as an important input and consideration in planning. At this level, additional, more detailed landscape analysis would be conducted to better

understand historical and present-day wetland networks and conditions and to establish a plan for reconnecting and/or restoring wetland ecosystems. Restoring ecological integrity and biodiversity, as defined earlier, would be important goals. Economic cost-benefit analysis might be used to determine an overall level of desired restoration.

At the *site level*, individual sites within the proposed network of sites would be selected for restoration based on their contribution to functional improvement consistent with state and regional priorities, their economic cost effectiveness with respect to other sites, their ownership and availability for restoration and subsequent protection, and other factors. For these individual projects, a structured site planning process would be used to assure that desired functions and habitats were restored (e.g., Zedler 1984; Williamson 1995). This might include additional historical analysis, the setting of goals and relating these goals to design and engineering decisions, specification of construction procedures, and development of monitoring and evaluation plans. This multi-level framework-state, regional, and site-and the rationale for it is described below.

State-level Planning and Priorities for Wetland Restoration

With very few exceptions, the practice of wetland restoration in Oregon is carried out on a case-by-case

basis. Although this research project is focusing on wetland ecosystem restoration, an implicit assumption here is that wetlands for the most part cannot be considered in isolation from the aquatic networks and watersheds within which they exist. That is to say, wetlands cannot be conceptually removed from the greater hydrologic network-the streams, lakes, and estuaries-to which they belong. This fact is widely acknowledged and affirmed by scientists, resource managers, policymakers, and the public alike, and indeed provides the basis for recent financial investments in "watershed approaches" to resource management and restoration in Oregon and the United States. However, it is important to note that most of these watershed-based strategies and programs do not integrate wetland considerations very well, if at all. Rectifying that shortcoming, at least for Oregon, is one of the goals of this project.

In Oregon, several studies have already been performed at the watershed scale to assess, or create a methodology to assess the condition of a basin's hydrologic health. Of the primary two, neither the Stage I Watershed Assessment nor the Bradbury Method address wetlands except as a small factor in deciding on what watersheds to give priority to. The Stage I Assessment basically says which watersheds are the "best" ecologically and thus is a better guide to what areas need protection more than restoration--the focus is on

the "best of what's left" but doesn't really say what functions should be restored, and in fact doesn't deal with historical conditions at all, except to say that if an area has been severely degraded, its probably NOT where we want to invest restoration dollars. The Bradbury method has an admittedly single-resource (wild salmonids) oriented approach to restoration. Any restoration of peripheral landscapes would be provided only as a mechanism to increase the opportunity for returning the salmon fisheries to historic levels.

Legislative and political reaction to this has been positive in a lipservice sense, but when it comes to allocating scarce restoration dollars, it is more popular to spread them around, rather than focus on a few priority watersheds and legislative districts. This is not cynical, just a realization that politics is the allocation of scare resources which people value and a sense of fairness prevails.

An alternative to the current watershed scale strategies involves analysis of wetlands at an ecoregion scale in order to determine restoration priorities. This ecoregion framework would occur at the state level for Oregon and would involve analysis, determination, and prioritizing of wetland functions for restoration at a statewide scale, based on the assumption that watersheds

within a given ecoregion will have similar wetland types and abundances, and thus, function.

Reasons For Using An Ecoregional Approach

Some of the most difficult problems facing natural resource managers center on the lack of relevant material linking ecosystem conditions and geographic variability (Omernik 1987). Ecological regions, or ecoregions, present a conceptual basis to examine spatial similarities and differences among various geographic areas (Omernik and Gallant 1986; Omernik 1987; Clarke et al. 1991). While the utilization of ecoregions as an analytical tool for resource managers is not new, the capacity of its regional predictive capabilities is yet to be fully explored.

Ecoregions are identified and delineated through the analysis of the patterns and composition of biotic and abiotic phenomena the reflect or affect differences in ecosystem quality and integrity (Omernik 1987). The process used in the analysis is based on physical and cultural factors such as soil, vegetation, land use/land cover, topography, and climate. Ecoregions have been defined at several hierarchical levels for the conterminous United States based on broad characteristics, and are identified by sequential Roman numerals. Oregon is comprised of 9 Level III ecoregions and has been further subdivided into more

detailed Level IV ecological subregions which will form the basis of this project's analysis.

Some of the recognized benefits of ecoregional analysis have allowed resource managers to: compare the similarities and differences of land/water relationships; establish water quality standards that are in tune with regional patterns of anthropogenic modifications; locate reference sites for research and monitoring; predict the effects of changes in land use and pollution; and extrapolate information from site-specific studies (Omernik and Gallant 1986). Applications vary from one state and region to another. Resource management objectives in the semi-arid region of eastern Oregon are understandably different from those in the Willamette Valley or even the Coast Range. Perhaps the management of resources should even vary within the same watershed.

Watersheds, however, represent the scale most frequently used for water resource management (Omernik and Griffith 1991). In other words they represent the most common spatial units for studying impacts of land management activities on water quality and on framing plans for restoration and enhancement. According to research performed by Omernik (1991) however, portions within drainage areas occupying different natural regions are likely to contribute differently to the streams in question.

An example of local scale ecoregional influence is

provided by the Calapooia River drainage in Oregon. The Calapooia watershed covers some 372 square miles and can be subdivided into three distinct Level IV ecological subregions: the western Cascades, the western Cascade foothills, and the Willamette Valley (Omernik and Griffith 1991; Clarke et al. 1991). They hypothesized that similar biological communities would be found in areas of similar habitat, and that variation, would correspond to observable patterns of change in the physical component of the watershed. Results indicated that while there is continuous community variation along the river, distinct assemblages can be delineated, and these changes tend to correspond to broad-scale geographic features within the watershed (Omernik 1991). Assessing just a reach or the channel or even the watershed may not be sufficient if the context of broader ecoregional influences are not considered as well.

Taking that concept a step further, if aquatic networks, including their wetland component, are inextricably linked, both physically and biogeochemically, then is it not correct to consider the same to be true of wetlands? That is, wetlands which exist at various landscape positions within a watershed differ geographically, and thus contribute differently in both form and function to that aquatic network. Because ecoregions consist of portions of several watersheds, and conversely, because watersheds generally fall into more than one

ecoregion, a given watershed will receive several sets of recommended functional priorities applicable to subdivisions of that watershed. Successful restoration will be achieved only if individual actions (e.g., site, project) and individual perspectives (e.g., goals, objectives, plans) recognize the system within which the action is taking place.

Wetland Functional Evaluation

The overall purpose of wetland functional assessment is to gain information about the ecological significance of wetland systems. The first tier in the proposed restoration planning process, statewide, is representative of a large geographic area with numerous wetland types and sizes. The proposed method for assessing wetland functions must address the need for analysis of large land areas without site visits to each individual wetland. This fact rules out the many site-specific functional assessment methodologies available (Adamus and Stockwell 1983; Adamus 1991; Brinson 1993). What Oregon needs is a technique for producing information about the relative functional importance of wetlands which would aid in their effective conservation and management. The methodology needs to be ecologically sound and based on the best information available about the functions of wetlands. Additionally, it should be based on

fundamental wetland principles and landscape ecology rather than on arbitrary or solely administrative decisions.

Introduced in a previous section, by far the most advanced wetland functional assessment methodology is the GIS-based CREWS procedure used in North Carolina. The ability to utilize digital information and obtain significant results from multiple queries is a critical advantage North Carolina has over Oregon. The challenge facing planners and managers here is how to utilize existing data to produce a wetland functional assessment procedure without advanced spatial analysis capabilities. If the CREWS procedure could be modified, according to officials in North Carolina, it could be of use in other regions. Adaption for other areas must include a clumping of wetland types based on best professional judgement (NCDEHNR, 1995). The selected method of wetland classification should make certain that the functional characteristics of the wetland types are constant and can be determined by field studies, literature reviews, or professional judgement.

State-Level Wetland Restoration Needs Analysis: Application of the Synoptic Approach

The general assessment model selected for use for the state-level assessment of wetland restoration needs for Oregon is the synoptic approach of Leibowitz et al. (1992). The synoptic approach to resource assessment was developed

by the U.S. Environmental Protection Agency to evaluate the contribution of wetlands to water quality maintenance and improvement. Its origins in EPA's Wetlands Research Program (WRP), and its highly structured, yet flexible approach makes it particularly suitable framework for the state-level assessment task in the present project.

The basic steps in the synoptic approach are outlined in Table 3. The first two steps focus on objectives and needs for an "ideal" assessment and are separated from the last three steps, which call for design of the assessment based on what data is actually available or relatively easy-to-develop. How each of these steps is used or proposed for use in the state-level ecoregion analysis for wetland restoration needs is detailed below. This outline should be viewed as a work-in-progress, with some parts better developed than others.

Step 1: Define Goals and Criteria

This step calls for defining specific assessment objectives, the intended use of the assessment, required accuracy level, and the constraints under which the study will be conducted.

1.1 - Assessment Objectives

The objectives of this application of the synoptic approach are (1) to assess the cumulative loss of wetland functions

Table 3: Steps In Conducting A Synoptic Assessment

Steps	Procedures
1. Define Goals and Criteria	1.1 Define Assessment Objectives
	1.2 Define Intended Use
	1.3 Assess Accuracy Needs
	1.4 Identify Assessment Constraints
2. Define Synoptic Indices	2.1 Identify Wetland Types
	2.2 Describe Natural Setting
	2.3 Define Landscape Boundary
	2.4 Define Wetlands Functions
	2.5 Define Wetlands Values
	2.6 Identify Significant Impacts
	2.7 Select Landscape Subunits
	2.8 Define Combination Rules
3. Select Landscape Indicators	3.1 Survey Data and Existing Methods
	3.2 Assess Data Adequacy
	3.3 Evaluate Costs of Better Data
	3.4 Compare and Select Indicators
	3.5 Describe Indicator Assumptions
	3.6 Finalize Subunit Selection
	3.7 Conduct Pre-Analysis Review
4. Conduct Assessment	4.1 Plan Quality Assurance/Quality Control
	4.2 Perform Map Measurements
	4.3 Analyze Data
	4.4 Produce Maps
	4.5 Assess Accuracy
	4.6 Conduct Post-Analysis Review
5. Prepare Synoptic Reports	5.1 Prepare User's Guide
	5.2 Prepare Assessment Documentation

(present day versus historic) in Oregon and, (2) to use this information to establish general functional priorities for wetland restoration and enhancement at the statewide level.

1.2 - Intended Use

The intended uses of the assessment are (1) to provide resource managers and policymakers with a statewide perspective of wetland function loss within ecoregions of Oregon; (2) to help guide city, county, and watershed council aquatic restoration planning efforts at the watershed or subwatershed level; and (3) to provide a partial basis for local, state, federal, and private investments in aquatic ecosystem restoration.

1.3 - Accuracy Needs

The intended use of this assessment is primarily as a planning tool and not meant to provide a significantly high level of scientific accuracy. Results need not be completely accurate; rather the data must be adequate for the stated purposes of the assessment. The methodology need only be ecologically sound and based on the best information available about the functions of wetlands.

1.4 - Assessment Constraints

Currently there are no resources explicitly available to conduct the proposed state-level assessment. There has to

be some minimal investment in funding for the assessment to proceed beyond this preliminary planning phase. Resources in the form of time, money, and personnel hours need to be allotted so that the pilot project can proceed. Other constraints include 1) difficulty in applying the existing SRI data to current functional needs; 2) the fact that ecoregions are not delineated on the NWI quad sheets used for digitization; and 3) the intricate task of assigning functional values to specific wetland types.

Step 2: Define Synoptic Indices

Once the objectives have been determined, specific synoptic indices must be defined to address the objectives and intended use of the assessment. If funding or other agency resources are scarce, then best professional judgements can be made to provide understanding of the interactions between wetlands and the defined landscape.

In order to arrive at functional priorities for wetland restoration and enhancement at the statewide scale some level of analysis needs to be performed not only for present wetland systems, but for the historic level of resources as well. If we subtract the present day level of wetland functional capacity from its historic counterpart, then we have that level of functions which has been lost. The goal of wetland restoration is to reestablish what has been lost and this analysis of historic wetland functional capacity

will assist in achieving that goal. Throughout the exploration of defining assessment indices, each section will address the needs for analysis of current wetland resources and functional capacity in addition to attempts at establishing a framework for analyzing historic levels of wetland resources.

2.1 - Wetland Types

Compiling a list of major wetland types is the first step in developing synoptic indices. Since the scope of state-level functional assessment is so large, the only practical wetland classification system to use is Cowardin. It exists as the basis for statewide NWI wetlands mapping and comprises the data currently available through the unpublished SRI materials. The classification should include or be cross-referenced with information on geomorphic setting and source of water. This could be done by examining the individual wetland's position in the topographic landscape and through the use of manual overlays of existing GIS stream network coverages.

For historic analysis, we will assume that general Cowardin wetland types represent the various stages of wetland succession. If that is the case, then wetland types occurring today would also have existed 200 years ago. While relative abundance per region may have been altered slightly through particular region-specific land uses, we

assume that they have not changed dramatically and will be treated the same.

2.2 - Natural Setting

Describing the natural setting of the assessed area aids in the understanding of the landscape driving factors responsible for the formation and maintenance of the associated wetland systems. A knowledge of broad-scale geologic processes, physiographic characteristics, hydrologic influences, climatic variability, and natural disturbance regime can add to the descriptive clarity. Since the proposed landscape boundaries (see 2.3) are Level IV ecological sub-regions, a description of determining landscape features is provided in Figure 4.

Since landforms and associated processes make their changes on geologic time frames, for the purposes of historic analysis, we will use current natural settings. There is no indication that, with the exception of the Mt. Saint Helens volcanic eruption, there have been any catastrophic changes to the landscape in the Pacific Northwest.

2.3 - Landscape Boundary

An alternative to the current watershed scale strategies involves analysis of wetlands at an ecoregion scale in order to determine restoration priorities. Ecological regions, or

Coast Range

1. Mountains

Land use/cover:	Mostly Forest
Vegetation:	Western hemlock zone and Sitka spruce zone
Soil:	Mostly udic mesic with some udic frigid and cryic
Topography:	Rugged hills to mountains

2.. Coastal Lowlands

Land use/cover:	Mixture of agriculture, forest and urban
Vegetation:	Sitka-spruce zone
Soil:	Predominantly udic isomesic
Topography:	Relatively flat, coastal plain

Willamette Valley

3. Plains

Land use/cover:	Mostly agriculture with som forest and urban
Vegetation:	Forest-prairie zones
Soil:	Xeric mesic
Topography:	Relatively flat valley

4. Foothills

Land use/cover:	Mostly forest with some agriculture
Vegetation:	Western hemlock zone and some forest prairie zones
Soil:	Xeric mesic
Topography:	Hills

5. Umpqua Valleys

Land use /cover:	Mosaic of agriculture and forest
Vegetation:	Forest-shrub zones
Soil:	Xeric mesic
Topography:	Hills and valleys interspersed

Klamath Mountains

6. Mountains

Land use/cover:	Forest
Vegetation:	Mixed needleleaf-broadleaf forest zones
Soil:	Mostly xeric mesic with some frigid
Topography:	High Mountains

7. Rogue Valleys

Land use/cover:	Mostly agriculture with some urban
Vegetation:	Forest-shrub zone
Soil:	Predominantly xeric mesic
Topography:	Relatively flat valleys

Cascades

8. Western Cascades

Land use/cover:	Mostly forest
Vegetation:	Western hemlock zone
Topography:	Highly dissected, steep east-west ridges

9. High Cascades

Land use/cover:	Mostly forest
Vegetation:	Pacific silver fir zone
Soil:	Mostly udic cryic with some frigid
Topography:	High elevation, gentler slopes punctuated with steep volcanic peaks

Eastern Cascades Slopes and Foothills

10. Slopes and Foothills

Land use/cover:	Mostly forest
Vegetation:	Ponderosa pine zone
Soil:	Mostly xeric cryic, some frigid
Topography:	Varied; tablelands with moderate to high relief, plains with low mountains, open low mountains, high mountains

11. Lake Basins

Land use/cover:	Agriculture, some shrub and brush range, and some forest
Vegetation:	Desert-shrub zones
Soil:	Xeric mesic
Topography:	Relatively flat basins

12. Marshes

Land Use/cover:	Mixture of agriculture and range (herbaceous; shrub and brush)
Vegetation:	Big sagebrush zone and ponderosa pine zone
Soil:	Aquic frigid and cryic
Topography:	Flat basins

High Desert

13. Mountain Ranges
    - Land use/cover: Mostly range with some forest
    - Vegetation: Western juniper zone
    - Soil: Mostly xeric cryic: some acidic/xeric frigid
    - Topography: Relatively steep, medium to high mountains
14. Uplands
    - Land use/cover: Range
    - Vegetation: Mostly big sagebrush zone, patches of desert shrub zones
    - Soil: Mostly aridic/xeric frigid; some aridic/xeric mesic
    - Topography: Plateaus with moderate relief
15. Dry Barren Basins
    - Land use/cover: Barren land, some irrigated agriculture and range
    - Vegetation: Desert-shrub zones and some big sagebrush zone
    - Soil: Mostly aridic/xeric mesic and frigid; some aquic frigid and cryic
    - Topography: Relatively flat basin
16. Basins with Fresh Water
    - Land use/cover: Irrigated agriculture
    - Vegetation: Western juniper zone, big sagebrush zone, and desert-shrub zones
    - Soil: Aridic/xeric mesic; aquic frigid and cryic
    - Topography: Relatively flat basins

Columbia Plateau

17. Basins
    - Land use/ cover: Irrigated agriculture
    - Vegetation: Steppe zones and big sagebrush zone
    - Soil: Aridic/xeric mesic
    - Topography: Slight to moderate irregular plains
18. Tablelands
    - Land use/ cover: Dry agriculture
    - Vegetation: Mostly steppe zones, patch of big sagebrush zone
    - Soil: Xeric/aridic mesic
    - Topography: Tablelands with moderate to high relief
19. Dissected Uplands
    - Land use/cover: Herbaceous; shrub and brush range
    - Vegetation: Steppe zones
    - Soil: Xeric/aridic mesic
    - Topography: Uplands and steeply incised valleys

Blue Mountains

20. Alpine and Subalpine zones
    - Land use/cover: Mostly forest, some tundra
    - Vegetation: Mostly Pacific silver fir zones
    - Soil: Udic cryic
    - Topography: Mountains
21. Nonalpine Forested Mountains
    - Land use/cover: Mostly forest
    - Vegetation: Partly ponderosa pine zone, partly grand fir zone
    - Soil: Mixture of udic cryic and xeric frigid
    - Topography: Rugged hills and mountains
22. Uplands and Valleys
    - Land use/cover: Herbaceous; shrub and brush range
    - Vegetation: Mostly big sagebrush zone and western juniper zone with some steppe zones
    - Soil: Xeric/aridic mesic and frigid
    - Topography: Moderately to very steep uplands and valleys
23. Basins
    - Land use/cover: Agriculture
    - Vegetation: Mixture of big sagebrush zone and steppe zone
    - Soil: Xeric/aridic mesic and xeric frigid
    - Topography: Relatively flat basins

ecoregions, present a conceptual basis to examine spatial similarities and differences among various geographic areas. While the utilization of ecoregions as an analytical tool for resource managers is not new, the capacity of its regional predictive capabilities is relatively untested. The process used in the delineation analysis is based on physical and cultural factors such as soil, vegetation, land use/land cover, topography, and climate.

Ecoregions have been defined at several hierarchical levels for the conterminous United States based on broad characteristics, and are identified by sequential Roman numerals. Oregon is comprised of 9 Level III ecoregions and has been further subdivided into more detailed Level IV ecological subregions which will form the basis of this project's analysis. Of the several data layers that determine ecoregional delineation, only land use and land cover represent societal influence. The ecoregional boundaries will thus serve their role in a historical capacity in addition to their present day one.

2.4 - Wetland Functions

Defining the particular wetland functions to be addressed during the assessment can be a difficult process. While there is some site-specific analysis that can predict the occurrence of wetland functions, there are no studies that directly relate specific wetland functions to individual

Cowardin wetland systems or classes. Three different sets of wetland functions (USFWS, 1992; NCDEHNR, 1994; NRC 1995) have been reviewed in this study, and any one of them might be utilized in the proposed assessment. Perhaps the wetland functions listed in Table 1 provide the best general evaluation, because listed alongside are the related effects of the functions, the corresponding societal values (see 2.5), and relative indicators of wetland function.

One of the reasons for utilizing functions as a basis for wetland restoration priority setting is that they operate independent of human values. The functions that wetlands perform today, they most certainly performed in historic times, probably just at greater levels. For that reason, current wetland functions, like those appearing in Table 1, will serve as the basis for historic functional assessment as well.

2.5 - Wetland Values

Determining whether wetland values will be included in the assessment is a policy decision, as they are but societal interpretations of what wetland functions provide. Including wetland values in the statewide assessment methodology would only serve to potentially confuse the individuals who will be asked to perform the best professional judgement analysis. Addressing the fact that

wetland values exist only as components of functioning ecosystems will be enough.

Since values are being removed from analysis of current wetland functional capacities, they will be left out of the historic analysis as well. It would be more of a sociological or anthropological exercise to analyze what societal values people living 200 years ago attributed to wetland functions. We do know that they were though of for the most part as being a means to society, and federal legislation subsidized their destruction until the 1970s.

2.6 - Identifying Significant Impacts

The major impacts to wetland restoration can be divided into four separate categories: those associated with 1) water management; 2) agricultural/silviculture practices; 3) urbanization; and, 4) resource extraction (Leibowitz, 1992). Examination and analysis of the primary land uses in each ecoregion will yield information on the relative causes of wetland degradation there. Since land use/cover analysis is a component of ecoregional delineation, the boundaries associated with Level IV sub-ecoregions should provide a good starting point for identifying significant impacts. Additionally, the impact selection process provides an opportunity to show how best professional judgements can be utilized in the assessment process.

200 years ago in the Pacific Northwest, there was certainly not uniform conversion of wetland resources to other uses. Indigenous people were primarily nomadic and sustained agricultural practices were not part of their traditional culture (Williams 1995). The significant impacts to wetland degradation are the avenues by which we will arrive at our desire result: the wetland restoration priorities that are based on lost functions. Another way to imagine significant impacts in the historic analysis equation might be to think of them as the minus sign. That is, they represent the mechanisms by which society has degraded their aquatic resource base.

2.7 - Landscape Subunits

While ecoregions will form the boundaries for individual assessment areas, landscape subunits must also be defined in order to make relative comparisons within the primary unit. A logical subunit delineation might be provided by the Strategic Watershed Management Group (SWMG) major watershed boundaries. For example, within the Willamette River watershed are three SWMG watershed boundaries which could provide points of comparison. Another option is the already digitized USGS HUC boundaries. If the comparisons which have to be made are on a fine scale, then perhaps HUCs would be a better choice because they are so numerous.

Whatever landscape subunit is established for use in the analysis of present day wetland functions will be utilized for the historical component as well. The relative comparisons that are made will be irrelevant where timescales are concerned.

2.7 - Methodology and Combination Rules

A general matrix has been established which is designed to examine specific wetland functions against general Cowardin wetland types. The results will provide some level of understanding of what relative capacity a specific wetland type has to perform a given function. The material on wetland functions has been borrowed from the NRC function list in Table 1. A specific matrix will be developed for each individual Level IV sub-ecoregion and contain data on wetland type and area. Each matrix will is composed of the wetland functions and subfunctions on one axis, and the specific wetland types that occur within the ecoregion on the other axis.

A panel of experts will be convened and asked to determine relative values for wetland functional capacity in each area according to the matrix procedure. Let's say for example that ecoregion A has the following types of Cowardin classes of wetlands: palustrine emergent (PEM), palustrine scrub/shrub (PSS), palustrine forested (PFO), and lacustrine forested. They are labeled across the x-axis. The slate of

functions and subfunctions is listed down the y-axis. The panel would then be asked to address each wetland type that occurred in the specified ecoregion and through the method of best professional judgement, make certain characterizations about its capacity to perform the listed functions. Taking the example a bit further, if the function in question is long-term surface water storage and the wetland type in question is palustrine emergent, several could be made during analysis. The concepts of opportunity and capacity for a wetland to perform the function are critical components of some assessment methodologies. The wetland type must have the opportunity and the capacity for the function. The opportunity component of the analysis is usually determined by factors external to the wetland and thus must be excluded from this broad scale approach. The panel of experts would be asked then, to assess a wetland's capacity to perform a specific function. The capacity is generally determined by properties of the wetland itself along with it's landscape position (NCDEHNR, 1995).

The objective of this process is to determine the ability of wetland types to perform certain functions. The next step would be to apply some level of relative functional capacity to the process. The grading for a wetland's ability to perform a certain function could be a yes or no process. On the other hand, if we applied a scoring procedure that involved a High, Medium, or Low

grading scale, then we could begin to arrive at the relative capacity for wetlands to perform functions.

The approach of classifying wetlands into broad functional significance categories (such as H, M, or L) is used because it is feasible to consider relative to our current understanding of wetland function. Attempting to assign specific values, either numeric or descriptive, greatly exaggerates the precision with which current knowledge can be realistically applied. The three categories suggested here will provide the information necessary to meet procedural objectives without going beyond the realm of reasonable scientific validity.

The basic evaluation, then, is performed at the sub-function level. An H, M, L, or N/A value is assigned to each wetland type as it relates to the wetland sub-function being considered. If the wetland type under evaluation is considered to have a high capacity to perform a given sub-function, then it is assigned a relative value of H. Similarly, if a wetland type is believed to have a moderate capacity to perform the function being considered, it is assigned a value of M. If a wetland has marginal functional capacity it is either designated L (for low) or N/A if the wetland function being assessed does not apply to that wetland type. That lettered evaluation is then assigned to its designated cell in the matrix, and so on until every cell has a relative value. We have arbitrarily assigned

numeric values to each relative value (H=3, M=2, L=1, and N/A=0).

Following the initial relative value input to the matrix, the next stage of analysis can begin. The wetland area per ecoregion can be calculated for each wetland type using the data compiled from the unpublished dot matrix analysis. For each matrix, and thus ecoregion, the total acreage for each wetland type would then be multiplied by the numeric value assigned to that cell from the previous step. Each cell would then have a numeric value in units of functional value (H=3, L=2, etc.) and acres (fv•ac). The next step would be to sum the fv•ac units for each sub-function, thus establishing a total relative functional value figure for the entire ecoregion. Although there are mathematical formulas which are built into the matrix analysis methodology, but no rigorous weighting procedures or normalization is needed.

A similar process would have to occur in order to assess the historic levels of wetland acreage, type, and function. Information on hydric soils would be used as a surrogate indicator for historic wetland positions. Data on existing wetland acreage would be subtracted from the area of hydric soils and the result would provide information on wetland area that was lost, relative position in the landscape, and position in the ecoregion. The same advisory panel established to provide best professional judgement on

current wetland functional capacity would be asked to address the results of the historic analysis on type, area, and landscape position. They will be asked to assign a wetland type to the historic results in order to provide the same matrix analysis discussed. Some of this best professional judgement analysis will be hand waving, while most of it will provide considerable insight into the current state of our knowledge.

Step 3: Select Landscape Indicators

Landscape indicators are the actual measures used to estimate the synoptic indices outlined above. Selecting indicators for use in the assessment requires balance between accuracy and cost. Selection of landscape indicators should not begin until goals are defined (see Step 1) and the relative environmental variables are determined (see Step 2). Since selecting landscape indicators requires an analysis of current data availability and the costs associated with increasing the level of information, it becomes apparent that if one considered the lack of useable data throughout the process, even practical considerations might not be considered. Goal setting, defining synoptic indices, and selecting landscape indicators is an iterative process, and results in reassessment of proposed procedures at several levels.

3.1 - Survey Data and Existing Methods

Oregon does not have digital data on wetland area, type, and location for a state-level analytical procedure. While some data exists in a digitized format (hydric soils, stream networks, wetlands of greater than 100 acres, watersheds, ecoregions, and water quality designations) it cannot help to any great degree in terms of statewide wetland management because there is no digital wetland database to overlay these coverages on. The SRI unpublished data will provide a significant amount of information to the procedural analysis, but until DSL allows the material to be used in a public forum, it will not be used to its fullest potential. NWI maps will provide information on a large scale as it is the only information existing at the state level for wetland area, type, and landscape position.

3.2 - Data Adequacy

Oregon needs to produce a digital version of NWI maps for the entire state. It will be an expensive undertaking, but the results can be used as a more effective means of managing the state's wetland resource base. The applications of such a GIS coverage are numerous. Some of the questions designed to assist in the assessment of data adequacy are outlined in Leibowitz (1992). Do comparable data exist for the entire study area? Do standardized data exist for the appropriate time frames? Are data at the

appropriate spatial scales? Much of this data exists at the watershed and sub-watershed scale, but for the state there will have to be a significant reliance on best professional judgement when compiling data and assessing its adequacy.

3.3 - Costs of Better Data

It is beyond the scope of this project to determine what the time and cost of obtaining better data would be. Certainly to obtain the level of data capability of the CREWS method in North Carolina it would take years and cost millions of dollars. Still, the costs of advancing the database of natural resources may be justifiable when considering the time and costs of potential litigation and manual overlaying processes. Advanced GIS analysis is currently being performed on land use planning, watershed assessment, and some levels of natural resource management. Having a digital wetland database would facilitate large spatial scale analysis such as that proposed here for wetland restoration, as well as other wetland resource needs and priorities.

3.4 - Compare and Select Indicators

Comparison of indicators has already been performed. Historic material will be obtained using the hydric soils digital data layer and subtracting out the wetlands of greater than 100 acres to obtain the previous wetland area

and landscape position. Current wetland resources will be obtained utilizing the SRI digital data for Oregon. Ecoregional data will be utilized for establishing both historic and present day landscape boundaries. Best professional judgement will be used to assign relative wetland functional capacity to ecoregion-specific wetland types and acreage and to provide information on historic wetland type that would have existed in the historic wetland area defined in the steps above.

3.5 - Indicator Assumptions

To devise a methodology for establishing wetland priorities on such a large-scale based on analysis of historic and present day wetland functions several assumptions have to be made. The use of hydric soil area as an indicator of historical wetland area assumes that (a) wetland soil retains it hydric characteristics following drainage or conversion, and (b) hydric soils are properly mapped at appropriate scales. The use of SRI data assumes that it has been properly digitized from NWI maps and accurately reflects Oregon's wetland resource base. Many assumptions will have to be made during the best professional judgement phases of the assessment process. Since no panel has yet been formed, and procedures not yet outlined for their analytical review, it would be impossible to comment on what assumptions might be made. Since the process is iterative,

assumptions made can be tested, within certain limits, and then changed accordingly.

3.6 - Subunit Selection

Final subunit selection will be made at some later point. Assessment of the use of HUCs versus watershed boundaries or some other possible choice have not been made. A thorough review of available data should be performed on the scale to be used for comparison and then finalize the subunit selection.

3.7 - Pre-Analysis Review

At this point in the assessment process, technical experts need to review the overall management objectives, the synoptic indices that were defined, and the selected landscape indicators. Considerations for the appropriateness of the indicators with respect to the objectives and constraints, and also review indicator assumptions for possible error. If any major violations are found, then returning to the appropriate section to redefine its content is the first step.

Step 4: Conduct Assessment

It is at this point that the current proposed procedure deviated from the synoptic steps outlined by Leibowitz (1992). Since this analysis has not been performed, and

since the technical panel has not met, then conducting the assessment would be placing the cart before the horse. The remainder of this section will be a combination of synthesizing the information and procedures outlined by the synoptic approach, and detailing proposed plans for the Oregon statewide assessment.

Once the landscape indicators have been defined and assumptions explicitly stated, maps and data can be obtained from the appropriate sources. The actual process of producing the synoptic maps will provide the necessary information to proceed to subsequent steps.

4.1 - Quality Assurance/Quality Control

The data gathered during the synoptic approach will be gathered from different sources, including the Water Resources Department, NRCS, ASCS, and the Oregon State GIS office, which serves as a clearinghouse for existing digital data sets. The database proposed for this project will be very small, and so the level of detail for quality assurance and quality control will be minimal. Proper documentation of data origin, description of protocol, and archiving formats should all be outlined so if changes were made in personnel associated with the assessment, explanations would exist to facilitate procedure and process.

4.2 - Map Measurements

Maps have been the basis for information gathered at the statewide level for assessment. Various examples include: wetland area and number of wetland types from NWI maps, hydric soils data digitized from county soil maps, and elevations and channel characterizations from USGS topographic maps. Measurements on area and length will need to be made, and levels of error and bias should be controlled as much as possible. The digital data provided by SRI already has this areal and length analysis performed, while that which need to be done in order to provide historic results will undergo some scrutiny.

4.3 - Analyze Data

Analysis of data for proposed assessment will involve compiling the ecoregional information and appropriate matrix functional assignments, best professional judgement designations for ecoregional approach, actual calculations of relative functional values for each ecoregion, and then establishment of a database including all the information. For the historic analysis, the manual overlay process and subsequent technical considerations for wetland type and landscape position will be the majority of the process. Matrix analysis will be relatively simple once the functions have been assigned relative values for each type.

4.4 - Produce Maps

Maps that will be produced as a result of this project will include the overlays of hydric soils and wetlands of greater than 100 acres, the ecoregion/wetland quad sheet overlay to define quad sheets per ecoregion, and the overlay with stream networks to provide some input on adjacency and connectivity.

4.5 - Accuracy

Since the scale of proposed activity is so broad, there will be some room for error. Much of the overlay process will be manual and thus subject to accuracy problems. However, the accuracy needs defined and updated in previous sections allow room for error as long as the "big picture" comes through. This step does provide an opportunity to go back and derive correction factors if mistakes are discovered following manual map production. Many times the quality and accuracy of the data source limit the accuracy of the results.

4.6 - Post-Analysis Review

The results of the assessment should undergo some level of technical review to allow for comments and suggestions to be made. This information can aid in deriving conclusions and suggesting alternative ways the results can be used. Because no method exists for quantitatively assessing the

accuracy of results, this step, and the pre-analysis review (see 3.7) are essential to ensure that results are adequate for intended use.

Step 5: Prepare Synoptic Reports

There are two sections involved in this step: 5.1) prepare user's guide, and 5.2) prepare assessment documentation. This last step provides an opportunity to report how the information was derived and how it can be used. Since no post-analysis review (see 4.6) has been conducted, the details of preparing the reports will not be included here.

Regional Level Planning Framework

Typically, decisions affecting wetlands are made on a project-by-project, permit-by-permit basis. This process often hinders effective consideration of the cumulative effects of piecemeal wetlands loss and degradation. It also hampers the ability of state, regional, and local governments to integrate wetlands restoration objectives into the planning, management, and regulatory tools they use to make decisions regarding conservation and other natural resource issues. This can often result in inconsistent and inefficient efforts among agencies at all levels of government, and frustration and confusion among the public.

Basis For A Regional Approach

Advance planning, particularly comprehensive planning conducted on a watershed basis, offers the opportunity to have strong participation by affected governments and private citizens in designing and implementing specific solutions to the aquatic restoration needs of that watershed. Advance planning in a restoration context would generally involve at least the identification, mapping, and preliminary assessment of relative wetland functions within the planning area. More comprehensive advance planning may identify wetlands that merit a high level of protection and others that may be considered for development, and may also

incorporate wetlands conservation, pursuant to Goal 5, into overall land use planning at the local level.

Restoration of degraded wetlands is recognized as an important mechanism for maintaining or increasing the wetland resource base of the state (SB 3). Despite this lofty goal, there are many administrative, political, ecological, and economic constraints to address prior to designing a regional wetland restoration planning framework. Emphasized in previous sections, policies and programs for wetland ecosystem restoration should emphasize a landscape perspective. Wherever possible , decisions about the management and restoration of wetland resources throughout Oregon should not be made on a small scale, site-by-site basis. Instead they should be made to promote the long term sustainability of all wetlands, and indeed all aquatic resources in the landscape. Success in recreating a viable wetland ecosystem is more likely when restoration is planned within the target ecosystem's larger context.

A single administrative body (e.g., watershed council, council of governments, wetland conservation planning council) should assume responsibility for setting regional priorities for restoration. This body would be advised and counseled by recognized wetland experts from relevant local, state, and federal jurisdictions. They would be responsible for examining sound restoration principles, integrating them with state-level ecoregion priorities and recommendations

for the watershed, ultimately providing achievable regional priorities.

Historical Conditions As A Baseline

Baseline assessments and inventories of likely historic conditions are integral components of any regional wetland restoration plan. They can serve to assess the feasibility of preliminary objectives, identify key lost or degraded wetland functions and conditions, refine the approach to restoration, and provide input to the next stage, which is individual project design. The information gathered during this phase of a wetland restoration planning process provides a bridge between the preliminary watershed planning phase and the actual project planning and construction.

Given that each region requires restoration or enhancement, the existing state is probably significantly different from the "natural" state, which existed prior to degradation (Williams 1995). It is often the case that the natural state of a watershed coincides with what may be the ultimate goal of a watershed council's planning process. It will therefore be beneficial to analyze the history and effects of human modifications to the natural physical and ecological processes. Analysis at some level, of prior physical functions and conditions of a watershed should be a consideration of every council addressing the restoration needs of the area. It is imperative to utilize all

available relevant materials when endeavoring to perform such historic analysis. Relevant materials would include, but not be limited to, old airphotos, soil survey maps and GIS coverages, NWI maps, city/county zoning maps, and regional hydrologic data.

There are three overt purposes for rigorous historic analysis: to understand what historic wetlands were like and how we can use that information in establishing regional and site goals; to identify and characterize wetland functions for use in restoration strategy and regional planning design; and to firmly establish the fact that humans are part of the system and need to be managed accordingly (Williams 1995). Indeed, providing answers on the nature of change to the landscape can serve to re-establish an important link between a community and its environment.

The use, then, of historic analysis in wetland restoration planning includes identification of former condition and functions, determination of how human alteration has affected these systems, and finally, utilization of information in establishing goals and objectives for the region in question. Further, wetland restoration implies not simply the reconstruction of previous physical conditions, but also re-establishing the integrity of the physical processes which can shape or maintain the desired conditions. The results of historic

analysis should be examined with respect to the established watershed goals and objectives.

Reestablishing Ecological Integrity

One of the fundamental recommendations that the work group considered was the explicit emphasis for wetland restoration on two closely interrelated ecological concepts; integrity and biodiversity. Ecological integrity is the capability of supporting and maintaining a balanced, integrated community of organisms, having a species composition, diversity, and functional organization comparable to that of natural habitats in the region (Karr and Dudley 1981). A critical sub-component of ecological integrity is biodiversity, which is comprised of three interdependent aspects of wetland ecosystems: composition, structure, and function (Noss 1995). Ecological integrity provides a broader ecological focus than biodiversity and thus is preferred for establishing regional management goals and objectives. While both considerations are important for restoration planning and priority setting, ecological integrity as a concept is fundamental to the design of a regional network of wetlands to be preserved and restored (e.g., within a watershed), whereas biodiversity is most valuable in site selection and priorities. If biodiversity were the most prominent ecological goal, then the integrity of the system could be compromised by alterations to

hydrology that might not adversely affect the overall biodiversity of the network in question. If the evaluation framework, on the other hand, emphasized overall integrity, then the hydrological alterations would not have been acceptable due to the nature of potentially degrading the structural and functional integrity of the watershed.

Within a watershed context, selecting sites for restoration represents a significant step towards recovering the lost functions of the area. Individual wetlands function through interaction with adjacent portions of the landscape and in most cases, with other wetlands. Determining wetland functional priorities at a watershed scale assumes some knowledge of the connectivity and adjacency of these systems. Indeed, maintenance of biodiversity, water quality, and natural hydrologic flow regimes in part depends on the total wetland acreage and on the types of wetlands present within the region and their relative proximity to one another.

If the ecological principles covered in previous sections are examined at the watershed scale and taken into consideration when planning for a regional network of wetlands, then the ecological integrity of the landscape will be improved along with the restoration of wetland ecosystems. Example ecological considerations include those of connectivity, adjacency, and size. It is logical to determine, and indeed has been stated many times

throughout this document, that wetlands which are connected functionally with the greater aquatic network provide greater ecological integrity to the entire watershed. The relative size and abundance of wetland within the watershed lead directly to their capacity to perform valued functions. The watershed councils should consider each of the ecological principles during the restoration planning phase. Where human changes make reconnecting systems impossible of impractical, let alternatives be considered. But the fundamental ecological integrity of a watershed can only be enhanced by a thorough examination and restoration of the structure, function, and biodiversity of the landscape.

The Role of Economic Analysis

One of the goals of the work group was to examine the potential role of economic analysis in relation to wetland restoration. All potential restoration sites are not the same. Some are larger than others. Some occur in an urban landscape while still others exist in a rural or even agricultural setting. Many of the state's restorable wetland base remains in private hands while other opportunities are provided through the public arena. One common thread throughout all the possibilities is that there will be some economic cost associated with each of them. One recommendation is that evaluation and ranking of wetland restoration alternatives should be based on an assessment of

opportunity cost rather than the more traditional benefit/cost analysis.

In Massachusetts, riverine wetlands along the Charles River were deemed effective in protecting the greater Boston area from flooding. Their position in the landscape provided functional floodwater storage and abatement, and were bought by the city to hold in a protected status. Their purchase was considered less expensive than costly engineering structures, and they also provided other functional benefits that dams and levees would not (USACOE 1972). USACOE engineers determined that losing the wetlands in the Charles River watershed would increase flood damage by over $17 million per year, or $5000/ha per year. The cost of purchasing the wetland acreage was less, and the flood protection is now considered a great success (NRC 1992).

Restoring degraded wetlands should now be a high priority considering the widely recognized view that they are valuable ecologic and socioeconomic systems. However, restoration can be very expensive in many instances. Urban wetland restoration, while necessary, is certainly a more costly prospect than restoring urban systems. Whereas the cost of draining and filling wetlands has largely been borne by private owners seeking to gain direct personal economic increase due to the alterations, the cost of restoring wetlands will be borne almost entirely by the public (NRC

1992; Wellman 1995). The most notable exceptions to this rule are those wetlands restored in the regulatory context pursuant to the compensatory mitigation process.

The most notable shortcoming to the often-used economic evaluation technique of benefit/cost analysis is the inherent difficulty in assigning dollar figures to wetland functions. Although economists have attributed numeric values to some functional processes (e.g., hydrologic, habitat, water quality), it is virtually impossible to predict all the benefits that wetlands will provide. There is no computational procedure by itself that will determine how far wetland restoration will proceed or the relative priorities for funding projects. The challenge in wetland restoration in the future may be to successfully evaluate trade-offs, not only between whether or not to restore, but also between the various alternative approaches to restoration.

An alternative to benefit/cost economic analysis is the more holistic opportunity cost model. "Within the opportunity cost framework, the correct answer to the question, How much restoration is enough? emerges from legitimate social choice processes within (a region) that will determine the degree of restoration desirable" (NRC 1992). Continually questioning the value of restoration efforts by asking whether the action is "worth" its cost may be the most practical way to determine how much restoration

is enough. One critical component in the opportunity cost analysis is the interested parties participating in the social choice processes must be informed in making the decisions. Being informed includes knowledge about the effectiveness of the various technical options for restoration, the wetland ecosystem functions that might be restored by those options, and the opportunity costs of different strategies for restoration (NRC 1992).

Site Level Planning Framework

There are many considerations for successful wetland restoration at the site level. One of the most important would be accurately following the strategies established at the regional level while integrating them into individual site specific considerations. In other words, fold the expectations of the state and region into achievable site plans which can begin to restore lost or degraded wetland functions and values. Individual restoration projects need to follow a pattern shaped by considerations for *multi-disciplinary preliminary planning*, *historic and current resource inventories, feasible project design,* and *achievable construction and monitoring considerations*.

Success of wetland restoration at the site level depends upon addressing various complex and constantly evolving criteria. The work group suggested that a thorough examination of current scientific literature regarding site level wetland restoration planning be included within this document (see References and Appendix B) Further, they recommend that a repository be established which would contain relevant information on wetland restoration project planning, including material which could expedite the often disjointed permit process. Although it has been established that "cookbook" approaches to wetland restoration rarely succeed, the material provided in this section contains

considerations which should be addressed by those seeking to undertake wetland restoration at any scale.

At the site level, it becomes imperative to further differentiate between restoration as compensatory mitigation, and that which is undertaken for non-regulatory purposes. The scope of individual non-regulatory projects is often too small to incorporate expensive and complex site specific analysis. While the projects themselves may have great merit, it is not feasible to force these measures on those organizations participating in the expressed need for wetland restoration for strictly altruistic reasons.

On the other hand however, restoration undertaken as mitigation for loss or damage to existing viable wetland ecosystems must involve the full range of known and tested scientific methods which increase the likelihood of project success. Those who seek and obtain the proper wetland permits should be compelled to undertake mandatory restoration project measures from complex pre-construction analysis to long term scientific monitoring. While the full extent of available information, along with the complete cooperation of relevant agency personnel, should be made available to those undertaking non-regulatory restoration projects, a more viable alternative should exist for their benefit.

Individual Site Considerations

Preliminary Planning

Throughout the seminal literature, scientists note that no wetlands can be restored or completely duplicated to their original condition. At the site or project level, preliminary planing is therefore critical for establishing the scope, goals, objectives, and general approach for each restoration endeavor. Early stages of project planning should involve many participants, several of whom were identified by the working group. The suggested multi-disciplinary participants include representatives of regulatory agencies, environmental scientists, contractors, engineers, developers, those familiar with regional priorities, and private non-profit organizations.

It is critical in the preliminary stages of a project to establish site or project-specific goals related to proposed wetland characteristics and functions to be restored or enhanced. Depending on the scope of the project, goals may include considerations for size of area to be restored, vegetation type and density to be restored, target wildlife species, and even management specifications. These goals should be identified in order to facilitate such subsequent project components as site design, construction, and project monitoring. Indeed, in many cases the success or failure will depend on the goals set forth at the beginning of the project (Kusler and Kentula 1990). One example of a

restoration goal might be to: maximize productivity and enhance the quality and diversity of a wetland system within the limits of available resources and technology. Another example might be: to reclaim a high quality wetland utilizing a project design that, based on sound ecological principles, is self-sustaining and in harmony with adjacent natural systems. Consultation with wetland experts or existing literature should provide guidance for those wishing to begin the preliminary planning process.

Baseline Inventories

Baseline assessments and inventories of potential project locations are integral components of wetland restoration. They can serve to assess the feasibility of preliminary objectives, identify key lost or degraded wetland functions and conditions, refine the approach to restoration, and provide input to the next stage, which is project design. The information gathered during this phase of a wetland restoration project provides a bridge between the preliminary planning phase and the actual project layout and construction.

Documentation of the existing state of the site can be used to evaluate the potential for restoration and should serve as a baseline for evaluating the success of a project. Physical factors, such as dams, weirs, dikes, or the presence of drainage tiles, which may limit the beneficial

functions of the site should be identified. Site assessments should supply data on several relevant conditions, incorporating information on site history, topography, hydrology, sedimentation, soil types, presence of existing wetlands and wildlife, and adjacent land uses (Jensen and Platts 1990).

Success of wetland restoration at the project level depends upon examination and understanding of various complex and constantly evolving criteria. As previously discussed, wetlands respond in various ways to changes in the physical, chemical, and ecological processes which shape their structure. They can be altered by both natural processes and anthropogenic modifications at many spatial and temporal scales. For example, wetland ecosystems evolve in response to the geomorphic and hydrologic progression at the site. Many variables, such as average rainfall, flooding sequences, and erosion rates fluctuate, yet remain relatively stable with respect to broader geologic time frames. Without human intervention, these physical processes shape wetland ecosystems into what can be considered a state of dynamic equilibrium (Williams 1995).

Given that the site requires restoration or enhancement, the existing state is probably significantly different from the "natural" state, which existed prior to degradation. It is often the case that the natural state of a wetland coincides with what may be the ultimate goal of a

particular restoration project. It will therefore be beneficial to analyze the history and effects of human modifications to the natural physical and ecological processes. Analysis at some level, of prior physical functions and conditions of a proposed wetland restoration project site must be a consideration of each individual project. It is imperative to utilize all available relevant materials when endeavoring to perform such historic analysis. Relevant materials would include, but not be limited to, old airphotos, soil surveys, NWI maps, zoning maps, and regional water surveys.

There are three overt purposes for rigorous historic analysis: to understand what historic wetlands were like and how we can use that information in establishing site goals; to identify and characterize wetland functions for use in restoration strategy and site design; and to firmly establish the fact that humans are part of the system and need to be managed accordingly (Williams 1995). Indeed, providing answers on the nature of change to the landscape can serve to re-establish an important link between a community and its environment.

In the Northwest, indigenous peoples had relatively little effect on wetlands. Following habitation by European settlers, however, the landscape began to change rather dramatically. Natural hydrologic and geomorphic processes were altered significantly by such activities as diking,

ditching, draining, and channelization. While such practices as grazing, clearing and sediment loading are certainly detrimental to the overall health of a wetland, alteration of the aforementioned physical processes prevents the recovery of proper wetland functionality.

The use, then, of historic analysis in wetland restoration planning includes identification of former condition and functions, determination of how human alteration has affected these systems, and finally, utilization of information in establishing goals and objectives for the site. Further, wetland restoration implies not simply the reconstruction of previous physical conditions, but also re-establishing the integrity of the physical processes which can shape or maintain the desired conditions. The results of historic analysis should be examined with respect to the established project goals and objectives. If the results indicate that slight modifications to the project plan need to be made, then this stage should serve as a feedback loop to the planning phase.

A detailed topographic survey is usually needed to establish existing gradients. The scale should be such that hydrologic variables can be reasonably obtained. Reliable and predictable hydrology are the most crucial components of any wetland restoration project, and it is necessary therefore, to provide an accurate projection of area hydrodynamics (Kusler and Kentula 1990; Lewis 1990; Broome

1990). This inventory material should include discharge, velocity, hydroperiod, permeability of substrates, groundwater level, and sediment rates.

There are several other inventories/surveys which may prove useful as inputs to a final project plan. Soil surveys can be used to determine the type and volume of materials available for use in restoration when grading is necessary. Plant inventories should include species composition and percent cover. Botanical information is useful for identifying vegetation designs, and to determine what plant materials are available at the project location which could serve as revegetation stock. Moreover, threatened, endangered, and sensitive plant species must be identified and catalogued. Fish and wildlife surveys can also identify particular species of concern. Restoration is often tailored to enhance the conditions necessary to attract certain species. Timing is critical when conducting these inventories due to the transitory nature of many inhabitants. Waterfowl, for example, may be dependent on the wetland system, but only for one month out of each year.

Baseline information should be assembled as maps and reports which can facilitate sorting, summary, and evaluation by relevant agencies (Jensen and Platts 1991). The data provided by the surveys should be used to modify goals and objectives, as well as the specific approach to

project restoration. Oregon should assemble materials collected from each individual project, and assemble them together for inclusion into a statewide GIS. The applications for such information are varied and subject only to the limits of our imagination and budget.

Project Design

Wetlands are dynamic systems, subject to a variety of complex physical characteristics. It is impossible to isolate specific design criteria which would uniformly serve as guidelines to successful projects since wetland attributes interrelate at such different temporal and spatial scales. Wetland restoration and enhancement projects require a holistic approach to design considerations in order to incorporate ecosystem dynamics. During this stage of planning, a further examination of the ecological principles provided earlier should also be performed. Considerations for project design should include provisions for biodiversity, connectivity, adjacency, relative size, and more. A detailed plan providing information on all phases of a project should be prepared in advance and supplied to the Division of State Lands for review. This material will enable DSL to evaluate the likelihood of success for that type of wetland. Included in this plan should be a description of all subsequent material

covered in this section as thoroughly and accurately as possible.

While a "cookbook" approach to restoration project design is undesirable, some technical guidance regarding possible ranges of conditions conducive to success are possible (Kusler and Kentula 1990). Each restoration plan should include all the relevant information needed to evaluate the chances of success for the individual project. While there are several critical features of any wetland restoration plan, some projects may not require consideration of each component, while still others may require additional considerations. Such features as buffers, barriers, and other protective measures should always be considered where they are feasible. Critical components of any plan are shaped by the scope, goals, objectives, and approach outlined in the preliminary planning phase.

Wetland communities are determined by hydrology. Indigenous vegetation is adapted to, and indeed depends upon, water level fluctuations. Success of restoration efforts can depend on the long term ability to manage and protect the site. Control of the hydrologic regime, through previously existing or constructed measures, can be critical to a project's success. Wetland design should consider concepts of connectivity to watershed water sources, other wetlands within the watershed, and adjacent upland or

downstream water habitat. A topographic design should be provided if activities involve alteration of a stream course or contouring. Minimum hydrologic considerations should include maximum and minimum depths, hydroperiod, velocity, sedimentation rates, nutrient levels, salinity, wave dynamics and potential toxicant interactions.

The design criteria of a restored system are not limited to hydromodification considerations. They extend to other areas as well. Two major substrate or soil questions need to be addressed: 1) can the substrate, when combined with the hydrodynamics of the site, support the desired wetland functions (e.g., soil permeability, water retention); and 2) will the substrate support the target wetland vegetation (e.g., nutrients and compaction)? (Willard et al. 1991).

Further design criteria to consider include provisions for revegetation. Selection of appropriate species is essential to successful revegetation efforts. Choices for target species will depend not only upon the project goals and objectives, but also upon specific site characteristics such as hydrology, climate, soils, and topography. Other concerns which should be addressed include tolerance, availability of propagules, maintenance requirements, and costs.

Timing of revegetation is critical to the success of planting efforts and should considered carefully. The

timetable should allow for planting in the proper season. Different species must be planted at different times of the year depending on individual physiological characteristics. A great deal of money can be wasted if these requirements are not met.

Well planned construction will greatly increase an individual project's chances of success. Plans should include parking and maneuvering considerations for heavy equipment where necessary (Erwin 1990). These precautions will reduce soil compaction and unnecessary disturbances. Additional considerations should be made for erosion control, adequate supervision of site personnel, and opportunities for midway corrections (Erwin 1990).

Simple checklists can serve both the permitting agencies and the restoration planners in different but equally beneficial capacities. For permitting agencies, checklists provide a uniform method of addressing concerns which are likely to arise. Potential problems can often be averted and individual project designs can be easily altered to conform with restoration goals and objectives of the state or region. For restoration planners, checklists provide a cost-effective means to examine at a cursory level such important project components as wetland type, siting, site preparation, construction and instillation, maintenance, and monitoring protocol. Although each individual wetland restoration project will vary in its size

and scope, the use of checklists can flag those issues that should be addressed by all parties concerned.

Monitoring

Monitoring is used to evaluate the success or failure of wetland restoration. Those parameters to be monitored originate from the goals and objectives established during the preliminary phases of the project. Habitat parameters may include frequency and duration of flooding, groundwater dynamics, flow characteristics, water quality, vegetation composition, density, and productivity, degree of shading, as well as a host of others. Population monitoring should include statistics on fish and wildlife counts as well as seasonal variations. Monitoring provisions should provide for periodic remeasurements of variables identified in the inventories.

Frequency of monitoring also is dependent on the project goals and objectives. Monitoring efforts should be made most frequently during the early stages of reconstruction and recovery. Once it is established whether the project is proceeding at an acceptable pace, then monitoring may be curtailed. Projects are routinely monitored on a monthly basis during the initial establishment, and then biannually thereafter (Jensen and Platts 1990). Notations should be made regarding the condition of the project during each season so comparisons

may be made at any time in the future. The overall time frame of monitoring depends on several criteria including limits of manpower, funding, and equipment. The lowest generally accepted length of monitoring is 3-5 years (Jensen and Platts 1991). Results of monitoring should be documented. The data collected should be compiled and made available to the public. Analysis of the material can lead to the potential reduction of errors in subsequent projects. Serious problems should be documented and further studied.

The question of restoration as mitigation versus non-regulatory restoration arises during the monitoring phase as well. Ten years of mandatory monitoring should be required of mitigation projects. If the goals and objectives of the project are not being met, then additional measures should be taken to ensure success. Monitoring for non-compensatory restoration efforts is a different matter. While a certain amount of monitoring should be required by the General Application to DSL, mandatory long-term efforts may not be advisable or acceptable. Organizations such as public schools, environmental groups, and plant societies are often sought out as volunteers to conduct inexpensive yet thorough and accurate monitoring of wetland restoration sites.

Decreasing the Prospect of Failure

There are many reasons for individual projects to experience failure, either completely or partially. Some

common problems include: lack of basic scientific knowledge; lack of proper site design and project supervision during implementation; improper physical conditions at the site (e.g., water supply, hydroperiod, water depth, water velocity, salinity, wave action, substrate type, nutrient concentration, light availability, sedimentation rates, improper grades); invasion by exotics; grazing by critters (e.g., muskrat, nutria, geese); destruction of vegetation or the substrate by natural or anthropogenic means; failure of projects to be carried out as planned. Consideration of all or most of these possibilities greatly increases the opportunity for project success. Additionally, each wetland that is successfully restored will add to the base of scientific knowledge, that is recognizably small, but growing with each experience.

Pre-restoration consultations with restoration experts should be conducted no matter what the scale and scope of the individual project. Additionally, relevant literature should be reviewed and critiqued. There is a great deal of material ranging from individual project reviews to manuals for restoration of specific types of wetlands. This literature may be helpful in assisting with various aspects of the restoration process encountered at different phases. In their book, Jon Kusler and Mary Kentula (1990, xiv) provide a table of the best known compilations of

information on wetland creation and restoration in the United States.

Finally, individual site plans should take advantage of specific attributes of the site itself, and not necessarily propose to fulfill all regional goals and objectives. Wetland ecosystems of certain ecological or functional value should be restored and enhanced rather than converted to different wetland communities. Remember, it is easier and poses less risk of failure to enhance or restore existing wetland habitats than to create new systems artificially.

IMPLEMENTATION STRATEGIES

Chances of effective implementation of proposed wetland restoration policy recommendations will be increased significantly if a thorough examination of viable measures is undertaken. Implementation of any policy is a difficult and iterative process and when we take into consideration that wetlands are a very controversial topic, the task becomes even more complex. According to Webster, *implementation* is defined: "to carry out, accomplish; to give practical effect to and ensure of actual fulfillment by concrete measures" (Webster's IX, 1985). There are several generic policy process models which aid in the overall understanding of a strategic approach to implementation. Before discussing specific implementation measures, it would be prudent to examine several process models.

Policy Process Models

Kingdon

By 1992, several indicators pointed to the need for a comprehensive review of Oregon's wetland restoration policies: accelerated desire to engage in wetland restoration by the public; recognition that there was a uniform need to sustain and improve the ecological structure of the wetland resource base; and acknowledgement that

current policies and procedures were inadequate. However, with state budget shortfalls, increased funding requirements for education, health care, and prisons, the key question for wetland managers was how to devise workable policy improvements along with appropriate considerations for how to implement the changes at a later time. The resulting strategy, developed by Oregon State University Extension Sea Grant, Oregon Division of State Lands, and funded by a grant from the US Environmental Protection Agency included: (1) establishing consensus-building dialogue among the public and private agencies and organizations involved in wetland restoration throughout Oregon by formation of an *ad hoc* policy working group; 2) developing a technically sound framework or context for wetland restoration with considerations for wetland values, historical conditions, lost functions and biodiversity, and; 3) instituting a consensus on goals, policies, and technical procedures for wetland restoration in Oregon that effectively integrate and coordinate the programs and actions of public and private agencies and organizations.

Policy improvement strategy has its conceptual basis in a descriptive model of the policy formulation process conceived by University of Michigan professor John Kingdon (1984). He thoroughly examined why some agenda items and alternative solutions to problems seem to get more attention than others. According to Kingdon, the answer lies in a

mixture of policy-making participants and processes. He describes policy formulation as being comprised of "streams" of processes operating simultaneously and independently: a problem process, a policy process, and a political process. Active participants in these streams, including both visible (e.g., the President, governors, legislators) and hidden (e.g., academia, lobbyists, agency staff), play important roles in setting the policy agenda, specifying alternative solutions, and initiating policy planning (Kingdon 1984). Periodically the three process streams will couple, creating a "window of opportunity" for uncomplicated enactment of specific public policy. For such a coupling to occur, policy makers must learn about the problem and believe it to be important. Additionally, alternative policy solutions must be made readily available to them and the political mood must be right. Utilizing the Kingdon model for assistance in examining the feasibility of establishing effective wetland restoration policy in Oregon may be beneficial.

While problems with successful wetland restoration and enhancement are apparent to relevant agency personnel as well as resource managers in the field (problem stream), there is little public knowledge about the significance of continuing loss of Oregon's wetland resource base. Kingdon says that indicators, program evaluation, and focusing events are important in highlighting policy problems. DSL

has employed several tactics to focus attention on the importance of viable functioning wetlands. First, in September of 1992, the Wetlands Restoration Workgroup convened in Hood River, Oregon to establish some preliminary general recommendations on wetland restoration policy. Additionally, in April of 1993, DSL published *Oregon's Wetland Conservation Strategy*, which detailed the agency's position on many relevant issues including regulatory programs, wetland planning, protection, and restoration, public information, and best management practices (DSL 1993). Finally, DSL secured an EPA grant to fully examine the background, issues and needs for wetland restoration in Oregon.

Effectively joining the problem and policy streams with the political stream will be the most challenging aspect of the process. Multiple strategies and tactics are being examined, but a significant amount of work by both visible and hidden participants is needed. As noted earlier, the coupling of each stream will increase the likelihood of success for the policy. The opening of a "window of opportunity" has yet to be determined, but the concerted effort is just underway.

Putt and Springer

To facilitate policy analysis, a process framework composed of identifiable stages or phases in the history of

a policy has particular advantages. Putt and Springer describe the policy process as a series of five stages, from initial awareness of the need for a new policy, to evaluation of results (1989). Analysis of the individual stages could assist future efforts to stimulate implementation of wetland restoration policy.

1. *Stimulation*: the first stage is a period of policy stimulation where the issues are identified and defined. Diagnostic studies can be performed and alternative ideas can be entertained. Those involved at this stage include the policy community and entrepreneurs.

2. *Policy Clarification*: during the second stage, the problems are refined and alternative solutions are developed. Evaluating policy feasibility is important along with estimating the impacts of implementation. Brainstorming becomes a useful tool.

3. *Initiation*: this stage encompasses the activity where policy makers decide to commit the necessary resources to carry out programs. Politics are crucial and a significant amount of bargaining, negotiation, and consensus must occur. There are several decision criteria that stakeholders need to use to make recommendations: effectiveness, efficiency, equity, and responsiveness.

4. *Implementation*: the fourth stage involves actually putting the program into practice. Most policies have vague goals, so needs and objectives must be specified, decision criteria should be determined, and budgetary constraints set.

5. *Evaluation*: The last stage is the principle feedback phase in the policy process. Evaluation criteria

> includes program monitoring, impact evaluations, and process evaluations. Input and outcomes can be determined.

It is difficult to assess exactly where the policy process will be upon completion of this document. DSL identified issues and began the process of generating alternatives to current policy by convening the first Wetlands Restoration Workgroup. That assembly consisted of citizens, interest groups, and relevant government agencies who began framing the issues and examining current policy. Prior to the first meeting of WG II, Extension Sea Grant and select government agency representatives began to clarify issues and alternatives. The full complexity of the task became apparent as information was presented, discussed, and revised at each of three meeting of the Task Force. No laws have been passed yet, but currently the process of policy initiation and adoption is underway. The political stage is uncertain at this time which may lead to postponement of the recommendations to be adopted. Nevertheless, the process has begun with significant amounts of time invested by many relevant parties, including some of those who will no doubt be involved in the subsequent stages of implementation and evaluation.

Sabatier and Mazmanian

Sabatier and Mazmanian may offer the most clear insight into the conditions which are most conducive to successful policy implementation (1983). Results of their research indicate that the crucial role of implementation analysis is to identify the factors that affect the achievement of statutory objectives throughout the entire process. Policy change then, which departs significantly from the *status quo*, has the highest chance of success if it adheres to a certain set of conditions:

> 1. The enabling legislation or other legal directive mandates policy objectives that are clear and consistent or at least provides substantive criteria for resolving conflicts.
>
> 2. The enabling legislation incorporates a sound theory identifying the principal factors and causal linkages affecting policy objectives, and gives implementing officials sufficient jurisdiction over target groups and other points of leverage to attain, at least potentially, the desired goals.
>
> 3. The enabling legislation structures the implementation process so as to maximize the probability that implementing officials and target groups will perform as desired. This task involves assignment of jurisdiction to sympathetic agencies with adequate hierarchical integration, supportive decision rules, sufficient financial resources, and adequate access to supporters.

> 4. The leaders of the implementing agency possess substantial managerial and political skill and are committed to statutory goals.
>
> 5. The program is actively supported by organized constituency groups and a few key legislators throughout the implementing process, with the courts being neutral or supportive.
>
> 6. The relative priority of statutory objectives is not undermined over time by the emergence of conflicting public policies or by change in the relevant socioeconomic conditions that undermine the statute's causal theory or political support.
>
> (Sabatier and Mazmanian, 1983)

Similarly, the Sabatier and Mazmanian implementation process has variables and stages which should not be overlooked. Independent variables include the tractability of the problem, which takes into consideration the availability of valid technical theory, extent of behavior change required, and percentage of target group as a percentage of the population. Other independent variables are used to assess the ability of the statute to structure implementation and provide insight into nonstatutory considerations which may affect implementation (Saboteur and Mazmanian, 1983). The five stages, or dependent variables, in the implementation process provide linear structure to policy planning efforts: 1) policy outputs of implementing agencies; 2) compliance

with policy outputs by target groups; 3) actual impacts of policy outputs; 4) perceived impacts of policy outputs; and 5) major revisions in the statute.

Implementation Opportunities In Oregon

Considerations for effective implementation of wetland restoration policy may well be one of the most important components of this policy formulation process. We have convened Kingdon's hidden and visible participants, examined alternative approaches, and clarified many of the relevant issues. The final strategy is liable to be a multi-faceted approach where effective policy implementation is dependent on the extent to which the participants understand, accept, and support the various recommendations for change. There are many forms of implementation which could prove beneficial to examine further.

Applied research represents a critical component of the early stages of effective policy. The functional assessment matrix outlined in previous sections needs to be field tested to a certain degree, and then subjected to technical review. Additionally, the unpublished wetland areal and type data currently in the possession of DSL could serve as initial material in a pilot project to verify the accuracy of the methodology. The role that universities, agencies, and even private firms play in furthering the "status of the science" will certainly act to uncover alternative

approaches to wetland restoration and provide clarification where none exists currently.

The methods for adopting policy in Oregon are varied in their scope and jurisdiction. Policy can be written as a bill, debated before the state legislature, subjected to change at the whims of individual politicians, and then potentially passed into law. This process can take a long time and bills must be championed by individuals with a motive for the proposed changes. Approving policy through the process of administrative rule represents a viable option. Alternative strategies are fashioned by participants, subjected to public review and comment, and then adopted in part or whole by agencies who would serve in lead roles.

The statewide land-use planning process represents another option open to implementation of recommendations. Local plans are subjected to periodic review by the Department of Land Conservation and Development, and changes can be made before or during this period. Along the coast, where Goals 16 and 17 specifically direct that wetland resources be addressed in the local planning process, the impetus already exists for restoration planning. Clear objectives and a unified direction are lacking, but the principles and objectives of this study can be added to the coastal planning process and perhaps even expanded to areas outside that jurisdictional authority.

Implementing Restoration Planning At the State Level

Implementing comprehensive wetland restoration policy at the state level presents a great challenge. We have established that wetland restoration planning should be focused on maintaining and increasing the critical functional components of aquatic systems. The proposed ecoregional framework for state-level, function-based priority setting involves analysis , determination, and prioritization of wetlands at large geographic scales. This multi-level process creates cross-jurisdictional obstacles to policy implementation.

DSL should take the lead effort in identifying the functional restoration objectives for each of the 23 Level IV sub-ecoregions. While the data on wetland area and type for the state which exists is dubious, it nevertheless provides some critical material with which to work. The proposed functional assessment and prioritization methodology should undergo some rigorous analysis, perhaps with some field testing to verify results. DSL should seek funding from EPA to develop a pilot project to fully examine proposed recommendations. A technical advisory committee or committees should be formed to analyze the ecoregion-specific wetland function matrix. All wetland types need to be assigned a relative value for each function in each ecoregion. Perhaps the advisory committees should meet to discuss the value assignments in each ecoregion in order to

take advantage of local knowledge and reacquaint themselves with regional landscape terrain and wetland resources. Most of the methodology process has been created in this document, but alternatives can be created and examined, new ideas brought forth and discussed, and the statewide functionality of such a system determined.

The feasibility of dovetailing the proposed processes, procedures, and recommendations with existing programs is enticing. Several frameworks are already in place that might effectively provide the necessary components for implementation. The priorities established at the state level would be fed down to the regional level and combined with the ecological, socioeconomic, and institutional principles outlined in previous sections.

Implementing Restoration Regional/Local Planning

One of the perplexing issues confronting aquatic ecosystem restoration planners surrounds the working definition and practical application of the term "region". If a regional goal is to restore migratory waterfowl habitat, then considerations for land uses and practices beyond the immediate drainage would certainly have to be addressed. If planning within a sub-watershed scale, examination of adjacent disturbances, including hydrologic alterations must be made.

Super-Regional Planning Level

Currently there are numerous private efforts at restoring wetland habitat. Unfortunately they are operating at different scales and many have single-resource objectives and goals. Partnerships between public agencies and private sector entities have become an viable opportunity for wetland restoration on a super-regional scale. The work group recommended that Oregon promote and participate in private partnerships with federal, state, and local agencies and Nos to achieve better efficiency through pooling of resources to take advantage of opportunities for wetland restoration projects.

Partnerships are a growing paradigm in resource management and they deserve further examination. They represent a workable method of enlarging financial resources, avoiding potential conflicts by bringing all participants to the table, and creating mutual respect and understanding. Examples of successful partnerships include Oregon Coastal Wetlands Joint Venture and the Oregon Watershed Improvement Coalition. These organizations seek to involve private owners of agricultural land in wildlife conservation, work with developers and communities to reduce the impacts of urbanization, and work with regional industries to educate them on the impacts of their operations on water quality and wetland habitats (PCJV 1994).

National programs also exist with the stated mission of restoring watershed and wetland habitats. The Nature Conservancy, the Wetlands Conservancy, and Ducks Unlimited each provide a host of services to individual landowners and to private entities. For example, a major goal of Ducks Unlimited is to maintain and enhance the habitat values of areas identified as internationally significant to waterfowl. Their efforts to restore habitat for migratory waterfowl extend beyond the borders of the United States into Canada and Mexico. Because of the international importance of Oregon wetlands, other joint ventures have been formed under the North American Waterfowl Management Plan (PCJV 1994).

The goal of maintaining and increasing ecologically significant wetland resources means transcending political boundaries, agency jurisdictions, and public and private ownership. Close cooperation will be required between a broad range of groups, agencies, and entities with a common interest in the future of wetlands and the functions they perform. Cooperative approaches should accommodate human use at large and small scales, and diverse activities in concert with resource conservation. Private partnerships may provide an answer to achieving sound ecological and planning procedures for effective wetland restoration.

Regional/Sub-Regional Planning Level

Evidence for using a watershed and sub-watershed scales for wetland restoration was explored in great detail previously. Even though the foundation for large-scale planning has been made, implementation strategies have not been explored. The final work group workshop focused on regional implementation issues, such as how to integrate wetland restoration into the existing institutional framework for watershed, wetland, and land use planning as well as restoration action programs.

In 1993 the Oregon Legislature passed Senate Bill 81 (SB 81) which dealt comprehensively with watershed scale management. The Strategic Water Management Group (SWMG), 13 state agencies and the Governor's office, was charged with the task of establishing the *Watershed Management Strategy for Oregon*. The cornerstone of the resultant Watershed Health Program (WHP) was the establishment of regional watershed councils among local residents, government, and other private citizens concerned with the health of their individual watersheds. These local councils must be approved by SWMG and serve to foster community-wide support. They set workable goals and criteria for the local program and seek funding sources for watershed improvements. The strengths of the watershed councils are numerous including community-based support and planning, a ready funding source from the state, and technical assistance from the agencies

represented on SWMG. The weaknesses include the drastic variability in local interests. Over 30 councils are in existence representing various watersheds, but they cover only 28% of the total area of the state (WHP 1994). In 1993 the Legislature also gave the Grande Ronde and South Coast/Rogue Basin communities $10 million in lottery funds to support their work towards watershed management. The 1995 Legislature drastically cut funding amounts to the WHP, but it nevertheless remains a viable option for funding.

Single or Multiple Local Jurisdictional Planning Level

Oregon's Statewide Planning Goals represent a long-standing partnership between state and local governments. The state requires that cities and counties plan for land use, and it sets the standard for such planning. Local governments perform the actual planning, with technical assistance, and administer most of the regulations. The resulting conglomeration of state-approved local comprehensive plans (LCPs) covers the entire state. These LCPs provide overall guidance for a community's land use, economic development, and resource management. Each plan is made of two main components. The first is a set of data and information called the inventory. It quantitatively and qualitatively describes the community's resources and physical features. The second component is the policy element, in which the community's long range objectives and

polices are established. The policy element of each community's plan is adopted by ordinance and has statutory authority (How to cite Goals?).

Senate Bill 3 (SB 3) proposes to reform the way wetland management is conducted in Oregon. The bill did not create major new programs, rather it sought to improve wetland management through changes to existing planning and regulatory statutes. Provisions included standardization of wetland related terminology and definitions, mandates for statewide wetlands inventory, and exemptions for agricultural land. A general authorization was provided for, which streamlined the regulatory process for activity in wetlands that was deemed to have minimal individual or cumulative impacts.

Perhaps the most relevant provision of SB 3 creates guidelines for establishing Wetland Conservation Plans (WCPs). WCPs are the mechanism by which the legislature proposes to join Oregon's existing land use planning process with regulatory programs for wetlands. At the local, and potentially regional level, WCPs focus on wetland resources in a geographic area and provide an opportunity for management decisions to be made in a broader context than is possible through a permit-by-permit regulatory process. WCPs contain maps of the area to be covered, detailed inventory of wetland resources in the planning area, and an assessment of wetland functions and values. Further,

wetland resources are designated for either protection, conservation, or development. Wetlands may be designated for development only if there is an expressed public need for the proposed uses set forth in the comprehensive plan for the affected area and provisions are made for full replacement of the planned wetland losses. WCPs are adopted at the local level, with technical assistance from relevant agencies, and amended to the local comprehensive plan pursuant to Goal 5. Approved WCPs can result in expedited review of dredge and fill permits in the planning area. WCPs represent a unique opportunity to insert wetland restoration planning guidelines and procedures. There may be no current statutory authority to broaden the scope of WCPs, but the language and intent are certainly there to provide a chance to include a regional wetland restoration strategy.

This multi-jurisdictional level represents perhaps the best opportunity for implementing sound wetland restoration policy beyond the research and pilot program recommended at the statewide level. The mechanisms are in place through the Statewide Planning Goals, and policy recommendations could be adopted during the periodic review process. While following the conceptual process models of Kingdon, Putt and Springer, and Mazmanian and Sabatier may provide insight into some of the obstacles potentially encountered, the actual planning and implementation will have to be done by

knowledgeable participants in Oregon.

REFERENCES

Adamus, P.R., and L.T. Stockwell, 1983, *A Method for Wetland Functional Assessment: Vol I*, Report to the Federal Highway Administration, US Department of Transportation, 178 pp.

Adamus, P.R. et al., 1991, *Wetland Evaluation Technique (WET); Vol I: Literature Review and Evaluation Rationale*, US Army Corps of Engineers, Waterways Experiment Station, VIcksburg, MS.

Arnold, Carol C., 1985, "The Arcata Marshes: A Case Study In Wetland Restoration", *Coastal Zone 85*, pp. 562-587.

Bella, David, 1979, "Marsh Craetion and Restoration-A New Horizon for Necessary Estuarine Activities?", *Coastal Zone Management: Today and Tommorow-The Necessity for Multiple Use*, Vol. 4, pp.77-105.

Bergstrom, John C. and J.R. Stoll, 1990, "Economic Value of Wetlands Based Recreation", *Ecological Economics*, Vol 2, No. 2, pp.129-147.

Boule, Marc C., and K. F. Bierly, 1987, "History of Estuarine Wetland Development and Alteration: What Have We Wrought", *Northwest Environmental Journal*, 3:43-61.

Boule, Marc C., and T. Miller, 1988, *Inventory of Wetland Resoureces and Evaluation of Wetland Management in Western Washington*, Washington State Department of Ecology.

Boule, Marc C., 1987 "Wetland Creation and Enhancement in the Pacific Northwest", *Increasing Our Wetland Resources*, John Zelazny and Scott Feierabend (eds), Proceedings of a Conference: Incresasing Our Wetland Resources, Mayflower Hotel, Washington, D.C., October 4-7.

Brinson, M.M., 1993, *A Hydrogeomorphic Classification for Wetlands*, Technical Report, WRP-DE-4, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, 80 pp.

Broome, Stephen W., 1990, *Creation and Restoration of Tidal Wetlands of the Southeastern United States*, Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 37-72.

Carothers, Steven W., Mills, G. Scott, and Johnson, R. Roy, 1990, *The Creation and Restoration of Riparian Habitats In the Southwestern Arid and Semi-Arid Regions*, Wetland

Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp.351-356.

Clark, John R., 1990, *Regional Aspects of Wetlands Restoration and Enhancement In the Urban Waterfront Environment*, Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp.497-515.

Clarke, Sharon E., Denis White, and Andrew Schaedel, 1991, "Oregon, USA, and Ecological Regions and Subregions for Water Quality Management", *Environmental Management*, Vol 15, No 6, pp. 847-856.

Clewell, Andre F. and Russ Lea, 1990, *Creation and Restoration of the Forested Vegetation In the Southeastern United States*, Wetland Creation and Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp.1195-233.

The Conservation Foundation, 1988, *Protecting America's Wetlands: An Action Agenda*, The Final Report of the National Wetlands Policy Forum, Washington, D.C., 69 pp.

Coquille Watershed Association, 1994, *Preliminary Watershed Condition Assessment and Restoration Strategy for the Coquille River*, Technical Advisory Group Draft Working Paper, 89 pp.

Cowardin, Lewis M., Virginia Carter, Francis Golet, and Edward LaRoe, 1979, *Classification of Wetlands and Deepwater Habitats of the United States*, United States Fish and Wildlife Service, FWS/OBS-79/31, 103 pp.

D'Avanzo, Charlene, 1990, *Long-Term Evaluation of Wetland Creation and Restoration Projects*, Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 487-496.

Daggett, Steve, 1994, *Stage 1 Watershed Assessment: Final Report*, Oregon Division of State Lands, 52 pp.

Dahl, T.E. 1990. *Wetland Losses in the United States 1780's to 1980's*. U.S. Department of Interior, Fish and Wildlife Service, Washington, D.C.

Dahl, T. E. and C. E. Johnson, 1991, *Status and Trends of Wetlands in the Conterminous United States, Mid-1970's to Mid-1980's*, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 28 pp.

Erwin, Kevin L., 1990, *Wetland Evaluation for Restoration and Creation,* Wetland Creation and Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 429-458.

Frayer, W.E., et al., 1983, *Status and Trends of Wetlands and Deepwater Habitats in the Conterminous United States, 1950's to 1970's,* Department of Forest and Wood Sciences, Colorado State University, 32 pp.

Frenkel, Robert E., S.N. Wickramoratne, and E.F. Heinitz, 1984, *Vegetation and Land Use Cover in the Willamette River Greenway in Benton and Linn Counties, Oregon: 1972-1981,* Association of Pacific Coast Geographers Yearbook, 46:63-67.

Frenkel, Robert E. and Janet C. Morlan, 1990, *Restoration of the Salmon River Salt Marshes: Retrospect and Prospect,* Final Report to the US Environmental Protection Agency, Region 10, February 15, 1990, 158 p.

Galatowitsch, Susan M. and Arnold G. van der Valk, 1994, *Restoring Prairie Wetlands: An Ecological Approach,* Institute for Wetland and Waterfowl Research, Iowa State University Press, 244 pp.

Garbisch, Edgar W., 1990, *Information Needs In the Planning Process For Wetland Creation and Restoration,* Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 423-427.

Good, James W, 1979, *Oregon Estuary Planning and Management,* Proceedings of the Fifth Annual Conference of the Coastal Society, 32 pp.

Good, James W., and Robert F. Goodwin, 1992, *Waterfront Revitalization For Small Cities,* Oregon State University Extension Service, EM 8414, 124 pp.

Harvey, T.H. and M.N. Josselyn, 1986, "Wetland Restoration and Mitigation Policies: Comment", *Environmental Management,* Vol 10, No. 5, pp. 567-569.

Interagency Committee on Wetlands Restoration and Creation, 1992, *A National Program for Wetlands Restoration and Creation,* 47 pp.

Jensen, Sherman E. and William S. Platts, 1990, *Restoration of Degraded Riverine/Riparian Habitat In the Great Basin and Snake River Regions,* Wetland Creation and Restoration: The Status of the Science,Jon Kusler and Mary Kentula (eds), pp. 367-404.

Josselyn, Michael (ed), 1982, *Wetland Restoration and Enhancement in California*, California Sea Grant College Program Publication.

Josselyn, Michael, Zedler, Joy,Griswold, Theodore, 1990, *Wetland Mitigation Along The Pacific Coast of The United States*, Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 3-36.

Kentula, Mary E., 1986, *Wetland Creation and Rehabilitation in the Pacific Northwest*, In R. Strickland (ed), Wetland Functions, Rehabilitation, and Creation in the Pacific Northwest: The State of Our Understanding, Washington State Department of Ecology, pp. 119-150.

Kentula, Mary E., et al., 1992, "Trends and Patterns in Section 404 Permitting Requiring compensatory Mitigation in Oregon and Washington", USA, *Environmental Management*, Vol 16, No. 1, pp 109-119.

Kentula, M.E., R.P. Brooks, S.E. Gwin, C.C. Holland, A. Sherman, and J.C. Sifneos. 1993. *An Approach to Improving Decision Making in Wetland Restoration and Creation*. Edited by A.J. Hairston. Island Press, Washington, D.C.

Kingdon, John W., 1984, *Agendas, Alternatives, and Public Policies*, Little, Brown and Company, 215 pp.

Kruczynski, William L., 1990, *Mitigation and the Section 404 Program: A Perspective*, Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp.549-570.

Kusler, Jon A., 1990, *No Net Loss and the Role of Wetlands Restoration/Creation in a Regulatory Context*, in No Net Loss and the Role of Restoration and Creation, a National Workshop of the Association of State Wetland Managers, 108 pp.

Kusler Jon A. and Mary E. Kentula, 1990, *Wetland Creation and Restoration: The Status of the Science*, Island Press, 591 pp.

Leibowitz, Scott G., et al., 1992, *A Synoptic Approach to Cumulative Impact Assessment: A Proposed Methodology*, US Environmental Protection Agency, EPA/600/R-92/167, 129 pp.

Lewis Roy R., 1990, *Wetlands Restoration/Enhancement Terminology: Suggestions For Standardization*, in Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 417-422.

Lightcap, Brian W., 1987, "Wetland Enhancement Near Columbia River Mile 68", *Coastal Zone '87*, pp. 1775-1786.

Little Butte Creek Watershed Council, 1995, *Little Butte Creek Watershed Action Plan*, (ed. Lu Anthony and Mark Grenbemer), 63 pp.

McCreary, Scott T. and John Zetner, 1983, "Innovative Estuarine Restoration and Management", *Coastal Zone '83*, pp. 2527-2551.

McCreary, Scott T. and Mark B. Adams, 1995, *Managing Wetlands Through Advanced Planning and Permitting: The Columbia River Estuary Study Task Force*, in Collaborative Planning for Wetlands and Wildlife (ed. Douglas R. Porter and David A. Salveson), Island Press, 292 pp.

The National Research Council, 1992, *Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy*, National Academy Press, Washington, D.C., 552 pp.

The National Research Council, 1995, *Wetlands: Characteristics and Boundaries*, Committee on the Characterization of Wetlands, National Academy Press, Washington, D.C., 268 pp.

North Carolina Department of Environment, Health, and Natural Resources, 1994, *A Wetland Functional Assessment Procedure for the North Carolina Coastal Area*, Coastal Zone Enhancement Grants Program, 36 pp.

Noss, Reed, 1995, *Biodiversity and Landscape Ecology: A Background Paper for Wetland Restoration Policy*, unpublished report to the Wetland Restoration Policy Work Group, 32 pp.

O'Donell, A., 1988, *The Policy Implications of Wetlands Creation and Restoration*, In Increasing Our Wetland Resource: Proceedings of a Conference, J. Zelazny and J.S. Feirabend (eds), National Wildlife Federation, pp. 141-144.

Omernik, James M. and Alisa L. Gallant, 1986, *Ecoregions of the Pacific Northwest*, EPA/600/3-86/033, 39 pp.

Omernik, James M., 1987, *Ecoregions of the Conterminous United States*, Annals of the Association of American Geographers, Vol 77, No 1, pp. 118-125.

Omernik, James M. and Glenn E. Griffith, 1991, "Ecological Regions Versus Hydrologic Units: Frameworks for Managing Water Quality", *Journal of Soil and Water Conservation*, Vol 46, No 5, pp. 334-340.

Oregon Division of State Lands, 1993, *Oregon's Wetland Conservation Strategy*, 100 pp.

Oregon Water Resources Department, 1995, *Watershed Health Staus Report, Number 8*, Report Summary to the Oregon Legislative Assembly, 12 pp.

The Pacific Coast Joint Venture, 1994, *Strategic Plan*, adopted by Oregon Coastal Wetlands Joint Venture, 57 pp.

The Pacific Rivers Council, 1994, *Prioritizing Watersheds and Wild Salmon Restoration: A Summary of the Framework Developed Under the Sponsorship of Oregon Senate President Bill Bradbury* (Draft), 14 pp.

Pearce, John B., 1985, *Estuarine Habitat Enhancement and Restoration*, Proceedings of the North American Wildlife and Natural Resources Conference, pp 457-464.

Putt, Allen D., and J. Fred Springer, 1989, *Policy Research: Concepts, Methods, and Applications*, Prentice Hall, pp. 11-55.

Roth, Emily et al., 1993, *Oregon Freshwater Assessment Methodology*, Oregon Division of State Lands, 178 pp.

Sabatier, Paul A., and Daniel A. Mazmanian, 1983, *Can Regulation Work?: The Implementation of the 1972 California Coastal Initiative*, Plenum Press, pp. 7-15.

Smith, R. Daniel, 1993, *A Conceptual Framework for Assessing the Functions of Wetlands*, Technical Report, WRP-DE-3, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Snyder Robert M. and Fred Landrum, 1987, "Estuarine Rehabilitation -A Management Perspective", *Coastal Zone '87*, pp. 251-287.

Tiner, Ralph W., 1984, *Wetlands of the United States: Current Status and Recent Trends*, U.S. Fish and Wildlife Service, National Wetlands Inventory, 129 pp.

US Environmental Protection Agency, 1994, *Partnerships and Opportunities In Wetland Restoration*, edited by M. Marz, A. Jarvela, K. Kunz, C. Simenstad, and F. Weinman, EPA 910/R-94-003, 245p.

Washington State Department of Ecology, 1986, *Wetland Functions, Rehabilitation, and Creation in the Pacific Northwest: The State of Our Understanding*, Richard Strickland (ed), Publication Number 86-14, 184 pp.

Watershed Health Program, 1994, *Watershed News*, newsletter of the Oregon Watershed Health Team, oregon Water Resources Department, 8 pp.

Webster's Ninth New Collegiate Dictionary, 1985, Merriam-Webster, Inc., Springfield, MA, 1531 pp.

Weinmann, F. and K. Kunz, 1994, *Wetlands: Infusion of Restoration Into the Management Formula*, In Partnerships and Opportunities in Wetland Restoration: Proceedings of a Workshop, edited by M. Marz, A. Jarvela, K. Kunz, C. Simenstad, and F. Weinman, 1-17. EPA 910/R-94-003. Seattle: U.S. Environmental Protection Agency.

Wellman, K.F., 1995, *The Potential Role of Economic Valuation in Wetlands Restoration Policy and Planning*, unpublished report to the Wetland Restoration Policy Work Group, 24 pp.

Wilen, Bill, 1992, *Use of National Wetlands Inventory Maps to Predict the Occurrence of Wetland Functions/Services*, USF&WS, unpublished report, Washington, DC, 68 pp.

Willard, Daniel E. et al., 1990, *Creation and Restoration of Riparian Wetlands in the Agricultural Midwest*, Wetland Creation And Restoration: The Status of the Science, Jon Kusler and Mary Kentula (eds), pp. 327-350.

Williams, Phillip B., 1995, *Considerations of Historic Functions and Conditions In Wetland Restoration Planning*, unpublished report to the Wetland Restoration Policy Work Group, 14 pp.

Winterowd Planning Services, 1985, *Statewide Planning Goal 5 Process Requirements*, 21 pp.

Zetner, John, 1988, "Wetland Projects of the California State Coastal Conservancy: An Assessment", *Coastal Management*, Vol. 16, pp. 47-67.

Zentner, J.J., 1988, *Wetland Restoration Success In Coastal California*, In Increasing Our Wetland Resource: Proceedings of a Conference, J. Zelazny and J.S. Feierabend (eds), National Wildlife Federation, pp. 216-219.

APPENDIX A

GLOSSARY

abiotic-nonliving; usually refers to substances or processes

aerobic-living, active, or occurring only in the presence of oxygen

alluvium-sediment deposited by flowing water, as in a river-bed, floodplain, or delta

anaerobic-occurring in the absence of oxygen, as in biochemical processes

artificial wetland-wetland constructed where one did not exist before

bog-a nutrient poor, acidic-peat-accumulating wetland

channel-the bed or deeper part of a stream or river

channelize-hydromodification in which the bed or banks of a stream or river are artificially straightened

classify-to assign to a category

compensation-provision for creation or restoration of "equivalent" wetland acres comparable to wetland acres and functions that have been destroyed

condition-the integrity of a wetland's physical and biological structure. Condition determines the wetland's capacity to perform specific functions, as well as its restoration or enhancement potential

conservation-the planned management of wetlands and water resources which encourages compatible management practices that maintain and provide for wetland hydrology, acreage, functions, and diversity

converted wetland-see *prior converted wetland*

coordination-the cooperative planning, funding, implementation, and education about management practices and lessons learned from joint efforts

creation-to convert a persistent non-wetland area into a wetland area through some activity of man. This definition

presumes the site has not been a wetland within recent times (100-200 years) and thus restoration is not occurring . Created wetlands are divided into two groups: artificial and man-induced

criteria-a standard on which a judgement or decision is based

degraded-lowered in quality from adverse impacts such as vegetation removal, invasion of non-native species, or hydromodifications

depressional wetland-wetland occurring in a depression in the landscape so that the catchment area for surface runoff is generally small

disturbed area (altered area)-area where vegetation, soils, or hydrology have been sufficiently altered, so as to make judgements on previous function or condition difficult

ecoregion-ecological region containing distinct geomorphology, soils, climate, land use/land cover, and dominant vegetation

ecosystem-an organic community of plants and animals, viewed within its physical environment. The ecosystem results form the interaction between its individual components, such as soils, climate, vegetation, and animal life

edge-the border between two vegetative types or between a vegetative type and open water. Edge contributes to diversity of wildlife in a wetland ecosystem.

enhancement-the alteration, maintenance, or management of existing wetlands for long term improvement of particular functions or services (often to the detriment of other functions or services)

evapotranspiration-loss of water by both evaporation from the soil and by transpiration of water from the plants growing on the soil

farmed wetland-area in which farming is compatible with land status

fen-peat-accumulating wetlands that receive water that has been in contact with mineral soils

fringe wetland-wetland near a large body of water, most typically the ocean, that receives frequent and regular two-way tidal flow, or wind-driven fluctuations in water-level

functions-physical, chemical, and biological processes or characteristics of wetlands that are vital to the integrity of the wetland system, and operate independently of whether they are viewed as important to society

functional equivalency-ability of a restored or created wetland to perform ecosystem functions that are indistinguishable in their effects from corresponding functions performed by natural wetlands

geomorphology-study of characteristics, origin, and development of landforms

goal-a broad statement of what you want to accomplish. The most constructive method for formulating goals is to take a negative problem and turn it into a positive one. For example:

> Problem: Wetland restoration efforts are often performed in a trial and error manner, while information gained subsequent to successful or failed projects is not used in future management decisions.
>
> Goal: Wetland restoration management must be adaptive and able to utilize information gained to adjust future decision making in a desired direction.

groundwater-water found at and beneath the water table in the zones of saturation

habitat-the environment in which the requirements of a specific plant or animal are met

hydric soil-soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper layer

hydrogeomorphic-of or pertaining to an aggregate of the geomorphic setting, the water source and its transport, and hydrodynamics

hydroperiod-depth, duration, seasonality, and frequency of flooding

hydrophyte-any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excess water. Plants typically found in wetland habitats

impact-an action that creates an effect

indicator-organism, ecological community, or structure

feature so strictly associated with a particular environmental condition that its presence indicates the existence of the condition

intermittent stream-streams that flow primarily during the wet seasons when the water table is high, and remain dry for a portion of the year

isolated wetland-wetland not adjacent to another surficial body of water

landscape ecology-discipline which deals with the patterns and processes of biological systems in spatially and temporally heterogeneous environments at the scale of landscapes, e.g., tens to hundreds of thousands of acres

lotic-pertaining to, or living in flowing water

marsh-wetland characterized by frequent or continual inundation, emergent herbaceous vegetation, and mineral soils

mitigation-restoration, enhancement, or creation of wetlands to compensate for permitted wetland losses.

mitigation banking-restoration, enhancement, or creation undertaken expressly for the purpose of providing compensation for wetland losses from future development activities. It includes only that activity which takes place prior to elimination of another wetland as part of a credit system.

objective-a concise measurable statement of what will be accomplished within a given time frame

peat-deposit of partially decomposed, or undecomposed plant material, or both

peatlands-generic term used to refer to all peat-accumulating wetlands-bogs and fens

perennial stream-a stream that normally contains flowing water throughout the entire year because it is sustained by either groundwater discharge or surface runoff, or both.

prairie pothole-shallow, marsh-like pond, particularly as found in the Dakotas and central Canadian provinces

prior converted wetland-wetland converted to farmable land before December 23, 1985

propagule-structure of a plant involved in dispersal and

reproduction; used to facilitate revegetation

protection-management of a resource in such a way as to ensure continued existence of its structure, functions, and integrity

regionalize-to divide into regions or administrative districts

restoration-intentional, goal-directed actions that result in the reestablishment of the ecological integrity and biodiversity of wetlands (including their place and role in the larger landscape, and their composition, structure, and functions), in areas where wetlands have been altered, degraded, or destroyed.

riparian vegetation-vegetation growing sufficiently close enough to a lake or river that its annual evapotranspiration is a factor in the lake or river regimen

riparian ecosystem-ecosystem that has a high water table because of its proximity to an aquatic system, either surface or subsurface water

riverine wetland-wetland system exposed to channelized flow regimes; can be tidal waters, slow moving waters with well-developed floodplains, fast moving waters with little floodplain, and intermittent systems

saturation-soil condition in which all pore spaces are filled with water

services-characteristics that are not necessarily critical to the wetland system itself, but are perceived as being beneficial to society

surface runoff-water that flows over the surface of the land as a result of rainfall or snowmelt; it enters stream and rivers to become channel flow

swamp-emergent wetland in which the uppermost stratum of vegetation is primarily composed of trees

tidal marsh-saltwater or brackish wetland dominated by herbaceous vegetation and subject to tidal flow

vernal pool-shallow, intermittently flooded wet meadow, generally covered by water for extended periods during the cool season but dry for most of the summer

water budget-balance between inflows and outflows of water

water table-the upper level of the portion of the ground in which all interstitial spaces are saturated with water

watershed-surface drainage area that contributes water to a river or lake

wet meadow-any type of wetland dominated by herbaceous vegetation (usually sedges) and with waterlogged soil near the surface but without standing water for most of the year

wet prairie-herbaceous wetland dominated by grasses rather than sedges and with waterlogged soil near the surface but without standing water for most of the year

wetland-an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development.

The definitions in this glossary are the result of consultation with many sources and the combined efforts of the Wetland Restoration Policy Work Group. The sources include:

Cowardin, Lewis M., Virginia Carter, Francis Golet, and Edward LaRoe, 1979, *Classification of Wetlands and Deepwater Habitats of the United States*, United States Fish and Wildlife Service, FWS/OBS-79/31, 103 pp.

Lewis Roy R., 1990, "Wetlands Restoration/Enhancement Terminology: Suggestions For Standardization", *Wetland Creation And Restoration: The Status of the Science*, Jon Kusler and Mary Kentula (eds), pp. 417-422.

Oregon Division of State Lands, 1993, *Oregon's Wetland Conservation Strategy*, 100 pp.

The National Research Council, 1992, *Restoration of Aquatic Ecosystems*, National Academy Press, Washington, D.C., 552 pp.

APPENDIX B

ANNOTATED BIBLIOGRAPHY

Adamus, P.R. et al. (1991)

Wetland Evaluation Technique (WET); Vol I: Literature Review and Evaluation Rationale, Technical Report WRP-DE-2, US Army Corps of Engineers, Waterways Experiment Station, VIcksburg, MS. 285 pp.

KEYWORDS: Wetland Functions, Aquatic and Wildlife Diversity
NOTES: This document arose as a supplement to a previous US Department of Transportation report on methodology for wetland functional assessment. Ten (10) wetland functions are identified and are fully examined with respect to their processes and interactions. A methodology is outlined to predict wetland effectiveness and opportunity. Finally, the authors examine the social significance of wetland functions. This document is used throughout the United States, but it is most effective for site-by-site analysis.

Anderson, R., and M. Rockel. (1991)

Economic Valuation of Wetlands. Discussion paper #065. American Petroleum Institute, Washington, D.C., 60 pp.

KEYWORDS: Wetland Functions, Environmental Benefits, Mitigation Economics
NOTES: This report provides a detailed economic evaluation of wetlands and wetland functions. The paper discusses wetland functions, valuing environmental benefits, estimates of the value of wetland functions, mitigation economics, and directions for future research. An excellent use of tables throughout the paper display and convey relevant information quite clearly.

Applegate River Watershed Council. (1994)

Applegate Watershed Assessment. Prepared for the State of Oregon Watershed Health Program and the Strategic Water Management Group. Applegate River Watershed Council. Jacksonville, OR., 184 pp.

KEYWORDS: Assessment, Monitoring, Public Involvement
NOTES: The objective of the watershed assessment is to enhance and restore the watershed as habitat, to promote the recovery of anadromous fish stocks in the Rogue Basin, to encourage community involvement in watershed management and issues, to provide educational opportunities, and to prioritize restoration and management efforts. The assessment includes a working assessment (physical, geographical, ecological, and social characteristics of the watershed), public involvement strategy, watershed health strategy, monitoring plan, and mechanisms for updating the watershed assessment.

Association of State Wetland Managers, Inc. (1990)

No Net Loss and the Role of Restoration and Creation. Background materials for national workshop. The Association of State Wetland Managers, Inc. Berne, New York., 108 pp.

KEYWORDS: Creation, Restoration, Enhancement
NOTES: This document has accumulated 11 documents and reports related to wetlands restoration, enhancement, and creation, to serve as background material for the No Net Loss and the Role of Restoration and Creation national workshop held April 3-7, 1990. Several of the papers found their way into the subsequent publication by Kusler and Kentula, *Wetland Restoration and Creation: The Status of the Science.*

Brinson, Mark M. (1993)

A Hydrogeomorphic Classification for Wetlands, Technical Report, WRP-DE-4, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, 80 pp.

KEYWORDS: Hydrogeomorphic, Wetland Classification, Functional Analysis
NOTES: The hydrogeomorphic (HGM) classification of wetlands is intended to lay a foundation for the development of an assessment methodology in order to examine the physical, chemical, and biological functions of wetlands. Strengths of the classification include its ability to clarify relationships between hydrology and geomorphology and wetland function. Brinson details his research outlining the classification of wetland systems based on the hydrogeomorphic properties of geomorphic setting (landscape position), water source, and hydrodynamics.

Finally, a development of "profiles" which reveal the functions that wetlands are likely to perform is discussed.

Clarke, S.,D. White, and A Schaedel. (1991)

"Oregon, USA, Ecological Regions and Subregions for Water Quality Management." *Environmental Management*, 15(6), 847-856.

KEYWORDS: Ecoregions, Ecological Regions, Water Quality Management
NOTES: The authors have defined an initial set of ecological regions and subregions of the state of Oregon that organize the spatial similarities and differences in water quality. The data is intended to serve as an organizational framework for data display and reporting, prioritizing monitoring and pollution control strategies, developing biological criteria for water quality standards, and developing other regional water quality management approaches.

The Conservation Foundation. (1988)

Protecting America's Wetlands: An Action Agenda, The Final Report of the National Wetlands Policy Forum, Washington, D.C., 69 pp.

KEYWORDS: Wetlands Policy, Planning, Management Process
NOTES: This publication is a seminal work which provides a national agenda for protection, restoration, creation, and overall conservation of America's wetland resources. It is a recognition by the Conservation Foundation that the various private and public programs designed to protect and manage wetlands address only limited aspects of the systems and have been adopted incoherently and in a disparate manner. This publication was the springboard for the now-famous interim goal of "no-net-loss" of wetland resources and the more ambitious long-term goal to increase the quantity and quality of the nation's wetland resource base. The heart of the document is a series of policy recommendations which are designed to be implemented on the national level to address the previously mentioned concerns.

Coquille Watershed Association. (1994)

Preliminary Watershed Condition Assessment and Restoration Strategy for the Coquille River, Phase 1 Watershed Action Plan, draft working paper. Prepared for the State of Oregon Watershed Health Program and The Strategic Water Management Group. The Coquille Watershed Association. Coquille, OR, 89 pp.

KEYWORDS: Public Involvement, Watershed Health, Dispute Resolution, Monitoring
NOTES: The Watershed Action Plan sets forth a strategy for assistance in coordinating natural resource management in the Coquille River Basin. It further serves as a basis for prioritizing, identifying, and accomplishing large scale restoration and enhancement on both public and private lands. The plan calls for public involvement and coordination with existing programs. It further provides a series of technical appendices such as criteria for project selection and selection of off-channel and instream improvements.

Daggett, Steve. (1994)

Stage 1 Watershed Assessment: Final Report. Oregon Division of State Lands. Salem, OR, 52 pp.

KEYWORDS: Priority Watersheds, SWMG, Watershed Assessment
NOTES: The Strategic Water Management Group (SWMG) is developing a watershed strategy that calls for a statewide assessment of watersheds based on three criteria: watershed health, public interest, and likelihood of success. The end result is to be a listing of high priority watersheds for the state and others to direct resources towards. The state expects to promote local progress in those areas to enhance natural resources that are critical to the local and state economy. This report resulted in two major products. The first is a single list of recommended priority watersheds focusing on areas with high resource values from a biological standpoint and incorporates information on impacts and risks. The second is the individual results that may be recombined in various combinations or examined in different geographic groupings to address other specific management questions.

Dahl, Thomas E. and Craig E. Johnson. (1991)

Status and Trends of Wetlands in the Conterminous

United States, Mid-1970's to Mid-1980's, U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., 28 pp.

KEYWORDS: Wetland Trends, Wetland Survey Techniques
NOTES: Although the figures used by Dahl are often contested, his work on a national scale cannot be overlooked. This publication of the US Fish and Wildlife Department examines the usage and individual trends of estuarine, palustrine, and deepwater habitats. Critical conclusions of the study indicate that wetland loss is still occurring at an alarming rate. Wetland acreage decreased during the study time period by over five (5) million acres, and there was a proportional loss in associated functions. Many of Dahl's references are sketchy and occur only in unpublished government studies.

Duncan, Angus. (1994)

A Proposal for a Columbia Basin Watershed Planning Council, Paper presented to the Northwest Electric Power and Conservation Planning Council. 24 pp.

KEYWORDS: Columbia Basin, Conservation, Watershed Planning Council
NOTES: This paper proposes, as a partial solution to impacts to the Columbia River Basin, that the Northwest Power Planning Council be charged by Congress with setting forth a general plan for conservation of the Columbia Basin watershed. Such a plan would not dissipate existing laws and institutions. It would, however, insist that the effects of current and planned uses be measured against a standard of the health of the whole watershed, from its headwaters to the ocean.

Fromuth, C. (1990)

Coquille Constructed Wetland Reconnaissance Study. Unpublished report to the Oregon Coastal Zone Management Association, 56 pp.

KEYWORDS: Constructed Wetland, Watershed Association, Oregon
NOTES: This report serves as a detailed review of constructed wetlands technology. Such technology is then evaluated for its ability to meet revised discharge standards. The paper also provides a conceptual review of wetland design alternatives and performance expectations. Sitting considerations are

outlined and regulatory acceptance guidance and recommendations are provided.

Garbisch, E. W. (1986)

Highways and Wetlands: Compensating Wetland Losses. U.S. Department of Transportation, Federal Highway Administration Report No. FHWA-IP-86-22. 78 pp.

KEYWORDS: Wetland Creation, Restoration
NOTES: This report presents methods, concepts, and general specifications for the creation and/or restoration of wetland habitats. The report also provides photographs and drawings of restoration methods, along with information as to criteria to consider when creating and/or restoring wetland habitat.

Gersib, R., G. Broadhurst, P. Cagney, M. Rylko, C. Samuelson, C. Tanner, F. Weinmann, B. Zeigler. (1994)

Working Together: A Non-regulatory Wetland Restoration Plan for Puget Sound River Basins (draft). State of Washington Department of Ecology, Olympia, WA. 178 pp.

KEYWORDS: Non-regulatory, Restoration Plan, Puget Sound

NOTES: This plan serves to guide and direct the Puget Sound Wetland Restoration Program in efforts to help solve ecological problems and meet community needs in watersheds. Methods for establishing technically sound, socially acceptable ways to restore wetlands in a watershed-based, voluntary, non-regulatory manner are presented. These methods are intended to provide a balanced approach to watershed analysis, public empowerment, and problem resolution.

Good, James W. (1987)

Wetland Creation/Restoration:Selection of Study Sites for Oregon. Final Report for the United States Environmental Protection Agency, Corvallis Environmental Research Laboratory. EPA Reference: DW89932026-01-0, Corvallis, OR. 21 pp.

KEYWORDS: Wetlands Creation, Restoration, Electronic Data Base, Site Selection
Notes: This report identifies wetland creation and restoration projects on Oregon, organizes this

information in an electronic data base, and provides information as to sites suitable for further field study and evaluation.. Although estuarine wetlands are included in the data base, fresh water wetlands are the primary focus of this report. There are 23 fresh water wetland sites recommended for further study, all of varying types, design features, degrees of maturity, geographic setting, and cultural features. The report further provides a review and critique of the EPA Permit Data Base.

Interagency Committee on Wetlands Restoration and Creation. (1992)

A National Program for Wetlands Restoration and Creation, Report of the Interagency Committee an Wetlands Restoration and Creation to the Policy Coordinating Group Interagency Task Force on Wetlands. Washington, DC. 47 pp.

KEYWORDS: Wetland Restoration, Creation, Implementation, Coordination
NOTES: This report contains the recommendations, criteria, and coordination vehicle to establish a National Program for Wetlands Restoration and Creation. Information generated by this report intended to be used in conjunction with non-regulatory projects and does not include restoration or creation conducted for mitigation, or in response to federal or state regulatory programs. The goals of the program are to increase the quantity and quality of the nation's wetland resources and to ensure that federal agencies practice and advocate wetland stewardship.

Jones and Stokes Associates, Inc. (1988)

Restoration Potential of Diked Estuarine Wetlands in Washington and Oregon: Phase 1: Inventory of Candidate Sites. Final report submitted to the Environmental Protection Agency Region 10, contract #68-02-4381. Jones and Stokes Associates, INC, Bellevue, WA. 112 pp.

KEYWORDS: Washington, Oregon, Site Selection Criteria
NOTES: This report was initiated as a first step in identifying candidate wetland restoration sites in Washington and Oregon. The study attempts to isolate areas that were once estuarine wetlands but are not now functioning as such due to dike construction, areas that are greater than 5 acres in size, and those areas that may be suitable for restoration. The report

concludes with an appendix that isolates potential restoration sites by U.S.G.S. Quads.

Kentula, M. E., J. C. Sifneos, J. W. Good, M. Rylko, K. Kunz. (1992)

"Trends and Patterns in Section 404 Permitting Requiring Compensatory Mitigation in Oregon and Washington, USA." *Environmental Management* Vol. 16, No. 1, p. 109-119.

KEYWORDS: Wetlands, Clean Water Act, Mitigation, Wetland Creation, Pacific Northwest, Washington, Oregon
NOTES: In this document, the effects of permitting decisions made under the Section 404 of the Clean Water Act for which compensatory mitigation was required were examined. The study illustrates how Section 404 permit data might be used in managing a regional wetland resource.

Kentula, M.E., R.P. Brooks, S.E. Gwin, C.C. Holland, A. Sherman, and J.C. Sifneos. (1993)

An Approach to Improving Decision Making in Wetland Restoration and Creation. Edited by A.J. Hairston. Island Press, Washington, D.C. 153 pp.

KEYWORDS: Projects, Natural, Restored, Created, Population, Success
NOTES: The US Environmental Protection Agency's Wetlands Research Program (WRP) developed an approach to improving decision making in wetland restoration and creation projects. There are some key recommendations from the research that include: 1) use information in project files to gauge decision making; 2) target projects in areas at greatest risk; 3) base the level of effort used in monitoring on information needs; 4) consider the landscape setting of the wetlands when defining the populations to be compared; 5) use the characteristics of natural wetlands and wetland projects to define the standard; and 6) make the process of setting performance criteria and defining design guidelines iterative.

Kusler, J. A. (1990)

No Net Loss and the Role of Wetlands Restoration/Creation in a Regulatory Context.

Background article for the National Workshop of the Association of State Wetland Managers, April 3-7, 1990. 12 pp.

KEYWORDS: Guidelines, Recommendation, Policy, Restoration
NOTES: The proposed guidelines are for inclusion in regulatory policy guidance documents, draft regulations, or ordinances. They are designed for use by a regulatory agency operating pursuant to a wetland permitting statute or ordinance. These proposed guidelines have been prepared to act as a starting point for agencies wishing to adopt their own regulations. The guidelines are "process-orientated" and broadly applicable to restoration, creation, and enhancement wherever they occur. The guidelines provide a draft text, definitions, standards for restoration, creation, and enhancement, permit application procedures and requirements, and a call for experimental and demonstration projects, as well as cooperative restoration, creation, or enhancement projects.

Leibowitz, Nancy C. (1992)

Summary and Recommendations of the Wetland Restoration Policy Work Group. Unpublished report to the Oregon Division of State Lands. 12 pp.

KEYWORDS: Wetland Restoration Policy Work Group, Priority Recommendations
NOTES: This document is a summary of the Wetland Restoration Policy Work group that convened on September 14-15, 1992, to develop recommendations on Wetland Restoration Policy issues. The working group has identified priority recommendations, general recommendations, proposed policy needs, criteria for prioritizing regions/watersheds for restoration, feasibility criteria, proposed priority regions/watersheds for wetland restoration, data layers for identifying potential restoration sites, and potential cost share opportunities, funds, and political support for restoration.

Leibowitz, Scott G., et al. (1992)

A Synoptic Approach to Cumulative Impact Assessment: A Proposed Methodology, US Environmental Protection Agency, EPA/600/R-92/167, 129 pp.

KEYWORDS: Impact Assessment, Landscape, Synoptic Approach
NOTES: This report provides resource managers and technical staff with an approach for evaluating the cumulative environmental effects of individual human impacts on the environment, particularly with respect to wetlands. The work is intended to give the reader a general understanding of cumulative impacts and to describe how a synoptic assessment is produced. A second objective of the report is to encourage resource managers responsible for wetland conservation to consider and view wetlands within a landscape context.

Levin, S. A. (1992)

"The Problem of Pattern and Scale in Ecology." *Ecology*, 73(6). 24 pp.

KEYWORDS: Heterogeneity, Patchiness, Pattern, Scale, Variability
NOTES: The paper argues that the problem of pattern and scale is the central problem in ecology. Analysis of ecological systems requires the interfacing of phenomena that occur on very different spatial, temporal, and ecological organizational scales. Furthermore, it is argues that there is no single natural scale at which ecological phenomena should be studied. Examination of ecological phenomena requires the evaluation of how pattern and variability change with the scale of description, and the development of laws for simplification, aggregation, and scaling.

Lightcap, B.W. (1993)

The Federal Wetlands Program- Mitigation Follow-up, Portland District's Experience. National Association of Environmental Professionals, Proceedings from the 18th Annual Conference. Raleigh, N.C. 9 pp.

KEYWORDS: U.S. Army Corps, Federal 404 Wetland Program, Mitigation, Permit Mitigation Evaluations
NOTES: This paper presents a selection of permits that require mitigation and in a brief case study/summary style, will present the mitigation project, type of wetland involved, and the status of the mitigation effort. It presents an overview of the success of mitigation projects that require written evaluations from the permittee as required in the Federal permit. The goal is to use this effort as a means to focus internal action on ways to improve U.S. Army Corps

permit descriptions and follow-up evaluations of mitigation projects.

Mitsch, W.J., and J. G. Gosselink. (1986)

Wetlands. Van Nostrand Reinhold Company. New York, N. Y.

KEYWORDS: Freshwater Wetlands, Coastal Wetlands
NOTES: This text provides a comprehensive discussion of both freshwater and coastal wetlands in the United States. The text isolates wetlands as systems, with chapters designed to address various components of these systems. 40 pages of citations provides the reader with an excellent wetland reference.

Montgomery, D. R., G.E. Grant, and K. Sullivan. (1995)

Watershed Analysis as a Framework for Implementing Ecosystem Management. Unpublished report to Sediment Hydrology and Mass Wasting Committee of the US Forest Service. FY93-004. 40 pp.

KEYWORDS: Ecosystem Management, Watershed Analysis
NOTES: This paper proposes that implementing ecosystem approaches to land use decision making and land management requires new methods for linking science and planning. The paper discussed the evolution of watershed analysis, provides a framework for watershed analysis, structure of watershed analysis (providing guidelines for asking the appropriated questions and identifying critical issues), linking watershed analysis to planning, and monitoring and restoration strategies. The paper further discusses the advantages of watershed analysis for implementing Ecosystem Management.

The National Research Council. (1992)

Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy, National Academy Press, Washington, D.C., 552 pp.

KEYWORDS: Ecosystem, Restoration, Management
NOTES: This report is the result of recognition by the Water Science and Technology Board of the NRC's Commission on Geosciences, Environment, and Resources that it should be concerned with the emerging science of restoration ecology in relation to aquatic

ecosystems. The book acknowledges that the primary reason for degraded aquatic ecosystems is through large scale anthropogenic hydromodifications. Several aquatic ecosystems are addressed including lakes, rivers and streams, and wetlands. The authors focus on recommendations for a national strategy encompassing integrated management objectives at various governmental levels. The answer for increasing the overall health and integrity of our aquatic ecosystems is through systematic, long-term, large-scale, coordinated restoration planning, evaluation, and monitoring.

The National Research Council. (1995)

Wetlands: Characteristics and Boundaries, Committee on the Characterization of Wetlands, National Academy Press, Washington, D.C., 268 pp.

KEYWORDS: Wetland Delineation, Characterization, Functions
NOTES: This publication is the result of a request from EPA to NRC to examine the scientific basis for characterization of wetlands. It contains review and evaluation of the consequences of alternative methods for wetland delineation and summarization of the scientific understanding of wetland functions. The authors also address the issues of wetland definition, the structure and function of wetlands, and regional differences among wetland systems. Finally, the book covers various methods for assessing wetlands and the administrative issues of wetland regulation.

North Carolina Department of Environment, Health, and Natural Resources. (1994)

A Wetland Functional Assessment Procedure for the North Carolina Coastal Area, Coastal Zone Enhancement Grants Program, 36 pp.

KEYWORDS: Functional Assessment, Wetland Conservation Plan
NOTES: The newest and probably most technically sophisticated functional assessment system for wetlands is the North Carolina Coastal Region Evaluation of Wetland Significance (NC-CREWS) system. Using digital data for a number of GIS data layers (wetland boundaries and types, soils, land use/cover, hydrology, watershed boundaries, endangered species occurrences, estuarine primary nursery areas, and water quality

classifications), the NC-CREWS procedure system analyzes wetland functions at a landscape scale. The rating results can be used to set priorities for protection of significant freshwater wetlands, explore non-point source pollution management strategies, and examine potential wetland restoration sites. However, such a system requires a large financial investment in inventory, mapping, and digitizing of data on wetlands, land use, and other layers needed for the analysis.

Omernik, J. and G. E. Griffith. (1991)

"Ecological Regions Versus Hydrologic Units: Frameworks for managing water quality." *Journal of Soil and Water Conservation*, v46(5), September-October. 7 pp.

KEYWORDS: Ecological Regions, Hydrologic Units, Water Quality
NOTES: This paper discusses the application of ecoregional versus hydrologic unit analysis for water quality assessment. The authors propose that water quality assessments need a regional framework that will help to achieve the following: 1) compare regional land and water patterns, 2) establish reasonable chemical and biological standards, 3) predict the effects of management practices and controls, 4) locate monitoring and special study sites, and 5) extrapolate site-specific information to larger areas. They additionally provide a comparison of frameworks for analysis at the national, regional/state, and local scales.

Pacific Rivers Council. (1995)

Handbook for Prioritizing Wild Salmon and Watershed Restoration (draft). Pacific Rivers Council. 35 pp.

KEYWORDS: Prioritizing Watershed Restoration, Scientifically Based Protection, Restoration Strategies
NOTES: This handbook provides a systematic approach to identifying activities and approaches that can best restore salmon habitat and their watersheds. The handbook serves as a guide for prioritizing watershed restoration activities while serving as a tool for resource managers for planning watershed restoration. The handbook has two objectives. First, to identify restoration activities for immediate implementation, and secondly to provide a sound scientific basis for protection and restoration strategies that may be implemented over longer temporal scales.

Roth, Emily, Richard Olsen, Patty Snow, and Richard Sumner. (1993)

Oregon Freshwater Assessment Methodology, Oregon Division of State Lands, 178 pp.

KEYWORDS: Functions, Values, Wetland Assessment
NOTES: The manual is designed to provide a method of wetland assessment for planners, public officials, and others who are familiar with wetlands but who are not necessarily wetland specialists. It is specifically intended for planning and educational purposes, not for detailed impact analysis of individual wetlands. The end products of the individual wetland assessments are qualitative descriptions of wetland functions and condition. When a more detailed functional analysis is appropriate, the Oregon Method is unable to handle the task.

Sport Fishing Institute. (1991)

The Economics of Wetland Valuation: A Review of the Literature and Recommendations for Future Research. Report prepared for the National Marine Fisheries Service. Sport Fishing Institute, Washington, D. C. 69 pp.

KEYWORDS: Wetland Valuation, Valuation Procedures
NOTES: This project addresses the current status of wetland valuation methods and develops a research agenda for strengthening valuation procedures for wetland services. The paper reviews the non-market evaluation literature, and also includes a section of recommendations for improving wetland valuation studies. Recommendations include quantifying wetland production functions, measuring the demand for and value of wetland outputs, transferring the production and demand functions to other sites, and institutional mechanisms. The general conclusions of this study is that there has been little research which links the biological functions and outputs of wetlands to the demand for those services by the public. The study concludes that studies should test biological and economic valuation methods, replicability of methods, and transferability of bioeconomic models across sites.

Thiele, S. and J. M. Omernik. (1993)

Subregions of the Columbia Plateau Ecoregion. Unpublished Draft report. U.S. Environmental Protection Agency, Corvallis, OR. 19 pp.

KEYWORDS: Ecoregion, Regional Framework to Management, Columbia Plateau
NOTES: This paper discusses the application of ecological regional analysis as a spatial framework of analysis necessary to structure research, assessment, monitoring, and management of environmental resources in the subregions of the Columbia River Plateau. The paper discusses delineation of ecoregions through the analysis of spatial characteristics such as climate and geology that indicate differences in ecosystem potential, the utility of a regional framework to state level management issues, and the methodologies used in the delineation of Columbia Plateau ecoregions and subregions. A discussion of each of the subregions of the Columbia Plateau is also presented.

U. S. Army Corps of Engineers. (1986)

Beneficial Uses of Dredged Material. Engineer Manual No. 1110-2-5026. Office, Chief of Engineers, Washington, D. C.

KEYWORDS: Dredged Material, Beneficial Use
NOTES: This report provides a discussion as to beneficial uses of dredged materials. The report addresses the use of dredged materials on wetland, beach, and island habitat development projects that may be useful in coastal wetland creation and restoration projects. The appendix includes notes on issues to consider, such as planting techniques, when considering the use of dredged materials in habitat development.

U. S. Environmental Protection Agency. (1988)

Restoration Potential of Diked Estuarine Wetlands in Washington and Oregon; Phase I: Inventory of Candidate Sites. Jones and Stokes Associates, Inc. EPA 910/9-88-242. 112 pp.

KEYWORDS: Diked Estuarine Wetlands, Oregon, Restoration, Site Selection, Washington
NOTES: The purpose of this project was to identify candidate wetland restoration sites in Washington and Oregon. The objective of the study was to identify sites in Oregon and Washington that: 1) were once estuarine wetlands, but due to dike construction, are

not presently functioning as such; 2) are greater than 5 acres in size; and 3) are suitable for restoration. A comprehensive listing of candidate sites complete with short description and site map is presented.

U. S. Environmental Protection Agency. (1994)

Partnerships and Opportunities In Wetland Restoration: Proceedings of a Workshop, edited by M. Marz, A. Jarvela, K. Kunz, C. Simenstad, and F. Weinman, EPA 910/R-94-003, 245 pp.

KEYWORDS: Wetland Management, Restoration, Riparian Wetlands
NOTES: This publication is the result of a conference designed to examine the numerous opportunities available for wetland restoration. The participants examined the range of potential options from those offered by the federal government to elementary school children. The workshop was a first attempt to collect a number of restoration case studies from the Pacific Northwest. The projects described range from the small and simple to the large and complex. The conference participants were divided into work groups and asked to examine a slate of relevant issues. One important component of the process was that many regional experts in attendance were allowed to brainstorm their ideas about approaches to wetland restoration.

Washington State Department of Ecology. (1994)

Strategic Wetlands Integration Strategy. Shorelands and Water Resource Program, 119 pp.

KEYWORDS: Integrated Planning, Wetland Policy, Education
NOTES: The Department of Ecology responded to citizen complaints of wetland policy inadequacies by convening several expert work groups to formulate state recommendations for change. The work groups addressed such relevant topics as integration of existing wetland policies with the changes that needed to be made, shortfalls in citizen education regarding the importance of wetland functions and values, and the need for coordinating economic development efforts of the state and the needs of private citizens.

White, D. and L. Shabman. (1994)

Watershed Planning to Facilitate Wetland Restoration. Institute of Water Resources, U. S. Army Corps of Engineers. Unpublished Staff Paper. 11 pp.

KEYWORDS: Watershed Plan, Watershed Planning vs. Protection Planning, Restoration
NOTES: This paper investigates how watershed planning can contribute to wetland restoration, expressed here as moving from no net loss to a net gain of wetland functions. The paper illustrates several components of watershed-orientated planning that have been found to contribute to restoration success.

Wolf, R. B., L. C. Lee, and R. R. Sharitz. (1986)

Wetland Creation and Restoration in the United States from 1970 to 1985: An Annotated Bibliography. *Wetlands*, 6, pp. 1-88.

KEYWORDS: Wetland Creation and Restoration, Site Engineering, Plant Propagation
NOTES: This annotated bibliography indexes 304 publications the deal with the creation and restoration of disturbed salt and freshwater wetlands in the United States. The authors have chosen to emphasize papers concerned with site engineering and plant propagation. Articles referenced in the bibliography address topics such as site selection, planning, engineering and design, seeding, harvest, plant material selection, storage and transplanting, fertilization, cost estimates, and maintenance requirements.

APPENDIX C

WETLAND RESTORATION POLICY WORK GROUP

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APPENDIX D

PRIVATE AND PUBLIC PROGRAMS FOR RESTORATION

FEDERAL PROGRAMS FOR WETLAND RESTORATION AND CONSERVATION

Agricultural Conservation Program
US Department of Agriculture

Description The Agricultural Conservation Program (ACP) encourages voluntary compliance with Federal and State requirements for solving point and nonpoint source pollution on farms and ranches. ACP provides 50% to 75%cost-share funds for approved practices providing long term and community-wide conservation benefits.

ACP is administered by the (USDA) Consolidated Farm Service Agency, state and county offices with technical assistance, and program guidance provided by the Natural Resource Conservation Service (NRCS), the U.S. Forest Service and State forestry agencies, and the Cooperative Extension Service. Each of the state and county Consolidated Farm Service Agency committees have considerable latitude as to which of the nationally approved practices they allocate using limited funds.

How the Program Works ACP agreements can be for one year or more. When entering an agreement, the farmer pays the total cost of establishing the approved conservation practices and is then reimbursed for the government's share of the cost, which may range up to 75 percent of total costs for annual agreements. The maximum cost-share limitations for annual conservation management plans is $3,500 per year.

Long-term agreements require the development of a conservation plan by the NRCS and approval of the plan by the Soil and Water Conservation District and the county Farm Service Agency office. Lump sum payments in excess of $3,500 may be authorized for a long term agreement under certain conditions. Farmers and ranchers may enter into pooling agreements to jointly solve mutual conservation problems. Pooling agreements could be used to restore a wetland area covering portions of several properties.

Eligibility The practices approved for cost-sharing must result in long term and community-wide benefits. The practices should also be those that the farmer or rancher would not, or could not, undertake without financial and

technical assistance. The producer making an application must own between 10 and 1000 acres to be eligible. Contact the nearest county Farm Service Agency office for more details on a particular program.

All the practices described above may not be presently approved in your county. If not, your county committee may be able to take action to approve them for use or it may need to request approval of the State Committee before approving them.

Forestry Incentives Program
US Department of Agriculture

Description The Forestry Incentives Program (FIP) is the major USDA forest tree planting program and can be used to help restore wooded wetlands. FIP provides technical and cost-share assistance to landowners participating in any one of the four national forestry practices eligible under FIP. The overall goal with FIP is to increase the Nation's supply of timber products from private non-industrial forest lands and preserve and improve the environment. FIP is jointly administered by the Farm Service Agency and the Forest Service with technical assistance from the Oregon Department of Forestry (ODF).

How the Program Works Landowners apply for participation in the program at the county Farm Service Agency office. Upon request from the Farm Service Agency, the State forestry agency examines the property, develops the Forest Management Plan, and certifies the need for the practice. Forest management plans should specify the need for wetlands and riparian area protection measures. During the planning process wetlands conservation and restoration opportunities, if any, should be discussed with the landowner and agreed to measures incorporated in the final plan. The State forestry agency will also provide technical advice and help locate approved vendors for getting the work accomplished.

Eligible FIP practices are divided into four forestry practice areas: tree planting (FP1), improving a stand of forest trees (FP2), site preparation for natural regeneration of trees (FP3), special forestry practices (FP4). All FIP practices require a minimum 10-year maintenance agreement from the landowner.

The state forestry agency must certify that the work has been completed in accordance with the approved plan before payment is made to the landowner by the county Farm Service Agency office. Cost-share assistance cannot exceed 65 percent of the actual, average, or estimated cost of

performing the practice. The maximum cost-share that a participant can earn annually for forestry practices under FIP is $10,000. In some states, assistance is available under long-term agreements of three to ten years.

Eligibility FIP is limited to landowners of 10 to 1,000 acres. Exceptions to the acreage limitation may be obtained for up to 5,000 acres. FIP is offered only in designated counties where a suitable number of ownerships capable of producing at least 50 cubic feet of timber per year each exist. Ornamental, Christmas tree production, and orchard tree plantings are not eligible for FIP funding.

Consolidated Farm Service Agency Wetlands - Related Programs
US Department of Agriculture

Description Persons with FSA loans secured by real estate may qualify for cancellation of a portion of their FSA indebtedness in exchange for a conservation easement. Easements may be established on wetlands, marginal cropland, and other environmentally sensitive lands for conservation, recreation, and wildlife purposes.

FSA borrowers who are up-to-date on their payments as well as those who are experiencing difficulty in keeping their loans current are eligible to participate. A conservation easement may be considered alone or in conjunction with FSA's Primary Loan Servicing Programs or new loans which are secured by real estate.

By participating in the Conservation Easement Debt Cancellation Program, borrowers reduce their FSA debt, thereby improving their overall financial stability. Also, borrowers can conserve wildlife habitat and improve the environmental and scenic value of their farms.

How the Program Works The process of easement establishment begins at the FSA County Office level when a borrower requests to be considered for a conservation easement. The County Supervisor determines if the borrower is eligible and contacts members of an easement review team. This team, consisting of representatives of FSA, the Natural Resource Conservation Service, the U.S. Fish and Wildlife Service (FWS), and interested State and local conservation agencies, works with the borrower to conduct a field evaluation of the farm. Within 30 days of the site review, the team provides a report to the County Supervisor indicating the following:

- Which lands are eligible and potential easement boundaries.

- A finding of whether the land is suitable for conservation, recreation, and/or wildlife purposes.
- The name of the agency or entity willing to accept easement enforcement responsibility from FSA.
- The recommended term and conditions of the easement.
- A proposed management plan which is consistent with the easement purposes.

The County Supervisor evaluates the easement review team's report to determine if a conservation easement can be established on the farm in exchange for debt reduction.

In general, the amount of a borrower's FSA Farmer Program debt secured by real property that can be cancelled is proportional to the amount of the farm that will be covered by the easement. However, for borrowers up-to-date on their loan payments or receiving a new loan secured by real estate, no more than 33 percent of the loan principal can be canceled in exchange for an easement. For delinquent borrowers, the amount of debt canceled may surpass this amount, provided it does not exceed the value of the land on which the easement is placed. The FSA County Supervisor can provide more detailed information on how much debt may be canceled. FSA will cover the costs of all surveys, appraisals, and recording fees associated with the conservation easement. However, the borrower must obtain written consent to the terms of the conservation easement from all prior and/or junior lien holders, if any exist.

In most cases, especially where wetlands and important wildlife habitat are involved, a permanent easement will be established. Under no circumstances will the terms and conditions apply for less than 50 years. In general, activities which are contrary to restoration and protection of the natural ecology of the area are prohibited by the easement.

The borrower retains the right to control public access to the easement area, and where compatible with the easement purpose, may use the area for hunting and fishing and other innocuous activities. The easement enforcement authority, in conjunction with FSA, monitors the terms and conditions of the conservation easement.

The easement enforcement authority may designate a manager of the easement to conduct habitat management activities and to "look after" the easement area. This may be a Federal, State, or local government agency, a private conservation group, or an individual capable of carrying out the activities outlined in the easement management plan. The landowner may be eligible to serve as easement manager.

In most instances, the FWS provides technical and financial assistance to restore wetlands and other important habitats valuable to migratory birds and other wildlife on the easement area. Once these habitats are restored, the easement manager bears the responsibility for maintenance.

Once a conservation easement is established, the property is subject to the easement for its duration, regardless of who owns the land. New owners of the property will be subject to the same restrictions and retain the same rights as the borrower who originally granted the easement in exchange for the debt reduction. To take advantage of this option, landowners can ask their local FSA representative about their eligibility to participate.

Wetlands Reserve Program
US Department of Agriculture

Description The Wetlands Reserve Program (WRP) was authorized by the Food, Agriculture, Conservation, and Trade Act of 1990 (1990 Farm Bill). WRP is a voluntary program offering landowners a chance to receive payments for restoring and protecting wetlands on their property. Under WRP landowners are provided cost share funds to restore wetlands. They are paid up to the full market value of the land for granting the government a permanent easement and agreeing to maintain the wetland values in perpetuity. The first WRP sign-up in Oregon was held in February of 1994. Another sign-up was June 1995. It is expected that by the year 2000 the WRP will have restored and protected nearly 1 million wetland acres nation wide.

How the Program Works Owners of eligible lands apply for enrollment at their local NRCS office by declaring their intent to participate during the specified enrollment periods. Following the declared intentions, the Natural Resource Conservation Service (NRCS) and the Fish and Wildlife Service (FWS) will determine the eligibility of the acres offered. In 1994 offers were ranked using national priority factors: 1) habitat for migratory birds and other wildlife; 2) wetland functions; 3) location significance; 4) wetland management requirements; and 5) physical conditions of the site. States may also develop additional ranking factors.

The State Conservationist will then select the high priority intentions on which to extend offers. A Wetland Reserve Plan of Operations (WRPO) will be developed for each of the high priority areas. The NRCS with the assistance of FWS will help landowners develop the plans. Each plan will describe intentions and objectives as to restoration

practices needed to accomplish the restoration, landowner requirements for maintaining the restored wetland values, and other details. The acceptable uses of the land after the easement is filed will also be spelled out in detail in the WRPO. They may include hunting, fishing, timber harvest, haying or grazing and other uses depending upon the situation. Duration and timing of these activities must be agreed upon and approved prior to completion of the WRPO. No activities may degrade or diminish the wetland functions and values of the land under easement.

After completion and approval of the plan by the agencies (including the conservation district) and the landowner, the landowner may accept the amount offered by NRCS for the easement. The government's offer will be based on the appraised agricultural value of the land. Up to one hundred percent cost share may be paid for restoring the wetlands and adjacent lands. State agencies and private conservation organizations may provide additional assistance and even incentives for enrollment. All legal costs associated with recording the easement will also be paid by the government. After the easement is filed and the restoration completed, a lump sum payment will be paid to the landowner.

The landowners will maintain full control over public access and use of the WRP easement lands. The WRP easement does not open the areas to public hunting, fishing, or other forms of recreation unless the landowner desires to do so. The landowner will be responsible for the minimal maintenance the area may require and for state and local land taxes. However, taxes will likely be minimal as the land can no longer be used for crop production or developed. When lands are sold the easement will follow the sale and the new owner assumes the easement obligations.

Eligibility Eligible for inclusion in the WRP are wetlands farmed under natural conditions, farmed wetlands, wetlands converted to cropland prior to December 23, 1985 (PC's). Adjacent land deemed necessary to protect the restored wetlands will also be included. Each WRP easement must be at lease 2 acres in size and have been planted or considered planted to an agricultural commodity in at least one of the 1986-1990 crop years.

Riparian areas that link wetlands protected by and easement or similar device are also eligible for WRP irrespective of their landuse. The protected areas being linked can be protected by a WRP easement entered in a previous sign-up or is being offered at the same time, or it may be a wetland area owned and protected by a government agency or a private organization. Because of the multiplicity of these values

provided by connecting riparian strips, riparian offers are generally given a top priority for acceptance.

Conservation Reserve Program
US Department of Agriculture

Description The Conservation Reserve Program (CRP), introduced in the Food Security Act of 1985, and amended by the Food, Agriculture, Conservation, and Trade Act of 1990, encouraged farmers to enroll highly erodable cropland and/or land contributing to a serious water quality problem into the reserve for 10-15 years. In return, farmers receive annual rental payments for the land, cost-sharing, and technical assistance to plant vegetation for conservation. The major goals of CRP included reducing soil erosion and sedimentation, improving water quality, maintaining fish and wildlife habitat, and providing support income to farmers. Administered by the Consolidated Farm Service Agency in cooperation with the NRCS, Cooperative Extension Service, State

forestry agencies, and local soil and water conservation districts.

Program Status Nationwide, farmers have entered over 36 million acres of, mainly, highly erodible cropland into the CRP and established it to permanent vegetation. The enrollment of additional acreage into this program is not expected. It is likely that there will be considerable changes in the CRP when it is reauthorized and future funding is not clear.

Lands in the program can not be tilled or grazed until the end of the 10 year contract (only lands planted to trees may have a longer contract). Although most CRP lands are classed as "highly erodible", fields often include areas of former wetlands that could be restored. A small acreage of cropland fields containing mainly farmed wetlands or former wetlands was entered into the program in 1988 and 1989. Although landowners may return these lands to crop production at the end of the contract period, much of it is not economical to farm under the requirements for cropping highly erodible lands.

Very few of these fields had their full wetlands values restored. Although CRP funds are no longer available to help restore wetlands on these lands, the landowner may do so at anytime. Non-USDA funds can be used to assist in the restoration, provided that the plans for the restoration are included in the landowners Conservation Plan maintained by the NRCS.

Rural Clean Water Program
US Department of Agriculture

Description The Rural Clean Water Program provides financial and technical assistance to agricultural landowners and operators in 21 selected areas throughout the U.S. where there are significant agriculture-related water pollution and water quality problems. Best management practices are adopted to reduce pollutants entering a stream or lake or underground water or prevent pollutants from leaving their source. Must provide long-term community-wide benefits for assistance.

Eligibility Participants must demonstrate a significant water quality problem and must have an approved water quality plan designed to treat the problem. Privately held agricultural lands, Indian tribal lands and land owned by irrigation districts are eligible.

Partners for Wildlife
U.S. Fish and Wildlife Service

Description The Partners for Wildlife program offers technical and financial assistance to landowners who wish to restore degraded or converted wetlands, riparian, stream and other critical habitats. The program focuses on re-establishment of original natural communities. Special consideration is given to projects that: (a) contribute to the survival of endangered, threatened, or candidate species, or migratory birds of management concern; (b) contribute to the objectives of the National Wildlife Refuge System or the North American Waterfowl Management Plan; (c) are located very close to existing habitat so that fragmentation of habitats would be reduced and recolonization by a full component of native plants and animals could easily occur; (d) contribute to the restoration of globally or nationally imperiled natural communities; (e) will result in a self-sustaining system that is not dependent on artificial structures.

How the Program Works The assistance that Fish and Wildlife Service offers to landowners may take the form of informal advice on the design and location of potential restoration projects, or it may consist of designing and funding restoration projects under a formal cooperative agreement with the landowner. Restoration efforts may include, but are not limited to, plugging drainage ditches, installation of water control structures, dike construction, planting trees in formerly forested wetlands, restoring natural stream channel characteristics, fencing streams and rivers, and

reestablishing natural riparian or prairie grassland vegetation.

If other considerations are roughly equal, cooperative agreements that are 25 years or longer in duration are preferable to those of shorter duration. In no case, however, may cooperative agreements be less than 10 years in duration. Cost-sharing may improve chances that the project will be funded, but it is not required. A restoration project that involves more than $10,000 of FWS funding for the initial restoration work must be justified in terms of biological significance of the work and (a) non-Federal cost-sharing of at least 50 percent or (b) a very large acreage is proposed for restoration. Nationally, an average of 40 percent non-Fish and Wildlife Service cost sharing is a program objective.

Eligibility Subject to priority and preference factors stated above, any degraded or converted wetland or degraded riparian or stream corridor is eligible for restoration with technical and financial assistance by the Service. Upland habitats are eligible for financial assistance only if their restoration will contribute to certain program goals. Contact the Portland Field Office for further information.

North American Wetlands Conservation Act
U.S. Fish and Wildlife Service

Description The North American Wetlands Conservation Act (NAWCA), established in 1989, encourages partnerships among public agencies and other interests to: 1) protect, enhance, restore, and manage wetland ecosystems and other habitats for migratory birds, fish, and wildlife in North America; 2) maintain current or improved distribution of migratory bird populations; and 3) sustain an abundance of waterfowl and other migratory birds consistent with the goals of the North American Waterfowl Management Plan and international treaty obligations.

The Act provides funding for wetlands conservation projects involving acquisition, restoration, and/or enhancement. Funding is approved by the Migratory Bird Conservation Commission (MBCC) based on recommendations from the North American Wetlands Conservation Council (Council). The Fish and Wildlife Service (FWS) coordinates with the Council on the NAWCA and can provide assistance to landowners to develop proposals for submission to the Council and MBCC.

How the Program Works Proposals may be submitted by any group or individual by the second Tuesday in April and August for funding available October 1. A proposal must

describe how the proposed work fits into a larger project (if applicable); the need for the proposal; where the work is to be done; the affect of the proposal on animals, plants and wetland functions; how much the proposal will cost; and partner commitments and responsibilities. A grant application instruction booklet outlining the above information in more detail is available through your FWS Regional Office or the North American Wetlands Conservation Council.

NAWCA grants require a minimum one-to-one grant match from any non-Federal source, such as a State, non-profit groups, or the landowner. Annual payments for leases or easements require a minimum 10-year agreement.

Eligibility Projects involving acquisition, restoration, enhancement, creation, management, and other activities that conserve wetland ecosystems and the fish and wildlife that depend on such habitats are eligible for Act or matching partner funds.

Natural Resource Conservation Service Technical Assistance
Natural Resource Conservation Service

Description The Natural Resource Conservation Service (NRCS) is the technical arm of USDA. Technical assistance and information is available for:

- Making wetlands determinations for wetland protection and management programs;
- developing conservation plans for protecting and managing wetlands;
- providing income-producing alternatives for use and management of wetlands;
- developing standards and specifications and designing and installing conservation measures, including wetland restoration, creation, and enhancement;
- providing information on plant materials for wetland planting; and,
- providing soil surveys and information for identifying, planning, and managing wetlands.

How the Program Works Land users request technical assistance through local soil and water conservation districts. Technical assistance and information is provided according to local priorities and available resources.

Eligibility Land users who sign agreements with local soil and water conservation districts can receive services for managing, using, enhancing, creating, and restoring wetlands, riparian corridors, and other fish and wildlife

habitats. They must comply with the conservation provisions of the Food Security Act of 1985.

Natural Resource Conservation Service Financial Assistance
Natural Resource Conservation Service

Description NRCS provides financial and technical assistance through the Watershed Protection and Flood Prevention Program (PL-566) and the Resource Conservation and Development Program (RC&D). See the RC&D description following this one.

Under the Watershed Protection and Flood Prevention Act of 1954, NRCS assists local communities in developing watershed protection and improving fish and wildlife resources. Both technical and cost-sharing assistance are available.

How the Program Works Under PL-566, NRCS assists state, local, and qualified non-profit organizations with planning and installing water control and conservation measures in small watershed areas. Projects can be undertaken to restore wetlands and natural stream characteristics throughout a small watershed to improve water quality, wildlife habitat, and general living conditions. Technical assistance plus the cost of construction for flood prevention and cost sharing for other purposes is available. Requests are made through local soil and water conservation districts. NRCS assists local sponsors in planning and carrying out RC&D measures in authorized project areas. Projects may include wetland protection, flood plain management, and wildlife developments.

Eligibility All of the above NRCS programs are available to all areas. Persons receiving USDA benefits must comply with the conservation provisions of the Food Security Act of 1985.

Resource, Conservation, and Development
Natural Resource Conservation Service

Description Resource Conservation and Development (RC&D) consists of local people, units of government, and non-profit organizations working together on a multi-county basis to solve problems and develop opportunities for the rural economy. Coordinated assistance provided through the U.S. Department of Agriculture helps these groups develop and carry out action-oriented plans for the social, economic, and environmental betterment of our communities.

How the Program Works RC&D staff assistance varies from providing a sounding board fro ideas to developing a step-by-step plan to reach a goal. The RC&D Coordinator can identify agencies, organization, and individuals who can help complete each step of a plan, outline sources of technical assistance, and suggest possible financial sources.

Eligibility Landowners should contact their local RC &D office to work through one of the sponsoring agencies (such as county commissions, council of governments, soil and water conservation districts, ports, cities, and tribes). Appendix A contains a list of statewide RC&D offices.

North American Waterfowl Management Plan
U.S. Fish and Wildlife Service

Description The North American Waterfowl Management Plan (NAWMP) is an agreement signed in 1986 between the United States and Canada to protect, restore, and enhance wetlands important to waterfowl and other wetland-dependent species. The NAWMP sets out objectives for returning waterfowl populations to levels observed in the 1970's. The plan is implemented at the grassroots level by unique partnerships called joint ventures. Wetlands identified under NAWMP as "areas of major concern" for waterfowl habitat benefit from these joint ventures. Mexico is expected to sign-on to the NAWMP by 1995.

How the Program Works The U.S. Fish and Wildlife Service (FWS) coordinates joint ventures with Federal, State, and private agencies, and private individuals that cooperate and pool resources together to achieve objectives of the plan. Private landowners of wetlands significant to waterfowl may receive technical and financial assistance through the variety of cooperative programs undertaken within their geographic area. The Plan also entails research on wetlands restoration and the effects of contaminants on wetlands, wetlands status surveys, and wetlands inventories. Landowners interested in learning about the joint venture NAWMP projects in their area should contact the joint venture coordinator in their area.

Eligibility Any landowner (Federal, State, group, or individual) of property with significant importance to waterfowl and other wetland-dependent species.

Forest Stewardship Program

U.S. Department of Agriculture, U.S. Forest Service, Oregon Department of Forestry

Description The Forest Stewardship Program (FSP) and Stewardship Incentive Program (SIP) were established through the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA) to help landowners protect and enhance their forest lands and associated wetlands. FSP provides technical assistance to help landowners enhance and protect the timber, fish and wildlife habitat, water quality, wetlands, and recreational and aesthetic values of their property. SIP provides cost-share assistance to private landowners for implementing the management plans developed under the FSP. The guidelines for SIP define eight major categories for funding: Management Plan Development, Reforestation and Afforestation, Forest and Agroforest Improvement, Windbreak and Hedgerow Establishment, Riparian and Wetlands Protection and Improvement, Fisheries Habitat Enhancement, Wildlife Enhancement, and Forest Recreation Enhancement.

FSP and SIP are administered by the State Forester for each State in cooperation with the Forest Service. The Consolidated Farm Service Agency provides administrative assistance. Technical responsibilities for SIP practices may be assigned to various other agencies and resource professionals.

Forest Stewardship Program (FSP), through State Foresters, assists private forest landowners actively manage their forests and related resources. Nationwide in FY 1992 and 1993 technical assistance was provided in the development of resource management plans for 5,406 landowners benefiting nearly 4.4 million acres. National program guidelines require wetlands and 11 other resource elements to be considered and evaluated as part of each plan. The "State Forest Stewardship Coordinating Committee", with a required representation of a wide range of agencies and organizations, meets regularly in each state to provide advice and recommendations on the Forest Stewardship, Stewardship Incentive, and Forest legacy Programs.

Stewardship Incentive Program (SIP) provides landowners with financial cost-share assistance to implement completed Forest Stewardship Plans. SIP-6, Riparian and Wetland Protection and Improvement," is the cost-share practice for restoring and protecting wetlands and riparian areas. Cost-share is authorized for purchase, installation and establishment of plant materials, stream bank stabilization, fencing, and the restoration of natural hydrology.

How the Program Works Oregon state forestry staff work with private landowners to develop a multi-use Forest Stewardship

Resource Conservation Plan specifically for their forested properties. These plans outline a course of action that will enhance forest products, wildlife, soil and water quality, recreation, aesthetics, and environmental quality. Existing management plans can usually be modified to meet Forest Stewardship Plan guidelines. Once a forest management plan has been developed and approved, up to 65 percent cost-share is provided through SIP to fund the plan's projects. Payments to the landowner may not exceed $10,000 per landowner per fiscal year. Significant accomplishments are recognized by designating the landowner "Forest Steward," which gives public recognition to the landowner.

Eligibility Eligible landowners must have an approved Forest Stewardship Plan and own 1,000 acres or less of qualifying land. Authorizations may be obtained for exceptions of up to 5,000 acres. Landowners must maintain and protect SIP funded practices for a minimum of 10 years.

Environmental Education Grants
Environmental Protection Agency

Description Grants to stimulate environmental education by supporting projects to design, demonstrate, or disseminate practices, methods, or techniques related to environmental education. Funds can be used to develop new programs or to significantly improve the quality of existing programs.

How the Program Works Any local or tribal education agency, college or university, state education or environmental agency, not-for-profit organization, or non commercial educational broadcasting entity may submit a pre-application. The project should include (and not be limited to):

- design, demonstration, or dissemination of environmental curricula, including development of educational tools and materials;
- design and demonstration of field methods, practices, and techniques, including assessment of environmental and ecological conditions and analysis of environmental pollution problems;
- projects to understand and assess a specific environmental issue or a specific environmental problem;
- provision of training or related education for teachers, faculty, or related personnel in a specific geographic area or region; and
- design and demonstration of projects to foster international cooperation in addressing environmental issues and problems involving the US and Canada or Mexico.

STATE PROGRAMS FOR WETLAND CONSERVATION AND RESTORATION

Governor's Watershed Enhancement Board
Water Resources Department

Description Grants for watershed restoration, improvement, enhancement, and management. Emphasizes on-the-ground activity. Includes educational projects. Interagency coordination and volunteers are encouraged. Funded projects are selected through a competitive process.

How the Program Works Unrestricted, public and private landowners, organizations. Each Soil and Water Conservation District may apply for $2,000 per biennium.

Oregon Register of Natural Heritage Resources
Oregon Natural Heritage Program

Description The Register is an official list of areas which contain significant natural heritage resources or special species. Inclusion on the register is an official finding by the Oregon Natural Heritage Advisory Council and the State Land Board that an area has significance for biodiversity conservation. Both public and private lands may be registered. An additional step in protection of natural areas in Oregon is the dedication of a registered site as a Natural Heritage Conservation Area. The Oregon tax code provides a property tax exemption for sites dedicated under this program.

How the Program Works Oregon's Natural Heritage Program is responsible for creating a discrete and limited system of registered and dedicated natural areas which are selected to represent the full educational purposes and nature interpretation. Private lands may be place on the Register of Natural Heritage Resources if the owner provides written consent, if the Council recommends the site as fulfilling specific criteria and if the Land Board approves.

The site can be removed from the register at the written request of the owner. A registered site privately owned may also be dedicated as a Natural Heritage Conservation Area if the owner signs a written agreement with the Land Board, terms of which will vary according to circumstances. Procedures for terminating dedication are spelled out in the agreement. The Oregon Natural Heritage Program also maintains the state's most comprehensive natural heritage data base of occurrences of species and natural communities, accessed by land managers and developers both public and private.

Non-Point Source Water Quality Control Section 319
DEQ-Water Quality Division

Description To support on-the-ground conservation, enhancement and education projects directed toward mitigating non-point source pollution, including wetland mitigation or restoration. The main focus of this program is implementation of projects.

How the Program Works Based on how well proposal matches state NPS program needs and issues as assessed in NPS and management plan. Matching funds, with 40% or more non-federal match required.

Salmon Trout Enhancement Program
Oregon Department of Fish and Wildlife

Description To restore and enhance salmon and trout habitat. Volunteers assist ODFW in agency projects including instream, watershed, and education projects.

How the Program Works Anyone interested in volunteering: individuals, landowners, agencies, and people who have skills or equipment to offer.

Fish Restoration and Enhancement Program
Oregon Department of Fish and Wildlife

Description The program was started in 1989 to restore state-owned fish hatcheries, enhance natural fish production, expand hatchery production, and provide additional public access to fishing waters. The Fish and Wildlife Commission has appointed a seven member citizen review board. Three members represent the commercial fishing industry, three represent sports interests, and one represents the at-large public. Projects are funded only if recommended by the Board and approved by the Commission.

How the Program Works The restoration program focuses on Department projects to repair fish hatcheries and fish passage facilities, and collect information on physical and biological characteristics of streams, lakes, or estuaries. The enhancement program focuses on projects to increase fish production, increase recreational or commercial opportunities or access to the fish resource, or improve fish management capabilities.

Extension Natural Resource Education Programs

OSU Extension Service

Description The Oregon Cooperative Extension Service was originally established as part of the universities' three part mission of teaching-research-extension. The Extension Service educates citizens to apply practical, research-based knowledge to critical issues, including wetlands conservation, which face individuals, families, communities and our global partners. Its mission is "Educating People To Help Themselves." Program areas include natural resources, agriculture, horticulture, home economics, 4-H youth development, and more. The total Extension effort is accomplished through a large informal network of county and regional offices that offer seminars, workshops, publications, volunteer training and other assistance to educate citizens. These programs are accomplished by working cooperatively with many organizations, agencies, and volunteers.

How the Program Works The County and Regional Extension Agents work with many organizations to organize education functions. The programs that provide information on wetlands and related topics are listed below. Additional programs can be found by contacting the local Cooperative Extension agent.

- County Farm Meetings- each county typically holds educational meetings, usually in the winter, for farmers. Call the local Extension Office for time and place.

- Income Opportunities Utilizing Your Natural Resources - enterprises related to forestry, wildlife, recreation, horticulture and more.

Open Space Deferral
Oregon Revenue Department

Description Provides a tax incentive by assessing property for its open space use and not the "highest and best use".

How the Program Works Landowner applies for designation through city or county planning office. Landowner must obtain comprehensive plan change of parcel to "open space" designation.

Coastal Zone Management Act
Division of State Lands, NOAA

Description In 1974 the state of Oregon set national precedent by establishing the South Slough National

Estuarine Research Reserve (NERR). Oregon was the first state to participate in the National Estuarine Research Reserve program, which was established by Congress in 1972 as part of the Coastal Zone Management Act.

The purpose of the NERR System is to enhance scientific and public understanding of estuaries, and thereby contribute to improved estuarine management. The System creates and maintains sites appropriate for long-term estuarine research, education and interpretation, and supports and coordinates research and education programs. Through the mutual commitment of state and Federal government over the past twenty years, South Slough NERR has steadily developed a range of opportunities and services for scientists, educators, and the general public.

There are currently twenty-three Reserves in the System, four of them on the west coast. South Slough NERR is representative of the Colombian bioregion (Cape Mendicino, California, to the Canadian border), with a particular focus on the mid-Pacific region (Cape Mendicino to the Columbia River estuary). South Slough NERR is located in an arm of the Coos estuary near Charleston, Oregon, west of the cities of North Bend and Coos Bay. The Reserve receives significant federal financial grant assistance, technical assistance and oversight through the Sanctuaries and Reserves Division (SRD) of the National Oceanographic and Atmospheric Administration (NOAA). Administrative support, including salaries for five of six staff members, is managed by the Oregon Division of State Lands (DSL). Reserve management policy and operation is determined by an eight-member Commission appointed by the Governor.

How the Program Works Private landowners who have estuarine wetlands on their property can contact the Division of State Land for technical assistance.

NONPROFIT ORGANIZATIONS AND LAND TRUSTS

American Farmland Trust

Description The American Farmland Trust (AFT) is a non-profit organization that works with farmers, business people, legislators, and conservationists to encourage sound farming practices and preserve America's most critical agricultural resources. AFT conducts on-farm research and demonstration projects with grass-roots sustainable agriculture organizations and farmers to develop and encourage the use of sound environmental farming practices. AFT also provides advice to private landowners on ways to include conservation strategies in land-use and estate plans

for farmers, and accepts donations of land and conservation easements for conservation purposes.

How the Program Works The Farm Legacy Program is a new AFT program that encourages individuals owning farms threatened by development to donate their lands to AFT. Farm Legacy is a very flexible program, allowing the prospective donor and AFT staff to structure gifts to meet the landowner's needs. Landowners donating their agricultural lands to AFT may retain lifetime use of the property. Donors may also receive significant income and estate-tax deductions. Upon receiving the donated property, AFT will sell the farm with conservation easements to guarantee the preservation of the property. Proceeds from the sale will then be used to protect other threatened farms.

In addition to agricultural properties, AFT also accepts nonfarm properties and appreciated securities to the Farm Legacy Program. The Farm Legacy Program, which will help to preserve wetlands located on agricultural lands that might otherwise be sold for development purposes, can potentially be coupled with other programs such as the Conservation Reserve Program to provide additional benefits to current and future landowners.

Eligibility AFT offers assistance to owners of lands with historical, agricultural, and environmental significance. For more information contact AFT at 1920 N Street, NW, Washington, D.C. 20036; (202) 659-5170.

The MARSH Program
Ducks Unlimited

Description The Matching Aid to Restore States Habitat (MARSH) Program was begun in 1985 to provide matching funds to public agencies and private conservation groups for projects significantly benefiting waterfowl. Private landowners can benefit from the funding provided through MARSH if waterfowl and habitat restoration projects on their property qualify for the funding and is applied for by the agency or group working with the landowner.

How the Program Works MARSH project proposals should be developed and submitted to the MARSH coordinator by the agency or conservation group developing a habitat project. These proposals should include all pertinent information regarding location, legal description, ownership, management objectives, description of work, projected costs, and any supplementary support information pertinent to the project. Once the MARSH coordinator receives all of the necessary

information, he will visit those sites with the most potential and prepare project evaluations.

Projects that lead to the protection and/or restoration of North American Waterfowl Management Plan (NAWMP) sites, benefiting non-game, threatened or endangered species, unique habitats or ecosystems, and/or having high public visibility or interpretive values, in addition to providing substantial waterfowl values, will receive priority for MARSH funding. Maximum cost-share assistance under the MARSH program is 50 percent.

Eligibility DU will consider proposals from any public agency or private conservation groups who are 1) able to execute long-term habitat agreements, 2) capable of delivering and managing the projects proposed, and 3) willing to assume all liability associated with the project. MARSH projects must be on lands under management control or oversight of a public agency or private cooperators. For more information contact Ducks Unlimited, West Coast Office, 9823 Old Winer Place #16, Sacramento, CA, 95827; (916) 363-8257.

The Nature Conservancy
Oregon Chapter

Description The Nature Conservancy (TNC) is an international, non-profit, science-based, membership organization whose mission is to preserve animals, plants, and natural communities representing the diversity of life on Earth by protecting the lands and waters they need to survive. The Conservancy owns and manages the world's largest system of private nature sanctuaries, including more than 50 preserves in Oregon. The Nature Conservancy provides information to private landowners on methods of protecting natural areas, including acquisition, conservation easements, bargain sales, donations, and other voluntary agreements. The organization also provides information on management practices and other scientific information.

For more information contact The Nature Conservancy's Oregon Chapter at 1205 NW 25th Avenue, Portland, OR, 97210; (503) 228-9561.

Trust for Public Land
Oregon Field Office

Description The Trust for Public Land (TPL) is a national nonprofit land conservation organization dedicated to

conserving land for people to enjoy as parks, community gardens, recreational and natural areas. Founded 20 years ago, TPL is a problem-solving organization that helps communities, public agencies, and nonprofit groups acquire and protect open space for public use. The Oregon Field Office is working to preserve Oregon's livability in the face of population growth by acquiring and protecting recreational, scenic, historic and ecologically significant land in the Portland metropolitan area, the Columbia Gorge, the Coast and throughout Oregon. TPL has protected 46,821 acres, valued at $58 million, in Oregon and the Columbia Gorge since 1979.

How the Program Works Property owners make a donation to TPL by selling land at below its fair market value. TPL then recovers this donation when it resells the land to a public agency, which provides permanent stewardship.

Eligibility Desirable open land. For more information contact TPL's Oregon Field Office at 1211 SW 6th Avenue, Portland, OR, 97204; (503) 228-6620.

The Wetlands Conservancy

Description The Wetlands Conservancy (TWC) is a nonprofit land trust dedicated to the preservation of Oregon's irreplaceable wetland. TWC acquires and manages wetlands for wildlife habitat, public enjoyment, education, and research. While the focus is on wetlands, TWC will accept associated uplands; they also take trade lands (land that they can trade or sell to acquire additional wetland property). They are a membership organization.

How the Program Works Based on the landowners needs, a number of options are available, including outright donation, donation by devise, bargain sale, full market value sale.

Eligibility In order for property to be considered for acceptance, one or more of the following three conditions should exist. If only one condition exists, or has the potential to meet that condition, it should be of very high or unique value for the site. Determination will be made on a site by site basis.

1. The property has local ecological value or significance; i.e., wildlife habitat/plant communities, flood plain, etc.

2. The property is of scientific or educational value to local citizens; i.e., is, or can be, used by schools, scout

groups, nature study groups, or individuals for education research for all age groups.

3. The property has value as a passive recreational site; i.e., nature study, bird watching, hiking, photography, or visual observation.

There are additional criteria and agreements; please contact The Wetlands Conservancy for that information and to discuss your particular situation: P.O. Box 1195, Tualatin, Oregon, 97062; (503) 691-1394.

Audubon Society of Portland

Description While not a land trust nor an organization that wished to own land, the Audubon Society of Portland (PAS) has worked extensively with agencies and private land owners on stewardship efforts. Their focus is on protection of fish and wildlife habitat throughout the state of Oregon, with a special emphasis on urban wetlands and stream habitats. PAS will work with other non-profits and private landowners to assist in wetland stewardship options.

How the Program Works On a case-by-case basis, and on a staff-availability basis, PAS will respond to requests for wildlife and wildlife habitat assessments.

Eligibility Willingness on part of private landowner and staff or volunteer availability; usually limited to the Portland Metro area. Contact PAS at (503) 225-9912, FAX (503) 292-1021 or 5151 NW Cornell Road, Portland, Oregon, 97210.

Oregon Wetlands Joint Venture

Description Oregon Wetlands Joint Venture is a loose coalition of private groups working with government agencies to protect, restore, and enhance important wetland habitats throughout Oregon. The organization serves as the Oregon steering committee for the Pacific Coast and Intermountain West Joint Ventures, two larger regional partnership efforts initiated under the North American Waterfowl Management Plan. Oregon Wetlands Joint Venture's primary mission is to coordinate and promote cooperative efforts to protect and restore wetlands in areas with important habitat values. The Joint Venture emphasizes non-regulatory conservation strategies and focuses its efforts on the state's largest and most important blocks of wetland habitat.

How the Program Works The Joint Venture helps coordinate the efforts of cooperating agencies and organizations and works to create public-private and state-Federal partnerships for wetland conservation projects. The Joint Venture does not fund projects itself, but does help agencies and organizations identify potential funding sources and secure project financing under a variety of Federal, state, and private programs.

Oregon Wetlands Joint Venture's steering committee is made up of private organizations and currently includes Defenders of Wildlife, Ducks Unlimited, National Audubon Society, Oregon Duck Hunters Association, Oregon Farm Bureau, Oregon Trout, Oregon Waterfowl and Wetlands Association, The Nature Conservancy, and The Trust for Public Land. Cooperating state agencies include Oregon's Department of Fish and Wildlife, and the Division of State Lands. Federal agencies include the U.S. Fish and Wildlife Service, Forest Service, Bureau of Land Management, Natural Resources Conservation Service, Corps of Engineers, and Bureau of Reclamation.

The Joint Venture's efforts in Oregon began in 1991 with the establishment of the Pacific Coast Joint Venture, an international effort targeting critical coastal wetlands in western Oregon, Washington, British Columbia, and northern California. The Oregon partners expanded their focus statewide in 1995 following the establishment of the Intermountain West Joint Venture, which encompasses eastern Oregon and interior portions of ten other states.

The Joint Venture has played an active role in a variety of habitat conservation efforts, including wetland restoration and enhancement on public and private lands; land acquisition; and educator training programs. The organization also serves as a communications link and is active in wetlands policy and planning at the state level.

For more information, contact Bruce Taylor at Oregon Wetlands Joint Venture, 1637 Laurel Street, Lake Oswego, OR 97034; (503) 697-3889.

APPENDIX E

WETLAND RESTORATION PROGRAM/FUNDING MATRIX

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Wetlands Reserve Program.	ASCS	RP	To purchase easements by ASCS from willing landowners of eligible land. To restore the hydrology and native vegetation close to its original condition. To protect functions and values of wetlands. Goal was to enroll 1 million acres by 1995.	Agricultural landowners who owned the land for at least the preceding 12 months prior to the end of the sign-up period (with two exceptions).	Yes, NRCS in consultation with USFWS and other cooperators.	None currently in Oregon. Purchase of easement. Cost-share to landowner for implementing management plan.	Open	Program still in pilot phase operating in nine states. Eligible land includes riparian areas, wetlands farmed under natural conditions, farmed wetland, or prior converted wetlands, and riparian areas.	Program still in pilot phase operating in nine states. Eligible land includes riparian areas, wetlands farmed under natural conditions, farmed wetland, or prior converted wetlands.	Apply through local ASCS committee.
Conservation Reserve Program.	ASCS	CR	To conserve highly erodible lands by taking them out of production. Permanent cover is planted on lands.	Funds may be used by landowners or agencies to conserve highly erodible lands. Limited to 25% of cropland in any given county.	Extension Service, NRCS State Forestry, local soil and water conservation districts.	Compensation for land taken out of production. Up to 50% of the cost of establishing vegetative cover. Maximum of $50,000 per year per farm.	Landowner agrees to plant permanent cover and maintain for duration of a project. Part of Food Securities Act of 1985. 10-year management agreement with landowner, with first ones due to expire in 1996.	National, according to eligibility criteria. Potential of 40-45 million acres.	Nationally, this program has had little effect on wetlands, and virtually none in Oregon. Shallow water provisions were deleted in 1990 and placed in Wetland Reserve Program. Oregon stayed away from allocating funds for shallow water areas in anticipation of Wetland Reserve Program. Assess potential for using this program for restoring riverine and gully areas. Explore opportunities for water storage areas for wildlife.	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Northwest Power Act.	Northwest Power Planning Council/Bonneville Power Authority.	CRP	The Council develops policies and facilitates partnerships between agencies that are directed toward hydroelectric mitigation for fish and wildlife, including restoration. The Council is required to identify the unmet mitigation needs of the Columbia River system. The Council directs BPA funding to achieve fish and wildlife goals.	N/A	Cooperating agencies.	Congressional and BPA appropriations fund agency projects that follow the councils policy directives. For FY 93, the Council was instrumental in getting $8 million for the Forest Service in Region 6. They have secured $30-35 million for salmon and steelhead projects.	On-going.	Columbia River watershed.	Policy directives have stressed importance of watershed level management, including conservation and protection of wetlands. Some fish and wildlife monies have been spent on wildlife habitat projects including purchase of wetlands. Currently negotiating with Oregon on unmet wildlife mitigation needs.	N/A
Resource, Conservation and Development.	NRCS, federal.	PREd	Federal grants to RC&D areas to accelerate resource projects and programs in multi-county areas as a base for economic development and environmental protection.	Landowner association and interest groups. Local councils award money from RC&D areas.	Cooperating agencies and groups.	$50,000-75,000 per area per year.	Annual grants.	Statewide; projects on district basis.	Linkage to wetlands appears to be 1) environmental protection in the course of economic development or 2) using wetlands as a strategy for economic development. This is an excellent source of funds for demonstration projects.	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Section 319, Non-Point Source Water Quality Control Program.	Department of Environmental Quality with funds from EPA.	CEEd R	To support on-the-ground conservation, enhancement and education projects directed towards mitigating non-point source pollution, including wetland mitigation or restoration.	Eligibility based on how well proposal matches state NPS program needs and issues as assessed in NPS and management plan.	Cooperating agencies, NRCS, ODA, ASCS.	Examples include riparian protection, protection of surface and ground water quality, public awareness and increase in-stream water supplies. 40%or more non-federal match required.		Statewide	Wetlands are a statutorily designated priority. Rare and endangered species are also a priority. Linkage to wetlands through water quality functions, especially in watershed context and related to mitigating non-point source pollution. A good source of matching funds for GWEB projects.	
Wetland Program Enhancement Grant.	EPA	PRC	EPA supports wetland program enhancements as needed to plan, augment, and implement a regulatory and non-regulatory wetland management program.	State agencies.		Regional and national awards have been offered and received for planning, protection, restoration, education, regulation, planning and public land management elements. Funds cover staff, policy development workshops, and document preparation and publication.			Wetland Program Enhancement has been instrumental in enhancing the Oregon wetlands program during the past 3 years.	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Coastal Wetlands Planning, Protection and Restoration Act (1990), Coastal Wetland Conservation Grants.	USFWS	CRP	Authorizes funding from the Sport Fish Restoration Account for coastal and Great Lakes wetland conservation projects. Priority given to acquisition of natural estuarine wetlands. Funds are also available for resource restoration, enhancement or management.	State agencies apply for grants (e.g. ODFW, DSL).	State agencies.	50-50 Federal to State Match, or 75-25 if state has a land trust for acquisition of wetlands or open space. Between $5 and $7 million available, nationally. Grant program receives 18% of Sport Fish Restoration Account, 70% of which is earmarked for Louisiana.	Program began in 1990; one granting cycle completed.	Coastal and Great Lakes states, primarily for coastal wetlands.	Dependent on matching funds from state. No grants awarded in Oregon yet, largely due to lack of state matching funds and effective land acquisition trust program.	
Fish Restoration and Enhancement Program.	ODFW	ER	To restore state-owned fish to hatcheries, enhance natural fish production, expand hatchery production, and provide additional public access to fishing waters.	Any public or private non-profit organization.	Applicants may seek assistance from state and federal agencies.	Half funding toward hatcheries and half to enhancement projects, including in-stream and riparian restoration. Approximately $4 million per biennium, $3.5 million from fees and $.5 million from lottery funds. Money raised from surcharge on sport.	Since 1989. Grants must be spent within the biennium in which they are awarded.	Statewide.	Competitive grant program. Proposals with matching funds given extra weight. Linkage to wetlands through fisheries production. There is potential to link upland projects with this source of funding such as larger landscape level projects production. Potential source of funds for salmon restoration and management.	No due dates on submissions proposals reviewed and awards made quarterly.

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Intermodel Surface Transportation Efficiency Act of 1991 (ISTEA).	ODOT	PRC Ed	Enhance the cultural and environmental value of the states transportation system. Proposed projects must meet one or more enhancement categories and have a direct relationship with a transportation system via function, proximity, or impact.	Funds are oriented primarily toward local government, wetland protection, restoration, or enhancement. Must be identified as a priority of the local government. In addition, the project must support intermodel transportation, be consistent with local, state and federal plans, and be supported by local cost-share (to support maintenance of the ecosystem).	Federal, state, and local government (MPO) agencies and other interested parties.	Acquisition of scenic easements and scenic or historic sites. Mitigation of water pollution due to highway runoff. Funds could be oriented towards conservation, protection, andenhancement of existing wetlands impacted by highway improvements. The program will explore its support of funding mitigation banks and interpretive areas. Matching funds of 10.27% required.	Program initiated in 1992. Projects funded for a 2-year duration. Program will need to be re-approved in 1996.	Statewide examples include the North Santiam Highway area, estuarine areas (Siletz Bay) and priority wetlands adjacent to highways or proposed highways.	Feasible for wetland conservation, restoration, and protection efforts post-1987, especially if WCPs are prepared.¥ Opportunity to marry this effort with Wetland Mitigation Bank efforts. Has increased potential if re-authorized in 1996.	
Rural Clean Water Program (RCWP).	ASCS in cooperation with soil conservation districts and other state and federal agencies.	R	Provides financial and technical assistance to agricultural landowners and operators in 21 selected areas throughout the U.S. where there are significant agriculture-related water pollution and water quality problems. Best management practices adopted to reduce pollutants entering a stream or lake or underground water or to prevent pollutants from leaving their source. Must provide long-term community-wide benefits for assistance.	Participants must demonstrate a significant water quality problem and must have an approved water quality plan designed to treat the problem. Privately held agricultural lands, Indian tribal lands and land owned by irrigation districts are eligible.	NRCS, Extension Service, EPA, state water quality agency, state forestry.	Practices to improve water quality, which may involve wetlands. 75% cost-share, no annual limit but total limit to a participant is $50,000. Currently, none in Oregon.	Cost-share practice must be maintained for a minimum of 5 years or for life span of the contract if more than 5 years.	Tillamook County (project now complete, although contract is still in effect).	Limited to agricultural, Native American, and irrigated land.¥ This program was designed primarily for the Midwest and East. Only one project was funded in Oregon. ASCS would like to expand the program. Need to explore potential for watershed planning and implementation efforts.	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Critical Habitat Private Sector Reinvest in Minnesota.(Reinvest in Minnesota Resources).	Minnesota Department of Natural Resources.	PR	Provides a means for private individuals and groups to help fund the cost of acquiring and developing critical fish and wildlife habitat. Contributions to the program are matched dollar-for-dollar with state funds appropriated to the account.	Anyone with money or land to donate.		50-50 state and private match.	On-going.	Minnesota.	A private-public partnership to raise money in a state that has lost 85% of its wetlands and 99% of its tall-grass prairie.	
Other foundations.	Oregon Community Foundation, 621 SW Morrison, Suite 725, Portland, OR 97205. Metro Green Spaces, 2000 SW First St., Portland, OR 97201. Tel. 221-1646. Collins Foundation. Tektronix Foundation. Portland General Electric Co. Ford Foundation, 320 E 43rd St., New York, NY 10017. Tel. (212)586-8621. Standard Oil Co. Corp. Contributions and Community Affairs. Tel. (216)586-8621. American Natural Resources Community Investment Program, 1 Woodward Ave., Detroit, MI. ARCO Foundation, 515 Flower St., Los Angeles, CA 90071. Tel. (213)486-3342. Weyerhaeuser Co. Foundation, Tacoma, WA 98477. Tel. (206)924-3157.	Granting agencies.	Non-profit organizations.		Variable.			These foundations support natural resource projects and should be explored in greater detail.		

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Agricultural Conservation Program (ACP); two subprograms are Wildlife Habitat for Food and Cover, and Shallow Water Areas for Wildlife.	ASCS	RPEC	To restore and protect nation's land and water resources and preserve the environment. To help prevent soil erosion and water pollution; protect and improve productive farm and ranch land; conserve water used in agriculture; preserve and develop wildlife habitat; and encourage energy conservation measures.	All farmers and ranchers who establish the need for cost-share assistance in solving resource conservation problems. Erosion and pollution problems receive the highest priority.	NRCS, USFS, State forestry agencies, Extension Service.	Examples: permanent vegetative cover, development of seeps, seeps and wells, environmental and wildlife enhancement, rehabilitation of shallow water areas to support wildlife. Allocation fir federal to state and county committees. This is a cost share program. Maximum of $3,500 per person per year, or up to 75% of the cost (varies according to county) to install practices (higher if approved by Sec. of Ag.) In recent years, about 10% of annual ACP money (or $33,500) spent on wildlife program. Amount directed to wetland habitat not known.	**Annual contracts, although some management plans are designed for implementatio n over several years.**	Statewide	Producers may enter into pooling agreements to jointly solve mutual conservation programs. Not specific to wetlands, although they may be addressed in the context of wildlife and erosion control functions. Wetlands and shallow ponds were created in Benton, Polk, and Yamhill counties. Projects are funded according to county priorities. Wetland work most likely in the counties that recognize wetlands as a priority.	Apply through local ASCS committees.
Salmon Trout Enhancement Program (STEP)	ODFW	EREd	To restore and enhance salmon and trout habitat. Volunteers assist ODFW in agency projects, including instream, watershed, and education projects.	**Anyone interested in volunteering-individuals, landowners, agencies, people who have skills or equipment to offer.**	ODFW	Technical assistance by ODFW with limited funds available for materials. Education and field projects supported. About $900,000 per year form state and federal agencies.	**Most projects are completed within annual funding cycle.**	Statewide.	STEP Projects get involved in riparian and watershed enhancement activities (education and on-ground) that may involve wetlands. Stream Scene curriculum includes watershed perspective Needs to expand to include more work in associated riparian and wetland habitat.	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Stewardship Incentive Program (SIP).	ASCS, in cooperation with Oregon Department of Forestry.	CPER Ed	Federal/state program with woodland owners to protect and enhance all the forest resources with an emphasis on tree planting and timber stand improvement activities. Program aimed at soil and water protection and wildlife improvements.	Woodland owners (individual, partnership, or corporate) with forest land or land suitable for growing trees. Most own 5 to 1,000 acres of forest lands in western Oregon or 10 to 1,000 acres in eastern Oregon. Owners with 1,000 to 5,000 acres may request a waiver through Dept. of Forestry.	ODF	Approved management practices such as tree planting, timber stand improvement, site preparation, non-commercial thinning, wildlife and fisheries enhancement, wind-breaks, and recreation and riparian improvement. $10,000 annual limit. Cost-sharing from 50 to 75% of actual or estimated cost. About $475,000 available in Oregon.	Annual.	National.	Wetlands receive the benefit of management to the extent they are addressed in the management plan. Focus on wetlands, wildlife, and water quality enhances opportunities for funding. Research and education assistance supplied by OSU. Extension Service. ODF has demonstrated interest in exploring cooperative opportunities to protect and restore wetlands with special orientation towards soil and water protection and wildlife improvement. 10 wetlands projects have been funded.	
USFWS Private Lands Initiatives (A.K.A. Partners for wildlife)	USFWS	RCE	To restore, create, and enhance fish and wildlife habitat on private lands, especially wetlands and riparian areas.	Private landowners.	USFWS, NRCS, stare resource agencies.	Cost-sharing for construction and implementation of management practices $10,000 per landowner per year. Phased, multi-year projects are possible. About $800,000 to 1.0 million per year for 7 western states with Oregon receiving $100,000 to $120,000. Project proposals complete for funding at regional level with about 70% approval for Oregon.	Funded annually, projects in place for minimum 10 years. Some projects are in perpetuity. Repayment required if practices are not maintained.	National.	A common practice is to link money available from this source with other ASCS programs to create a conservation package that is larger than any single program. Chances for funding and conservation impact is greater with linkages. This program is administratively understaffed. Back-log of potential projects numbered 40 to 50 as of Dec. 1992. Acquiring necessary permits for work in waterways sometimes takes 2 years, which drops proposal out of current funding cycle, requiring re-submission in competitive grant process.	Open. Proposals initiated by landowner, often upon recommendati on of NRCS.

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Land and Water Conservation Funds.	Oregon Dept. of State and Parks Recreation.	CREd	Provides matching grants to states and through states to local governments for acquisition and development of public outdoor recreational areas and facilities. Wetland and natural areas may be included as part of recreational area.	Local governments.	N/A	Acquisition and development of outdoor recreation areas and facilities. 50-50 matching between state and local government. $356,000 available in FY 93. 20% of projects funded.	Since 1965.	National.	State funding from National Park Service has fluctuated between $0.2 and $3.0 million. Potential source of funding for wildlife viewing area and wetland interpretation center. Funds may not be used for maintenance.	Apply Oct.1 to Jan.1 for funds in the following federal fiscal year.
Pittman-Robertson and Kingell-Johnson Acts.	USFWS, state fish and wildlife agencies (ODFW in Oregon).	CR	Federally collected money allocated to states for fish and wildlife research and habitat restoration.	ODFW or sub-contractors (e.g., Dept. of Fish and Wildlife, Oregon State University).		Funds are used for habitat enhancement, maintenance and acquisition, research, aquatic and hunter education, surveys and fish production. Wetlands acquisition, restoration, and management are eligible. Funds collected from taxes on hunting and fishing equipment, as well as a portion of the gasoline tax. About $350 million collected annually.		National.	Linkage to wetlands is through fish and wildlife function of wetlands. States have broad leeway in how funds will be spent. Greater emphasis on wetlands would probably require strong political directives. Need to explore potential for directing more research to wetlands. Need to lobby ODFW to give more financial support to wetland habitat for wildlife.	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Public Law 566 Watershed Program.	NRCS	ECPR	Federal grants for planning, flood protection, and implementation for watershed protection and management.	State agencies or qualified local organizations. Maximum size of 250,000 acres.		Reduction of soil erosion, siltation, and flooding; agricultural water management; improve fish and wildlife resources; provide recreation; recharge ground water reservoirs; and provide water quality management. Awards limited to $5 million per Council. Maximum of $1 million can be authorized by state NRCS, above to Washington D.C. for approval.		National.	Linkage to these funds for wetlands is through functions: water quality, ground water recharge, recreation, fish and wildlife resources. Explore opportunities for cooperative watershed health and improvement efforts.	
State-level dedicated taxes for conservation.	Various states.	CPR	These programs address how to generate income for environmental protection and conservation without having to compete with other agencies for general fund revenue. Possibilities include: Excise taxes Tax on property transfers Sales tax Bonds Fees Lottery Severance tax						Creates dedicated funding source that has worked well in FL, LA, WA, and TN. In Oregon, GWEB, and ODFW receive lottery funds. New taxes currently unpopular with Oregon voters..	

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
Governor's Watershed Enhancement Board.	GWEB, state (OR).	EREd	Grants for watershed restoration, improvement, enhancement and management. Emphasizes on-the-ground activity. Includes educational projects. Interagency coordination and volunteers are encouraged. Funded projects are selected through a competitive process.	Unrestricted, public and private landowners, organizations. Each SWCD may apply for $2,000 per biennium.	Yes, cooperative agencies include NRCS, ODF, BLM, Extension Service, USFS, ODFW, and others.	Grants awarded annually. $500,000 proposed for 1993-1995 biennium. Matching funds from other sources required (federal, state, or private). Most project grants are less than $20,000. Funding from lottery revenues.	Money must be spent within the biennium in which it is awarded. Five-year post-project monitoring.	Statewide.	Budgeted lottery revenue not always available although full amount received last biennium. Number of grant applications far exceeds funding capabilities. Few applications and projects for wetland enhancement. Need to educate land-owners with wetlands about GWEB criteria. Grants awarded on basis of individual merit with relatively little focus on geographic priority or priority problem areas.	Apply Nov. 1 to Feb. 28; awards made once each spring. Contact GWEB for application packet.
Natural Resource Conservation Service Financial Assistance.	NRCS.	PR	NRCS provides financial and technical assistance for local communities in developing watershed protection and improving fish and wildlife resources.	State and Local Governments and qualified non-profit organizations.	Projects can be undertaken to restore wetlands and natural stream characteristics throughout a small watershed to improve water quality, wildlife habitat, and general living conditions.	The cost of construction for flood prevention and cost sharing for other purposes is available.		Nationally.		

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
North American Wetlands Conservation Act.	USFW	CEPR PI	To protect, enhance, restore, and manage wetland ecosystems. To maintain current or improved distribution of migratory bird populations. Sustain an abundance of waterfowl and other migratory birds consistent with goals of the North American Waterfowl Management Plan.	Projects involving acquisition, restoration, enhancement, creation, management and other activities that conserve wetland ecosystems and wildlife that depend on such habitats.	FWS can provide assistance in developing proposals for submission.	Provides funding for projects involving acquisition, restoration, and enhancement. Funding approved by Migratory Bird Conservation Commission (MBCC).		Nationally.		Proposals may be submitted by the second Tuesday in April and August for funding available Oct. 1. Proposal must describe how the proposed work fits into a larger project, the need for the proposal, where the work is to be done, the effect of proposed work on animals, plants, and wetland functions, cost, and partner commitments and responsibilities. Instructional booklet available through FWS Regional Office.
Natural Resource Conservation Service Technical Assistance.	NRCS is the technical arm of USDA.	PRE PI	Land users request technical assistance through local soil and water conservation districts. Technical assistance is provided according to local priorities and available resources.	Land users who sign agreements with local soil and water conservation districts can receive services for managing, using, enhancing, creating, and restoring wetlands, riparian corridors, and other fish and wildlife habitats. Must comply with conservation provisions of the Food Security Act of 1985.	Technical assistance and information is available for: 1) Making wetlands determinations for wetland protection and management programs; 2) Developing conservation plans for protecting and managing wetlands; 3) providing income-producing alternatives for use and management of wetlands; and 4) developing standards and specifications and designing and installing conservation measures, including wetland restoration, creation, and enhancement.			Nationally.		

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
North American Waterfowl Management Plan.	USFWS	PRE	The North American Waterfowl Management Plan (NAWMP) is an agreement signed in 1986 between the US and Canada to protect, restore, and enhance wetlands important to waterfowl and other wetland dependent species. The NAWMP establishes objectives for returning waterfowl populations to levels observed in the 1970's. Mexico is expected to sign-on to the NAWMP by 1995.	Any landowner (Federal, State, group or individual) of property with significant importance to waterfowl and other wetland dependent species.	Private landowners of wetlands significant to waterfowl may receive technical and financial assistance through the variety of cooperative programs undertaken in their area.	USFWS coordinates joint ventures with Federal, State, and private agencies, and private individuals that cooperate and pool resources together to achieve plan objectives.		Nationally.		Landowners interested in joint venture NAWMP projects should contact the joint venture coordinator in their area.
Forest Stewardship Program.	USDA USFS	PR	The Forest Stewardship Program (FSP) and Stewardship Incentive Program (SIP) were established through the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA) to help landowners protect and enhance their forest lands and associated wetlands. SIP-6, "Riparian and Wetland Protection and Improvement," is the cost-share practice for restoring and protecting wetland and riparian areas.	Landowner must have an approved Forest Stewardship Plan and own 1,000 acres or less of qualifying land. Exceptions of up to 5,000 acres may be obtained.	FSP provides technical assistance to help landowners enhance and protect timber, fish, and wildlife habitat, water quality, wetlands, and recreational and aesthetic values of their property. SIP provides cost-share assistance for implementing the management plans developed under the FSP.	Payments to the landowner may not exceed $10,000 per landowner per fiscal year.	Landowners must maintain and protect SIP funded practices for a minimum of 10 years.	Nationally.		

Program	Administrator	Type	Summary	Eligibility	Technical Assistance	Funding Availability	Duration	Geographic Coverage	Evaluation	Application Guidelines
The Matching Aid to Restore States Habitat (MARSH) Program	Ducks Unlimited.	PR	MARSH Program provides matching funding to public agencies and private conservation groups for projects significantly benefiting waterfowl.	Proposals will be considered from any agency or group who are: 1) able to execute long-term habitat agreements; 2) capable of delivering and managing the projects proposed; and 3) willing to assume all liability associated with the project.		Maximum cost-share assistance under the MARSH program in 50 percent.			Projects that lead to the protection and/or restoration of NAWMP sites, benefiting non-game, threatened or endangered species, unique habitats or ecosystems, and/or having high public visibility or interpretive values, in addition to providing substantial waterfowl values, will receive priority for MARSH funding.	Proposals should include all pertinent information regarding location, legal description, ownership, management objectives, description of work, projected costs, and any supplementary information pertinent to the project.

APPENDIX F

OREGON WETLAND RESTORATION PROJECT INVENTORY

- **Astoria Mitigation Bank**

Contact: Ken Bierly
Oregon Division of State Lands
775 Summer St.
Salem, OR 97530

This 14.4 ha site adjacent to Young's Bay on the Columbia River is owned by the Division of State Lands as the state's first mitigation bank. The area was diked for pasture uses in the late 1890's and had converted to pasture vegetation, shrubs, and small trees. In 1987 five large breaches were made in the dike and tidal flow was allowed to return. Hydrologic problems were apparent early, including poor tidal circulation and creation of a freshwater wetland where a brackish one was proposed. The fact that the newly created freshwater wetland is fully functioning may still provide an opportunity for payment-in-lieu mitigation, but with palustrine systems instead of estuarine or riverine tidal.

- **Dalton Creek Restoration Project**, South Slough National Estuarine Research Reserve (SSNERR): Charleston, OR.

Contact: Craig Cornu
South Slough National Estuarine Research Reserve
P. O. Box 5417
Charleston, OR 97420
(503) 888-5558

The goal of the Dalton Creek restoration project was to increase habitat complexity of the stream. Primary goals of the restoration project were to 1) reintroduce woody debris into stream channels as fish habitat, 2) promote hydrodynamic functions of scour pools and channel meanders, 3) formation of hydric soils through elevation of the water table, and 4) enhance species composition and diversity of streamside vegetation. The Dalton Creek restoration project is one of several restoration elements of the South Slough Estuary

Conservation Strategy. The project is located along Dalton Creek in the South Slough National Estuarine Research Reserve in Charleston, Oregon. SSNERR is operated as a partnership between the Oregon Division of State Lands (ODSL) and the National Oceanic and Atmospheric Administration/ Sanctuaries and Reserves Division (NOAA/SRD).

- **Dunn Wetland Project**: Corvallis, OR.

Contact: Michael Dunn
720 NW 34th St.
Corvallis, OR 97330
(503) 754-9517

George Ice
SWCD
305 SW C St. #5
Corvallis, OR 97333
(503) 757-7285

The project as proposed will create approximately 26 acres of shallow water habitat for the purpose of increased water retention and enhancement of degraded wetland habitat. The project is located on Decker Road, in Corvallis Oregon. Project sponsors include the Benton County Soil and Water Conservation District, the U. S. Fish and Wildlife Service, and the Oregon Department of Fish and Wildlife. The USDI FWS will provide funding not to exceed $19,830. The ODFW will provide $5,000 for the project while the landowner and ASCS will contribute $3,500 for a total project cost of $28,330.

- **Fairview Creek Watershed Demonstration Project: Gresham, OR.**

Contact: Susan Bergen
City of Gresham
Parks and Recreation Division
1550 NW Eastman Parkway Suite 175
Gresham, OR 96030
(503) 669-2659

This project encompasses approximately 18.28 acres with the purpose of storing groundwater and surface water to retain and establish wetland characteristics that support indigenous plants and animal communities, improve public awareness, involvement, and educational opportunities in watershed values, process, and management, and to buffer adjacent land uses that degrade habitat quality. Project sponsors include the Oregon Department of Fish and Wildlife (technical assistance) and the Multnomah Soil and Water

Conservation District. Funding for the project was provided by the Governor's Watershed Enhancement Board.

- **Fern Hill Wetlands Enhancement Project: Forest** Grove, OR.

Contact: City of Forest Grove
1924 Council St.
P.O. Box 326
Forest Grove, OR 97116
(503) 359-3227

This project is a 5-7 acre enhancement of an existing wetland and creation of new wetlands on city-owned property near the Forest Grove treatment plant for the purpose of wildlife habitat and recreational and educational opportunities. Project sponsors include the City of Forest Grove, the Oregon Department of Fish and Wildlife, the Unified Sewerage Agency, the Oregon Waterfowl and Wetlands Association, and The Wetlands Conservancy. The Forest Grove City Council is providing $5,000 for the project.

- **Hidden Creek Watershed Restoration Project**, South Slough National Estuarine Research Reserve (SSNERR): Charleston, OR.

Contact: Craig Cornu
South Slough National Estuarine Research Reserve
P. O. Box 5417
Charleston, OR 97420
(503) 888-5558

The goal of the Hidden Creek watershed restoration project was to restore strands of native coastal forest throughout the riparian area of Hidden Creek. Restoration activities included removal of brush and extensive planting of a variety of tree species. The purpose of the restoration was to restore natural hydrologic regimes and to restore riparian habitat necessary for the health of anadromous fish species. The Hidden Creek watershed restoration project is one of several restoration elements of the South Slough Estuary Conservation Strategy. The project is located along Hidden Creek in the South Slough National Estuarine Research Reserve in Charleston, Oregon. SSNERR is operated as a partnership between the Oregon Division of State Lands (ODSL) and the National Oceanic and Atmospheric Administration/ Sanctuaries and

Reserves Division (NOAA/SRD).

- **Labish Creek Project**: Salem, OR.

  Contact: Wil Staver
  Chemewa Indian School
  3700 Chemewa Rd.
  Salem, OR 97305

  This project proposes the construction of a pond and adjacent riparian area encompassing 22 acres for the purpose of educational, recreational, and career opportunities for Chemewa's students and adult community. The proposed project is in the Labish Creek basin of the Willamette River. Project sponsors include the Soil Conservation Service, the Oregon Department of Fish and Wildlife, and Oregon State University. The Salem Audobon Society, Native Plants Society, Wetlands Conservancy, Inter-Tribal Fish Commission, OSU American Indian Science and Engineering Society, Tahana White Crow Foundation, and OMSI are contributing a total of $4,000 for the project.

- **Multnomah County Parks Beggars Tick Refuge Wetland Enhancement**: Multnomah County, OR.

  Contact: Charles Ciecko
  1620 SE 190th Ave.
  Portland, OR 97233

  This project consists of excavation of approximately 5000 cubic yards of earthen material, and placement of approximately .5 acre of fill for creation of a limited pedestrian and viewing access area, as well as wetland enhancement. The project is located in the Beggars Tick Wildlife Refuge; Johnson Creek, Multnomah County. There were no project sponsors noted. Funding is a joint venture between Multnomah County Parks Services Division (50%), and the Metropolitan Service District (50%) through it's Greenspaces Restoration Grants Program.

- **Salmon River Estuary Restoration**, Cascade Head Scenic Research Area, Lincoln County, OR

  Contact: Robert Frenkel
  Dept of Geosciences
  Oregon State University
  Corvallis, OR 97331

A landmark saltmarsh restoration project in several regards. It seves as one of the first and only long-term intensive monitoring effort on the west coast. The project was a cooperative effort using National Forest Service money and Oregon State University research and monitoring. The project encompasses over 80 ha of previously diked saltmarsh where the dikes were removed and tidal flow allowed to resume. Some of the information gained includes data on the long-term effects of subsidence due to livestock grazing. While primary production has increased from that calculated immediately before and after dike removal, and a fully functioning saltmarsh ecosystem has been re-established, the marsh still exist at nine cm lower than historic levels. Monitoring efforts continue.

- **Soap Creek Tributary Enhancement: Benton County, OR.**

Contact: Steve Smith, Habitat Biologist
Oregon Department of Fish and Wildlife
7118 Vandenberg Ave., NE
Corvallis, OR 97330
(503) 757-4186

This project proposes to restore approximately 17 acres of shallow water wetland habitat for the purpose of restoring and enhancing wetland habitat on the E.E. Wilson Wildlife Management Area pursuant to Goal #2 of the draft management plan for the area. The project is in Benton County near Adair Village, in the Soap Creek Basin of the Willamette River. The project sponsor and funding agency is the Oregon Department of Fish and Wildlife.

- **South Jetty Wetlands Enhancement**, Siuslaw River: Reedsport, OR.

Contact: Mary Beth Moss
Siuslaw National Forest
Oregon Dunes National Recreation Area (ODNRA)
Reedsport, OR 97467

This project was designed as part of the ODNRA waterfowl habitat enhancement program for the purpose of enhancing breeding and wintering habitat for waterfowl, enhancing foraging habitat for shorebirds and wading birds, and providing wetland-related recreation opportunities for ODNRA visitors. There are no noted project sponsors or funding agencies for this project.

- **Valley River Village, LLC**: Lane County, OR.

  Contacts: Fred Lockhart
  3610 Goodpasture Lakes Loop Road
  Eugene, OR 97401
  (503) 687-1212

  This project will expand existing wetland area from 0.5 acre to 2.0 acre with 1.7 acre of open water surface for the purpose of enhancement of wetlands for future recreational use, and the establishment of vegetative transects for characterization of plant community dynamics. The project is located in Lane County, Oregon. The enhancement/ restoration was performed by Landesign West, Inc., Eugene, Oregon.

- **Winchester Tidelands Restoration Project (WTRP), South Slough National Estuarine Research Reserve (SSNERR): Charleston, OR.**

  Contact: Craig Cornu
  South Slough National Estuarine Research Reserve
  P. O. Box 5417
  Charleston, OR 97420
  (503) 888-5558

  The Winchester Tidelands Restoration Project will remove earthen dikes and tidal gates to restore tidal circulation, native marsh vegetation, and eelgrass beds to 75 acres of degraded agricultural lands. These tidal lands were diked at the turn of the century to promote draining for agricultural uses. Such activities have resulted in the loss of critical habitat for anadromous fish, waterfowl, mammals, and invertebrates. The purpose of the WTRP is to restore estuarine functions of the tidelands, and to serve as an important research and educational example providing guidance and technical information for future restoration projects. The project is organized into 5 phases: Phase 1: Collection of Baseline Information; Phase 2: Active Breach/Passive Restoration; Phase 3: Active Breach/Experimental Restoration; Phase 4: Improved Implementation of Restoration Activities; Phase 5: Monitoring. The project is located along the western arm of the South Slough National Estuarine Research Reserve in Charleston, Oregon. SSNERR is operated as a partnership between the Oregon Division of State Lands (ODSL) and the National Oceanic and Atmospheric Administration/ Sanctuaries and Reserves

Division (NOAA/SRD).

APPENDIX G

EDUCATIONAL INFORMATION DISSEMINATION TECHNIQUES

The topics of wetlands and related management concerns are very complex and controversial. One of the ways to broaden understanding of the issues is to educate the citizenry. Explaining complex issues or providing information to the general public is important during all stages of the policy formation process and subsequent implementation phases. Good and Goodwin (1992) have outlined several public-involvement techniques designed to help citizens understand the issues, avoid confusion and unnecessary conflict, and effectively participate in the policy process.

One example of such an educational technique involves convening a public meeting. Such meetings can be used to explain resource inventory data and survey results, provide opportunities for the public to speak out (for or against) project proposals, and generally allow groups with divers interests an opportunity to communicate in a non-confrontational setting. Other vehicles for communicating information and providing an opportunity for education include information centers, seminars, informal group discussions, field trips, and mass media.

Information Centers

Such centers are well-publicized places where public information can be easily obtained. They can be formal centers, established exclusively to disseminate information; or they can be informal areas where citizens normally gather. Since wetland restoration involves obtaining a general permit for any activity, one such logical information center would be the main office of DSL. Relevant literature could be stockpiled and displayed for public viewing, as well as being included in each request for information on the wetland restoration process. Other possible venues for educational material include: regional offices for ASCS, FHA, EPA, USFWS, and NRCS; state offices for DEQ, WRD, ODFW, and DOF; and county offices for each soil and water conservation district. Materials could also be made available from the various private NGOs involved in wetland restoration.

Many different types of information should be made readily available to the public. Brochures could be

developed on establishing overall objectives and needs of an individual landowner, evaluating an area for potential restoration, assessing problems and opportunities, and then choosing the best option available. For example, what are the advantages and disadvantages to the various options available to the landowner? Is it most appropriate to obtain a conservation easement, a lease, a mutual covenant, or does the landowner want to place a section of the property in trust? Emphasis should be placed on the critical considerations for ecological integrity, economic viability, and the re-establishment of lost wetland functions. There is a great deal of literature which currently exists, and it need only be consolidated. Further, a directive needs to be established whereby an agency would take the lead on uniformly disseminating the educational material.

Advantages:

- They allow quick and easy accessibility to relevant information.
- They represent the agency's or NGOs desire to make information available.
- They can be staffed by professionals capable of giving accurate information or providing correct information sources to the public.

Disadvantages:

- They provide marginal citizen, agency, or NGO contact and communication.
- They require careful planning and substantial effort.
- They can be expensive in terms of informational material and personnel.
- If not staffed by knowledgeable personnel, they can lead to misinformation.

Informational Seminars

Seminars can bring together interested parties within a regional context. In this relatively informal setting, citizens, government, and NGO representatives can ask questions, present specific technical information, and freely discuss the options available to each potential participant. Technical advisors and program facilitators should always be present to answer questions and moderate discussion. In addition to being an effective mechanism for providing information and educating landowners, seminars are also an excellent interactive technique.

Seminars would provide an ideal opportunity to educate the public on regional wetland restoration planning efforts

being undertaken by a local watershed councils. Regional plans could be discussed, inventory results presented, and alternatives generated by the affected parties. Landowners who are provided with a stake in the outcome of regional planning efforts are more likely to participate in the process.

Advantages:

- They provide a two-way educational exchange medium.
- They allow a high degree of citizen-agency interaction.
- Problems and alternatives can be discussed without pressure to arrive at formal decisions.
- The information generated helps to build community awareness.

Disadvantages:

- They can become confrontational meetings between opposing interests, rather than free education/discussion settings, unless participant discussion is guided by a neutral moderator.

Informal Group Discussions

These are meetings of small discussion groups involving community leaders, general citizens, landowners, agency officials, and any combination thereof. Their primary purpose is to present information, analyze community or regional needs, outline community opinion, and discuss ideas for stimulating community awareness of key issues.

Similar in many ways to a seminar, but less rigid, informal group discussion can be very beneficial in terms of educating people about the advantages of wetland restoration. Landowners could be presented with their host of options and indeed, an informal group discussion might target even one landowner who was inclined to offer up a large wetland area for restoration or enhancement. The individual landowner would feel free to ask questions and agency or NGO personnel could offer solutions to problems or technical advice in order to clear up any misunderstandings about state or regional policy.

Advantages:

- They can begin the initial process of exchanging information and assessing regional or individual landowner needs.
- Their informal nature encourages a high degree of intimate citizen, agency, and NGO contact.
- Individuals who remain silent under more formal

conditions tend to express ideas and opinions more freely.

Disadvantages:

- They seldom reflect community-wide representation

Field Trips or Tours

Buses are provided, or carpools arranged for transportation to wetland restoration project areas. Several examples should be examined from restoration of prior converted croplands to large-scale mitigation projects to government funded non-compensatory sites. There are a variety of reasons for a field trip or tour, including identifying problems or opportunities, examining site design and construction techniques, and obtaining visual confirmation that wetland restoration really works.

It is critical to have a guide, staff specialists, and outside experts to provide needed information about each area. Field trips offer an ideal opportunity for agencies to show off successful projects and for NGOs to provide examples of objective-specific restoration planning. Conversely, these excursions also provide an opportunity to examine inadequate projects and to discuss the causes of failure.

Advantages:

- They provide first hand knowledge of individual sites.
- Printed materials relating to the successes and failures of each site can be distributed to participants.
- They provide an informal setting for discussion.

Disadvantages:

- They require a significant amount of planning for advance notice, transportation, and accessibility.
- The weather may interfere with the trip, especially here in Oregon.
- The physical condition and capabilities of the participants need to be taken into account.
- A number of experts may need to be present to adequately answer questions.
- Insects, noises, or other factors may inhibit group interaction.

Mass Media

This technique involves the planned and systematic use of major media, such as news releases, articles in local and regional publications, newsletters, brochures, pamphlets, posters and displays, public service announcements, television programs, television documentaries, and radio and television talk shows. Another technique which should be explored is the use of the Internet as a tool to reach those citizens with computer access. A wetland restoration *home page* could be designed which would facilitate the dissemination of educational material and even provide an opprtunity for feedback . Mass media can be one of the most effective ways to spread information and to educate the general public. It can provide many details to a great deal of people. Agencies can direct pertinent information and inform citizens of important meeting dates.

Mass media can be a valuable tool in an overall plan of public education. On the other hand, it could turn against you. Negative publicity should be avoided at all costs. If the general public perceives wetland restoration to be an extremely time-consuming, arduous, repetitive process filled with endless governmental red-tape, then they are liable to not seek enrollment in any planning activities. Careful planning should be used at all times.

Advantages:

- It increases the opportunity for region-wide information coverage.
- It enables technical advisors to present their information to a wider audience.
- Citizens have the advantage of sitting in their own home and assessing relevant information.

Disadvantages:

- It requires careful planning and can be quite costly.
- It is generally limited to a one-way exchange of information.

APPENDIX H

WETLAND FUNCTIONS AND SERVICES

Below is a very detailed wetland functions and services list which is recognized by the US Fish and Wildlife Service. Although several lists of wetland functions are included in the body of this text, providing this inclusive list is important to provide increased scope.

1. *Floodwater Alteration/Control:*
   Floodwater alteration/control is the process by which peak flows from a variety of sources (runoff, surface flow, discharge, precipitation) enter a wetland and are stored or delayed in their downslope journey. Floodwater alteration also includes floodflow desynchronization, which is the process by which flood waters are stored in a series of wetlands within a watershed, and then gradually released. This gradual release results in lower, more persistent flows downstream. Basically, anywhere there is a depression in the topographic profile of a watershed, there exists an opportunity for storage of water on the surface or in the underlying sediments. Flood storage is significant only in palustrine, lacustrine, and riverine wetland systems. Marine, estuarine and lower riverine wetlands sometimes reduce coastal flooding by desychronizing runoff or storm surges, but they can also intensify problems if tidal conditions are right. Wetlands can also dissipate the energy of waves and currents which may lead to flooding (Adamus, et al., 1991). Flood storage and conveyance functions can be quantitatively assessed and restored with some certainty by applying the results of hydrologic studies. Topography is the critical parameter and this is probably the easiest criteria to restore.

2. *Food Chain Support:*
   Food chain support is the process of flushing relatively large amounts of organic detritus from the wetland to downstream or adjacent deeper waters. This material is the export from net primary and secondary production within the wetland system. Wetlands generally have relatively high rates of primary production. Indeed, for some wetlands such as salt marshes and mangroves, primary production rates are among the highest ever recorded. The relationship between food chain support and the eventual utilization of production materials is not easily understood, due

primarily to their potential spatial and temporal separation.

3. *Water Quality:*
The process of water purification consists of two main areas: sediment/toxicant retention and nutrient removal/transformation.

Sediment/toxicant retention is the process by which suspended solids and chemical contaminants such as pesticides and heavy metals adsorbed to them are retained and deposited within a wetland. Deposition of sediments can ultimately facilitate toxicant removal via burial, chemical breakdown, or assimilation into plant tissue. Toxicants include heavy metals, pesticides, and even organic chlorines and phosphates. Toxicants are included in the sediment retention section because their chemical nature causes them to adsorb onto the organic matter portion of the sediment or its clay fraction. Most vegetated wetlands are excellent sediment traps, and serve in that capacity until overloaded. Few wetland systems actually export more organic sediment than they collect. Although turbidity may be greater downstream of wetlands, this is due primarily to suspended organics and to algal production. Adamus (1991) reports that the time sediments and toxicants are retained depends on the hydrologic, morphologic, and chemical characteristics of the specific wetland.

Nutrient removal/transformation includes the storage of nutrients, primarily nitrogen and phosphorous, within the plant matter or sediments. Transformation occurs when an inorganic nutrient is converted to its organic form, or to a gas. Nutrient removal and transformation involves trapping nutrients before they reach deep water, are carried downstream, or are transported to underground water supplies.

4. *Fish Diversity/Abundance:*
Fish diversity/abundance is the support of a variety of recognized finfish. Nearly all freshwater fish and a significant number of saltwater fish require some type of wetland habitat at some stage of their life cycle. Wetlands provide opportunities for spawning, predator avoidance, shelter from environmental conditions, and feeding. Vegetation increases the attractiveness of wetlands to most fishes (Adamus, 1991). Fisheries functions can be assessed and restored, however the ability to achieve success depends on site conditions and desired target species.

5. *Wildlife Diversity/Abundance:*
   Wildlife diversity/abundance is the support of myriad wetland-dependant birds and other fauna. Despite the fact that birds are often emphasized, this should not diminish the fact that there are many other species (mammals, furbearers, amphibians, and some reptiles) that are equally dependant on wetland environments, and would surely perish if they did not exist. According to Adamus (1991), the wetland edge is often the most diverse and productive area for wildlife. Waterfowl production functions may be assessed with some confidence in many contexts, due primarily to a wealth of expert experience and scientific knowledge. Additionally, prime waterfowl habitat exists where marshes are present, and they are relatively easy to restore or create.

6. *Groundwater Recharge:*
   Groundwater recharge is the movement of surface water into the groundwater system. Shallow recharge is termed leakage, and is not considered to be as important as deep recharge, which has the most benefit to regional groundwater systems. This function is difficult to assess and restore. Perhaps the most complex factor is the soil permeability, which may change following project completion. For example, a sandy substrate may be altered due to deposition of undesired materials, and become impermeable

7. *Groundwater Discharge:*
   Groundwater discharge is the lateral or upward movement of groundwater into surface water. Wetlands function only marginally within this context due to the fact that the majority of flow volume originates in the shallow upper layer and is discharged during the wet season when streams need it least. Indeed, many discharges may be lost during the dry season.

8. *Recreational Use:*
   Recreational use includes both consumptive (e.g., sport fishing, aquaculture) and non-consumptive (e.g., swimming, boating, bird watching, wildlife viewing) forms of water dependent recreation. Additionally, wetlands provide aesthetic values to many people who enjoy these types of activities. Wetland aesthetics may or may not be difficult to restore depending on the desired wetland type and the specific site conditions. Visual characteristics are, in general, much easier to restore than complex ecological functions.

9. *Dissipation of Erosive Forces and Shoreline Anchoring:*

This function is also commonly referred to as sediment stabilization. Dissipation of erosive forces is the attenuation of energy associated with waves, currents, water-level fluctuations, or groundwater flow. Shoreline anchoring is the stabilization of soil at the water's edge or in shallow water by roots and other portions of a plant's anatomy. Wetlands that are anchored by extensive, persistent vegetation and extend outward into the water body, provide significant protection from waves and current.

APPENDIX I

WETLAND RESTORATION IN OREGON: ISSUES, FINDINGS, AND RECOMMENDATIONS

Issue 1: Definition of wetlands

Commonly used definitions for the term wetland do not adequately address restoration in a watershed or ecosystem context.

Findings:

- The two commonly used regulatory definitions of the term wetlands (Clean Water Act: 33 CFR 323.2(c) and Food Security Act) emphasize diagnostic characteristics that can be used to delineate wetlands, but tell little about the wetland ecological characteristics, functions, or services that are the basis for seeking their restoration.

- The commonly used inventory and mapping definition of wetland (Cowardin 1979) suffers from the same shortcomings as regulatory definitions with respect to wetland restoration considerations.

- Wetlands are a part of broader aquatic ecosystems. In a restoration context, they cannot be separated in a structural or functional sense from the streams, lakes, rivers, and riparian lands with which they are usually associated. Nevertheless, the commonly wetland definitions referenced above do not explicitly link wetlands to these larger aquatic ecosystems. Conversely, aquatic ecosystem restoration definitions and programs, particularly those for streams and salmon in the Pacific Northwest, do not make explicit mention of wetlands, despite the fact that these areas are often ecological "hotspots" in watersheds, playing a role disproportionate to their size in supporting endangered species and maintaining biodiversity in general.

Recommendation:

1. Redefine "wetland" for restoration policy purposes in a relatively elaborate fashion to emphasize not only diagnostic features, but also wetland functions, services, and connections to larger aquatic ecosystems; explicitly distinguish this definition from those developed for regulation or inventory purposes. For restoration purposes:

"A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development. Healthy wetland ecosystems are often key elements of larger aquatic ecosystems-streams, lakes, and rivers and riparian lands-and have hydrologic, biogeochemical, and habitat and food production functions that mitigate flood damage, maintain water quality, and support diverse populations of wildlife, fish, and other aquatic life" (modified from NRC 1995).

Issue 2: Definition of wetland restoration

There are a variety of definitions of wetland restoration and related terms, contributing to philosophical and practical conflicts among resource managers, regulators, scientists, interest groups, and landowners involved in regulatory and nonregulatory restoration activities. Although definitions have some common features, many emphasize different goals, purposes, or methods.

Findings:

- Most definitions of wetland restoration properly emphasize that restoration involves "returning an ecosystem to a close approximation of its condition prior to disturbance" (NRC 1992). This emphasis should be maintained.

- Some definitions of restoration (and the associated public and private programs) focus on a single function or resource, such as waterfowl or salmon enhancement, or water quality improvement. Some are scientific, technical, or complex in nature while others are simple and practical. Some definitions include broad goals, like biodiversity, while others are more specific.

- Federal, state, and local governmental agencies, nongovernmental organizations at all levels, individual researchers and landowners, and others have developed definitions of restoration and wetland restoration that serve their particular missions or interests, resulting in a confusing or at worst conflicting array of restoration projects with little ecological or functional coherence (for examples, see a review of definitions by Weinman and Kunz [1994]).

- Much of the existing confusion over the purposes and methods for aquatic ecosystem restoration (including wetland ecosystems) is becoming institutionalized as different government agencies and nongovernmental organizations develop different regulations, policy, and procedures for wetland restoration.

- The *Oregon Wetland Conservation Strategy* (ODSL 1995, 33) defines wetland restoration as: "The process of intentionally altering a degraded or historic wetland to produce an attainable wetland ecosystem and associated ecosystem processes in order to achieve statewide, regional, or local ecological goals. The intent of the work is to emulate the natural hydrology, structure, functions, diversity, and dynamics of the defined or indigenous wetland system." This definition is a bit awkward and does not include all the desired features of a comprehensive, ecosystem-based restoration definition.

Recommendations:

1. The Division of State Lands should attempt to develop a broad consensus definition of wetland restoration among the state's natural resource agencies. Federal agencies and private organizations conducting wetland restoration activity in Oregon would be encouraged to participate and to the extent that mission allows, use this definition in their own restoration activities.

2. The following definition of wetland restoration, based in part on the definition of restoration developed by the National Academy of Sciences Committee on Restoration of Aquatic Ecosystems, is a good starting point for this proposed consensus process:

"Wetland restoration is defined as the return of a wetland ecosystem to a close approximation of its condition prior to disturbance. In restoration, ecological damage to both the structure and function of the wetland is repaired. The goal is to emulate a natural, functioning, self-regulating system that is ecologically integrated with the surrounding landscape. Wetland restoration may require one or more of the following activities: reconstruction of antecedent physical hydrologic conditions; chemical cleanup or removal or other adjustment of anthropogenic stressors; and biological manipulation, including revegetation and the reintroduction of absent or currently nonviable native species" (modified from NRC 1992).

This definition is attractive because it is based on a more general, science-based definition of restoration of aquatic ecosystems-streams, rivers, and lakes, as well as wetlands (NRC 1992). It addresses commonalities in restoring these systems. It is also hierarchical in that the first sentence provides a simple, stand-alone definition. The next two sentences elaborate by adding necessary actions and goals that focus on functions and ecological integrity. The final part of the definition deals with common problems and methods for restoring wetlands.

Issue 3: Wetland restoration and protection programs not well-integrated

Present land use planning policies and processes for wetland *protection* are not sufficiently integrated with existing policies and programs for wetland *restoration*:
- **the need or potential for restoration is either not addressed (LCDC Goal 5), or inadequately addressed (LCDC Goals 16/17 and Wetland Conservation Planning [WCP])**
- **protection and restoration of associated aquatic ecosystems and riparian lands are not adequately addressed**
- **wetland planning policies and processes do not require or even recommend use of a watershed approach**

Findings:

- Wetland restoration (or creation or enhancement) is well-integrated into regulatory decision-making (Corps Section 404 program and DSL removal/fill program), but compensatory mitigation projects have not been judged particularly successful with respect to ecological restoration criteria (Kentula et al 1992; Schaich and Franklin 1995). Although it is not well-documented, it is very important to note that mitigation requirements promote avoidance of wetlands, thus helping to protect remaining wetland ecosystems.

- LCDC Statewide Planning Goal 5 (Open Spaces, Scenic and Historic Resources, and Natural Resources) requires that cities and counties identify and protect significant wetlands, but they do not require or even recommend that jurisdictions identify and consider protecting sites with potential for restoration. In fact, the most degraded wetland sites, many of which

may be prime candidates for restoration, are generally written off and opened for further alteration and development.

- Despite the fact that Goal 5 was adopted in 1974 and all cites and counties have acknowledged comprehensive plans, few (how many?) cities and counties actually have completed Goal 5 wetland evaluations because needed inventory and functional assessment information for decision making is not available.

- When communities complete Local Wetland Inventories (LWI) and freshwater wetland functional assessments, they are required to go through the Goal 5 process. More than 30 cities or counties have begun or completed LWIs for all or a portion of their jurisdiction. Again, however, restoration potential is not addressed in these inventories.

- Neither Goal 5 nor the WCP planning procedures require or even recommend a watershed-based approach; Goal 5 administrative rules (existing and proposed) and plan elements are generally for a single jurisdiction, although these is coordination between cities and counties within urban growth boundaries. Similarly, the WCP process is not watershed-oriented, focusing almost exclusively on urban and urbanizing areas where significant wetland resources are at risk because of rapid growth or where other growth-related conflicts need to be sorted out. While the urban and urbanizing area focus of these programs is not inappropriate, they should at least deal with the additional portions of subwatersheds needed to apply ecological landscape planning principles.

- An LCDC subcommittee and advisory committee has been reviewing Goal 5 administrative rules for more than a year. New rules are being proposed address shortcomings and promote compliance with the law. Wetland restoration needs or potential are not presently part of the proposed revisions.

- Although Goals 16 (Estuarine Resources) and 17 (Coastal Shorelands) required that cities and counties identify potential restoration sites and protect them from conflicting uses, the principal purpose of this exercise was to reserve these sites for future use as compensatory mitigation for estuary wetland filling and dredging for water-dependent development. Goal 16/17 planning, while not truly watershed based, did integrate estuary and shoreland planning efforts to the

head of tide, often far up coastal rivers (e.g., 41 miles on the Coquille; 23 miles on the Yaquina).

- The WCP process requires identification of potential mitigation sites to compensate for wetland areas local jurisdictions propose to alter. Identification and protection of nonregulatory restoration sites, either in the WCP inventory process or subsequent planning is not required.

Recommendations:

1. Incorporate a watershed approach to inventory and planning into Goal 5 and WCP administrative rules. While the urban and urbanizing area focus of these programs is not inappropriate, they should at least deal with the additional portions of subwatersheds needed to apply ecological landscape planning principles within the areas of primary concern. A two-tier approach may suffice, with more detailed inventory and planning analysis in the urbanizing portions. For both Goal 5 and WCPs, a multi-jurisdictional, collaborative planning approach should be required, much like estuary planning efforts in the 1970s and 1980s organized by coastal local governments. This change is URGENT, given current Goal 5 rulemaking schedule.

2. In addition its wetlands protection requirements, both Goal 5 plans and WCPs should incorporate a required wetland restoration element. Wetland restoration elements should be based on historical analysis of the planning landscape, identify functional replacement priorities using, in part, regional and state-level priorities, and identify and protect priority sites for restoration. This change is URGENT, given current Goal 5 rulemaking schedule.

3. Planning for wetland conservation through both the Goal 5 and WCP processes should be integrated as much as possible with restoration "action plans" being developed by the more than 30 watershed councils in Oregon, who are focusing primarily on streams, rivers, and riparian areas.

Issue 4: Wetlands not well integrated into aquatic ecosystem restoration programs

The major state-level aquatic ecosystem restoration program (Watershed Health Program [WHP]) does not explicitly address wetland restoration needs or

potential. Further, the WHP is a restoration-only program; there are no mechanisms in the program to protect critical habitat-existing or restored-in streams, rivers, riparian areas, or wetlands.

Findings:

- Restoration "action plans" under the WHP focus primarily on stream and riparian zones, and the fish production function these aquatic ecosystems provide. Although there are exceptions, wetlands and wetland restoration needs are not explicitly addressed in most plans (e.g., ...), in part because of a lack of guidance and direction from state-level administrators.

- The WHP "action plan" process does not provide mechanisms to protect existing aquatic ecosystems in watersheds, yet there are significant investments being made in restoring degraded areas in these systems. It is widely acknowledged in the scientific and resource management communities that protection of existing high quality resources needs to be assured prior to restoring degraded areas (PRC 1995). The WHP does not provide such assurances, nor does it provide adequate mechanisms to ensure that investments in restoration are protected on the ground.

Recommendations:

1. Revise rules and guidance for the WHP to explicitly incorporate wetland restoration needs and priorities into watershed "action plans" developed by councils.

2. Revise rules and guidance for the WHP to promote linkage with land use planning programs designed to protect significant wetlands (and other aquatic ecosystems) in watersheds, and to require protection of restoration project areas from alterations that would erase the benefits trying to be achieved.

Issue 5: Lack of state-level priorities and criteria for wetland restoration at watershed or site scales

Oregon has not established state-level priorities and criteria for wetland restoration nor has the state determined a process for establishing such priorities. As a consequence, wetland restoration planning and projects at the watershed or individual site scales are undertaken on a largely ad hoc, uncoordinated basis, particularly with respect to ecosystem attributes and functions.

Findings:

- A number of methods have been developed and used to establish priorities for restoration of aquatic ecosystems. Two of the most prominent in Oregon are the Stage I Watershed Assessment done by DSL for the WHP (Daggett 1994) and the Bradbury Process (Pacific Rivers Council 1995). Neither has a wetland-specific orientation, although both might result in wetland restoration, depending on the results and local interests and priorities. From a state-level perspective for both methods, some watersheds come out winners and others losers. This has created political and equity problems for policymakers who must allocate scarce restoration resources-all watershed councils want to have equal opportunity to compete for funds. Consequently, neither approach has been implemented from an investment perspective.

- For the Stage I Assessment, priority watersheds for protection, enhancement and restoration are those that are still relatively pristine or "the best of what's left" and have a high risk for future loss; however, the results of the analysis do not suggest what functions or attributes should be restored in priority watersheds, rather it says "here is where we should invest our restoration dollars." The overall purposes and goals of the WHP need to be looked to for state-level, albeit general guidance. Regional and local guidance on what to restore is left to the "action plans" developed by local watershed councils.

- The Bradbury Process is aimed at (1) identifying priority restoration activities that in the short run have a high likelihood of success and permanence and (2) providing a basis for protection and restoring salmon and their watersheds over the long term. It has a state-level process to determine what watersheds are highest priority and it includes watershed evaluation procedure for use at that level. Its state-level priorities overlap somewhat with the Stage I Assessment, perhaps because of their different weightings of factors.

- It is the functions and services that wetlands provide-flood protection, water quality improvement, and fish and wildlife support-that people understand and relate to, not their particular physical character, type, or vegetation. These functions and services also provide the basis for protection and restoration efforts. Consequently, cumulative functional loss should be an important determinant for setting wetland

restoration priorities at all levels-state, watershed, and site scales. Such analysis requires and understanding of both historic and present-day wetland functions and conditions.

- The state-level priority setting processes outlined above do not specifically address the need and potential for wetland restoration. Further, as applied to watersheds, they do not yield results about the relative functional loss of aquatic or wetland ecosystems in different parts of the state (or within watersheds) that in turn might be used to set function-based restoration priorities.

- Although watersheds are hydrologically and functionally linked in a downstream fashion, wetland functions in different parts of the watershed (e.g., headwaters, foothills, floodplains, and estuaries) tend to vary widely. Because there is more ecological and functional spatial homogeneity within ecoregions than within watersheds, wetland functional loss analysis and subsequent priority setting at a statewide level is more appropriate on the basis of ecoregion.

- Because there is no basis for wetland functional loss analysis, regional planning efforts for restoration at the watershed or subwatershed level (e.g., the WHP) have little guidance as to restoration needs from a statewide perspective. Further, the state has not articulated planning procedures or criteria for development of watershed "action plans" that might contribute to some level of comparability with respect to plans, approaches, monitoring needs, and future evaluation. These shortcomings contribute to relatively ad hoc planning and project implementation.

Recommendations:

1. Within the framework of DSL's wetland conservation program, establish a wetland restoration planning and implementation process with three interrelated tiers: a state level, a regional level, and an individual site or project level. At each level, the need for restoring wetland functions and associated societal services are the principal basis for setting priorities and drawing up restoration plans.

At the *state level*, set restoration priorities for wetland functions based on an analysis of historic versus present conditions within ecological regions (hereafter ecoregions). Ecoregions, discussed in more detail later, are areas with similar physical,

biological and human use attributes. The principal products of this state-level analysis would be wetland function restoration priorities and a set of reference wetlands that might serve as benchmarks for guiding individual restoration projects within that ecoregion.

At the *regional level* (watersheds or subwatersheds), use state-level wetland restoration priorities for each ecoregion as an important input and consideration in planning. At this level, conduct additional, more detailed landscape analysis to better understand historical and present-day wetland networks and conditions and to establish a plan for reconnecting and/or restoring wetland ecosystems. Restoring ecological integrity and biodiversity are important goals. Economic cost-benefit analysis might be used to determine an overall level of desired restoration.

At the *site level*, select individual sites for restoration within the proposed network of sites based on their contribution to functional improvement consistent with state and regional priorities, their economic cost effectiveness with respect to other sites, their ownership and availability for restoration and subsequent protection, and other factors.

Issue 6: Variable site or project planning procedures

Wetland restoration plans and built projects at the individual site level suffer from inadequate and inconsistent planning, goal setting, design, monitoring, and evaluation.

Findings:

- Variations in project planning can be expected at some level and indeed, may be necessary based on individual site characteristics and project goals and purposes.

- Wetland restoration projects based on good historical analysis, that incorporate landscape analysis of surroundings, and that have clear well-defined goals and expected outcomes are generally more successful than those projects that lack these features (Zedler 1984; Williams 1995).

Recommendation:

1. To help achieve a quality standard for wetland restoration projects, a comprehensive but generic

project planning process should be developed and implemented, along with general criteria and guidelines for restoration. Such a process would be flexible enough to be applicable to any wetland restoration project and might, at a minimum, include:

- assessment and mapping of antecedent historical conditions to serve in part as a target for restoration

- clear project goals (including considerations from available regional plans and recommended priority wetland functions) and measures for determining project success

- ecologically sound design and engineering, including (1) boundaries of the proposed restoration area; (2) proposed elevations and slopes; (3) sources of water supply and connections to existing waters and uplands; (4) proposed soils and probable sedimentation characteristics; (5) proposed plant materials; (6) exotics that may be present and if so, control measures; and (7) methods and timing for plantings (if replanting is to take place)

- a monitoring program that anticipates evaluation needs

- procedures for mid-course correction and project management capabilities

Issue 7: Regulatory programs perceived to hamper restoration

There is a perception among some, particularly individual landowners, that regulatory hurdles and paperwork make restoration approvals time-consuming and unnecessarily difficult. In addition, some landowners will not restore areas for fear of future regulation and loss of property value.

Findings:

- Both DSL and the Corps have simplified general permit processes designed to minimize processing requirements. For restoration activity, the Corps delegates dredging authority to DSL, who reviews the permits under their "general authorization" for restoration. If the proposed work is described in detail, and signatures are present from the relevant agency personnel indicating compliance with any statutory regulation,

then the applicant will be notified within 15 days of the permit's status.

- Landowners who restore wetlands to their former condition may face prohibitive wetland regulatory requirements if they want to alter the restored area in the future, thereby limiting their options and preventing temporary restoration activities pending future land development or sale.

- Natural resource management agencies spend a disproportionate percentage of their human resources on regulatory restoration, creation, or enhancement. Critiques of compensatory mitigation projects suggesting limited success would seem to indicate a reallocation of resources to providing technical assistance for nonregulatory wetland restoration planning and project design.

Recommendations:

1. DSL should develop a handbook for wetland restoration and preservation on private lands, following the model developed by the State of Washington (WDOE 1992).

2. DSL and the USACOE, in cooperation with the OSU Extension Service and agency technical experts at BLM, USFS, NRCS, ODFW, and universities, should conduct more education targeted on the opportunities and interests of landowners in both rural and urban areas. The process and relative ease of obtaining wetland restoration permits should be part of that program.

3. Natural resource management agencies, including DSL and the USACOE, should conduct a cost-effectiveness audit of the time and resources expended on regulatory versus nonregulatory restoration activities and make indicated adjustments.

Issue 8: Land use and management practices conflict with wetland restoration

Actual and perceived land use conflicts impose constraints on wetland restoration activities.

Findings:

- To prevent localized flooding, city and county public works departments have historically promoted the

fastest possible drainage of surface storm waters off the land. Other activities in urban areas also promote rapid runoff, such as impervious surfaces and land fill in floodplains. This strategy is counter to one of the natural functions of wetlands, namely short and long-term storage of floodwaters, and works against restoration of this function.

- Zoning and ordinance conflicts at the local level do not provide for or prevent use of potential sites for restoration. Inflexible lot coverage, density requirements, and similar measures are one example of local ordinance procedures that may conflict with both protection and restoration of wetlands and streams. Goal 16/17 strictures regarding protection of potential wetland mitigation sites is another example that was faced in 1995 by the South Slough National Estuarine Research Reserve. The county had earlier identified lands within Reserve boundaries as potential mitigation sites. Nonregulatory restoration would take those sites off the mitigation site inventory.

Recommendations:

1. Integrate urban and rural drainage with plans for open space, wetland, and resource protection and restoration, including set-asides of "natural" storage areas.

2. Survey local government planning departments for potential conflicts between comprehensive plans and zoning and other ordinances and wetland protection and restoration activities.

3. Require that local governments include variance provisions in local plans and ordinances providing for restoration of wetlands and other aquatic ecosystems.

4. Examine opportunities flexible building specifications, performance standards (e.g., density bonuses, density transfers, transferable development rights), and conservation easements designed to promote wetland preservation and restoration.

Issue 9: Economic evaluation tools not well-integrated into wetland and other aquatic ecosystem management programs

Traditional economic decision-making tools are not sufficiently well-developed to contribute significantly to priority setting for wetland restoration,

particularly at the state and regional levels. This prevents their effective use in planning for wetland restoration.

Findings:

- Economic analysis and decision-making tools, including benefit-cost analysis, cost-effectiveness analysis, and economic valuation of nonmarket environmental goods and services (e.g., certain wetland functions), have not been sufficiently developed to address wetland restoration decision-making questions, particularly at the statewide and watershed scales. Questions like "how much restoration is desired?" and "what mix of potential projects is most cost-effective?" are difficult if not impossible to answer. Assigning a monetary value to wetlands is inherently difficult in that the functions that they provide are very complex and do not lend themselves to the practice.

Recommendations:

1. Following the lead of the background economic paper prepared as part of this project, DSL should fund two kinds of studies:

- undertake one study to examine the economic value of wetland functional loss at an ecoregion level and contribute to the priority setting process at that level

- using strategic benefit-cost analysis, conduct a second study at the watershed level to determine an "optimum" level of investment in restoration relative to expenditures for other purposes; at the watershed level, another tool, cost-effectiveness analysis, could be used to help set priorities among proposed restoration sites.

Issue 10: Historical data is not available or easy to use

Data on historical condition and functions of wetlands is either not available, or it is difficult and/or expensive to obtain and evaluate. It is therefore rarely used in wetland restoration planning.

Findings:

- Baseline assessments and inventories of likely historic conditions are valuable components of wetland restoration planning efforts an all scales. They provide insight into prior conditions, wetland surface area and landscape position, and hydrological and ecological connectivity. The data that does exist is scattered throughout the state, some residing at universities, others at the individual state and federal agencies, some at local libraries, some with private parties or businesses, and some at the state GIS center. In order to establish what wetland area has been lost or degraded, data on prior conditions, historic data is needed.

- Original public lands surveys, available from the BLM, provide the best full record of aquatic system networks and vegetation types. Supplemented with other available data, such as hydric soils information, and with best professional judgement of resource professionals and scientists knowledgeable in the ecology of an area, reasonably good historical reconstruction of wetlands and other aquatic ecosystems can be made.

Recommendations:

1. Conduct an inventory of what historic data is available in Oregon. Provide that list to all resource agencies and private entities that conduct restoration throughout the state. Produce some literature on how to utilize historic data to arrive at prior conditions.

2. DSL should require use of historic information in determination of restoration needs for WCPs, thus driving the development and documentation of the best available historical data. Similar efforts should be promoted for Goal 5 planning and for watershed "action plans" under the WHP.

Issue 11: More technical assistance is needed

There is limited guidance or technical assistance provided at the state level for those who want to conduct wetland restoration.

Findings:

- Education is a generally underutilized but very effective nonregulatory resource management tool; investments in education for wetland restoration area

likely to yield greater return than for most other expenditures.

- Information on restoration planning at regional or site level, including how to get at elusive goals like ecosystem integrity, biodiversity, and functional improvement, is not widely available to landowners. For example, farmers with marginal cropland in production may not be aware of the opportunities that exist for conservation easements or other opportunities available.

Recommendations:

1. Implement education recommendations in *Oregon's Wetland Conservation Strategy* (1994).

2. Find an existing pathway for educational materials to appear in front of landowners. Look for opportunities such as title transfers or tax packets to provide information to the appropriate sources.